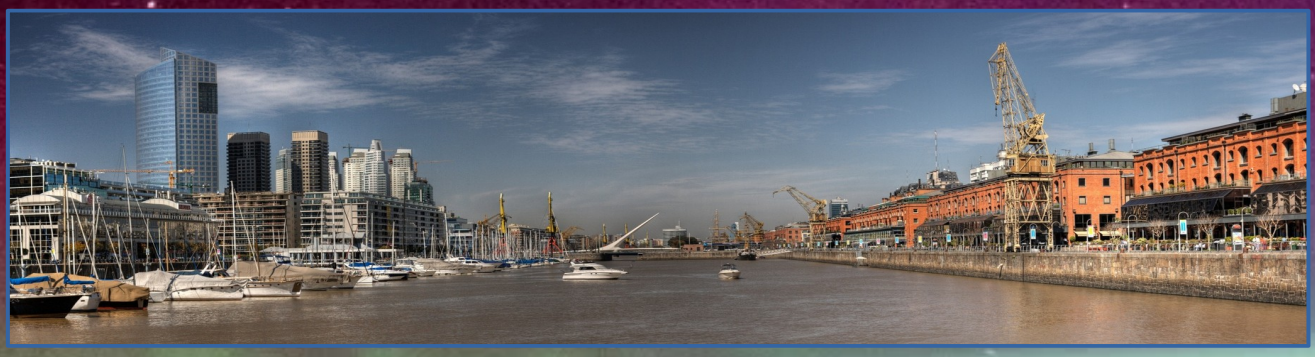
Asociación Latinoamericana de Geofísica Espacial

COLAGE XI - Eleventh Latin American Conference on Space Geophysics

16-20 April 2018, Buenos Aires, Argentina



Solar Physics
Solar Wind
Planetary Magnetospheres
Cosmic Rays
Ionosphere and the Upper Atmosphere
Plasma Physics and Nonlinear Processes
Space Weather





http://www.iafe.uba.ar/colage11

CONICET · CONAE · COSPAR · AGENCIA Nacional de Promoción Científica y Tecnológica · IAFE CONICET UBA · Presidencia de la Nación · Ministerio de Ciencia, Tecnología e Innovación Productiva

ICTP The Abdus Salam International Centre for Theoretical Physics · IAEA · celfi Centro latinoamericano de formación interdisciplinaria · SCOSTEP Scientific Committee on Solar-Terrestrial Physics · ISWI · RAPEAS · IUGG UGGI Union Géodésique et Géophysique Internationale

COLAGE XI

11^{th} Latin American Conference

on Space Geophysics

16 – 20 April 2018, Buenos Aires, Argentina

Sponsorship

ALAGE
Asociación Latinoamericana de Geofísica Espacial

CONICET
Consejo Nacional de Investigaciones Científicas y Técnicas

CONAE
Comisión Nacional de Actividades Espaciales

COSPAR
Committee on Space Research

ANPCyT
Agencia Nacional de Promoción Científica y Tecnológica

SCOSTEP
Scientific Committee on Solar-Terrestrial Physics

ISWI
International Space Weather Initiative

Sponsorship

MinCTIP
Ministerio de Ciencia, Tecnología e Innovación Productiva

ICTP
The Abdus Salam International Centre for Theoretical Physics

CELFI
Centro Latinoamericano de Formación Disciplinaria

RAPEAS
Red Argentina Para el Estudio de la Atmósfera Superior

IUGG
International Union of Geodesy and Geophysics

Conference Committees

Scientific Organizing Committee

Marcos Machado, Argentina (ALAGE President)

Abraham Chian, Brazil (ALAGE International Secretary)

Hernán Asorey, Colombia

Alisson Dal Lago, Brazil

Daniel Gómez, Argentina

Juan Américo González Esparza, México (Chair)

Marco Milla, Perú

Local Organizing Committee

César Bertucci

Hebe Cremades

Sergio Dasso

Pablo Dmitruk

Daniel Gómez (Chair)

Marcelo López Fuentes

Cristina H. Mandrini

Collaborators

Nahuel Andrés

María Cambón (Secretariat)

Mauro Fontana

Carlos González

Cecilia Mac Cormack

Vanina Lanabere

Diego Lloveras

Fernando López

Rodrigo Lugones

Federico Nuevo

Mariano Poisson

Norberto Romanelli

COLAGE 11

	MONDAY	TUESDAY	THURSDAY	FRIDAY
8:00--8:15				
8:15—8:30				
8:30—8:45				
8:45—9:00				
9:00—9:15	REGISTRATION	KEYNOTE	SESSION 5	SESSION 6
9:15—9:30		& GALL AWARD		
9:30—9:45		Matthaeus		
9:45—10:00	OPENING	ACUÑA AWARD		
10:00--10:15	POSTERS	Valdes-Galicia		
10:15—10:30	& COFFEE			
10:30—10:45	KEYNOTE	POSTERS	POSTERS	POSTERS
10:45—11:00	Roederer	& COFFEE	& COFFEE	& COFFEE
11:00--11:15			SESSION 5	
11:15—11:30	SESSION 1	SESSION 3		SESSION 6
11:30—11:45				
11:45—12:00				
12:00—12:15				Space Weather
12:15—12:30				forecast
12:30—12:45				
12:45—13:00				
13:00--13:15				
13:15—13:30				
13:30—13:45				
13:45—14:00	LUNCH		LUNCH	
14:00--14:15	SESSION 1	SESSION 3	SESSION 5	SESSION 7
14:15—14:30			KEYNOTE	
14:30—14:45			White	
14:45—15:00				
15:00--15:15			POSTERS	
15:15—15:30		SESSION 4	& COFFEE	
15:30—15:45				
15:45—16:00			ASSEMBLY	
16:00--16:15	POSTERS	POSTERS		POSTERS
16:15—16:30	& COFFEE	& COFFEE		& COFFEE
16:30—16:45	SESSION 2			SESSION 7
16:45—17:00		SESSION 4		
17:00--17:15				
17:15—17:30				
17:30—17:45				
17:45—18:00				New programs in
18:00--18:15				Sun-Earth
18:15—18:30				
18:30—18:45				
18:45—19:00				

NOTE: Wednesday is a free day.

Keynote Presentations

Keynote talk

60 Years of Radiation Belt Physics

Juan G. Roederer

University of Alaska Fairbanks and University of Colorado, Boulder, USA

Abstract. 1958 marks the year the Earth's radiation belts were discovered independently by James Van Allen of the USA and Sergei Vernov of the USSR. However, the theoretical possibility that energetic charged particles could be stably trapped in a dipole magnetic field was already known since Störmer's laborious cosmic ray orbit calculations at the beginning of last century. Once the existence of terrestrial radiation belts was verified, their study was strongly motivated by military interests on both sides of the Iron Curtain, mainly in connection with matters of high-altitude nuclear explosions (human-induced space weather!) Soon, however, the field became a fascinating part of international space geophysics. Progress was of course tied to the development of appropriate spacecraft instrumentation and theory. Regarding the first, the goal was to be able to determine mass, charge, flux, energy spectrum and angular distribution of the trapped particles as a function of space and time; regarding theory, the issue was to develop quantitatively useful and trustworthy approximations of the ultra-complicated particle orbits—the so-called adiabatic theory of magnetically trapped particles. Having participated in these developments almost since their beginning, I will discuss the history of radiation belt research from a somewhat subjective point of view (with some funny and not-so-funny anecdotes). I will focus on three distinct stages: (1) the stratospheric balloon flights in Argentina to detect X-rays from nuclear bomb radiation belt electrons precipitating into the atmosphere; (2) the application of adiabatic theory to studies of the dynamics of terrestrial and Jovian radiation belts; (3) the current studies with the two Van Allen Probes to address important basic and applied physics problems of solar-controlled space weather.

E-mail: *jgroederer@alaska.edu*

Keynote talk and Ruth Gall Award

How Do Weakly Collisional Plasmas Dissipate?

William H. Matthaeus[1], Sergio Servidio[2], Yan Yang[3], Tulasi Parashar[1], Alexandros Chasapis[1], Vadim Roytershteyn[4]

[1]University of Delaware, USA
[2]University of Calabria, Italy
[3]Peking University, Mechanical Engineering, China
[4]SciberQuest, Inc., USA

Abstract. Turbulence cascade transfers energy from large scale to small scale but what happens once kinetic scales are reached? In a collisional medium, viscosity and resistivity remove fluctuation energy in favor of heat. In the weakly collisional solar wind, (or corona, m-sheath, etc.), the sequence of events must be different. Heating occurs, but through what mechanisms? In standard approaches, dissipation occurs though linear wave modes or instabilities and one seeks to identify them. A complementary view is that cascade leads to several channels of energy conversion, interchange and spatial rearrangement that collectively leads to production of internal energy. Channels may be described using compressible MHD & multispecies Vlasov Maxwell formulations. Key steps are: Conservative rearrangement of energy in space; Parallel incompressible and compressible cascades – conservative rearrangment in scale; electromagnetic work on particles that drives flows, both macroscopic and microscopic; and pressure-stress interactions, both compressive and shear-like, that produces internal energy. Examples given from MHD, PIC simulations and MMS observations. A more subtle issue is how entropy is related to this degeneration (or, "dissipation") of macroscopic, fluid-scale fluctuations. We discuss this in terms of Boltzmann and thermodynamic entropies, and velocity space effects of collisions.

E-mail: *whm@udel.edu*

Mario Acuña Award

Particle acceleration at the Sun: what can we learn from solar neutrons?

J.F. Valdés Galicia

Programa Espacial Universitario, Universidad Nacional Autónoma de México, México

Abstract. An M6.5-class flare was observed at N12E56 on the solar surface at 16:06 U on July 8, 2014. In association with the flare, two neutron detectors located at high mountain locations, Mt. Sierra Negra in Mexico and Mt. Chacaltaya in Bolivia, recorded two neutron pulses, separated approximately by 30 min. Moreover, enhancements were also observed by the solar neutron detector onboard the International Space Station. We analyzed these data and contrasted them with solar images from the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory. From the existing evidence, we noticed that the production mechanism of neutrons cannot be explained by a single model; at least one of the enhancements may be explained by an electric field generated by the collision of magnetic loops and the other by the shock acceleration mechanism at the front side of the CME.

E-mail: *jfvaldesz@igeofisica.unam.mx*

Keynote talk

Solar Science with the Atacama Large Millimeter/submillimeter Array

Stephen M. White

Air Force Research Laboratory, USA

Abstract. The Atacama Large Millimeter/submillimeter Array (ALMA), the world's most important (and costly) radio telescope, has now been operating at 5000 m altitude in Northern Chile for several years. The high altitude is necessary to minimize the impact of the atmosphere on observations at such short wavelengths, but it adds to the complexity and cost of running such a large telescope. Astronomy at millimeter wavelengths tends to focus on dust and gas as cold as a few Kelvin, so using ALMA to observe the thousand-times hotter Sun is a challenge. Nonetheless, following a significant commissioning effort, ALMA has commenced scientific observations of the Sun. This talk will describe ALMA and the peculiarities of solar observations. Solar science at millimeter wavelengths focusses on two main areas: energy transport and dynamics in the solar atmosphere, and the most energetic particles accelerated by solar flares. In the current state of low solar activity, the former topic dominates the early solar science carried out with ALMA, and examples of the data and the science that results from it will be described.

E-mail: *stephen.white.24@us.af.mil*

Session 1

Solar Physics

Conveners:

Cristina Mandrini
Jean Pierre Raulin
Santiago Vargas-Domínguez

Invited talk

State-of-the-art Simulation of the Solar Wind and CMEs

W. Manchester[1], B. van der Holst[1], I. Sokolov[1], G. Toth[1], T. Gombosi[1], E. Landi[1], A. Vásquez[1,2,3,4]

[1]University of Michigan, USA
[2]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[3]Departamento de Física, Universidad de Buenos Aires, Argentina
[4]Departamento de Ciencia y Tecnología, Universidad Nacional de Tres de Febrero, Argentina

Abstract. Results are presented for our state-of-the-art data-driven three-dimensional global simulations of the solar corona and coronal mass ejections extending from the base of the transition region to 1AU. The model includes advanced thermodynamics including two-temperature (electrons and protons) and three-temperature (electron and parallel and perpendicular proton) descriptions with electron heat conduction and radiative losses. Alfvén wave turbulent transport is included to provide the energy and momentum to heat the corona and accelerate the solar wind. Wave energy is injected through the lower boundary and propagated with self-consistent wave reflection. Dissipation is driven by the nonlinear interaction of forward and counter-propagating waves, which approximates the cascade of Alfvén waves to the ion-gyroradius scale. Electron heat conduction transports much of the dissipated energy from down to the low corona where it is lost by radiative cooling in the extreme ultraviolet (EUV). Results for steady state and CMEs are shown and compared with a host of observations including EUV SDO/AIS images, differential emission measure tomography, coronagraph images and in-situ measurements at 1 AU. The model is shown to be capable of reproducing and explaining many observed phenomena in the corona and interplanetary space.

E-mail: *chipm@umich.edu*

Invited talk

Chromospheric Flares: Recent Observations and Modelling

P. Simões

University of Glasgow, UK

Abstract. Recent observations of solar flares and eruptions have revealed the dramatic effects of the magnetic energy release in the solar corona. However, to advance our comprehension of the basic physics of flare energy transport and dissipation it is necessary to understand the behaviour of the lower solar atmosphere during flares. High-resolution observations of flares carried out by the Interface Region Imaging Spectrograph (IRIS) and the Solar Dynamics Observatory (SDO), and a number of ground-based telescopes, have exposed the complex dynamical evolution of the localised chromospheric regions disturbed by a transient energy input. Allied with state-of-the-art numerical tools for radiative hydrodynamic simulations, these observations have been used to diagnose the spectral signatures of the flaring chromosphere and to refine our views of solar flares. In this talk I will review some of these recent results from observations and modelling, and include some expectations for new instrumentation and model upgrades.

E-mail: *paulo.simoes@glasgow.ac.uk*

Invited talk

Diagnostics of Solar and Heliospheric Phenomena in the Solar Orbiter and Parker Solar Probe Era

E. Landi

University of Michigan, USA

Abstract. The two new missions to the inner Heliosphere – Solar Orbiter and the Parker Solar Probe – open a new era in space exploration, by reaching regions of the inner heliosphere never directly explored before, and carrying state-of-the-art instrumentation. Their data will be coupled with new ground based instruments dedicated to the solar atmosphere, and new generation of 3D global models of the solar atmosphere and of the heliosphere. I will present an overview of novel diagnostic techniques and observational capabilities that will provide a unique opportunity to advance our understanding of the Sun and of the Heliosphere, as well as improve our Space Weather forecating capabilities.

E-mail: *elandi@umich.edu*

Contributed talk

Moreton Waves: Numerical Simulations and their Comparison with Observations

G. Krause[1], M. Cécere[2,3], E. Zurbriggen[2,3], A. Costa[2], C. Francile[4], S. Elaskar[1]

[1]Instituto de Estudios Avanzados en Ingeniería y Tecnología (IDIT, UNC – CONICET), Argentina
[2]Instituto de Astronomía Teórica y Experimental (IATE, UNC – CONICET), Argentina
[3]Observatorio Astronómico de Córdoba, Universidad Nacional de Córdoba, Argentina
[4]Observatorio Astronómico Félix Aguilar, Universidad Nacional de San Juan, Argentina

Abstract. We examine by performing 2D compressible MHD simulations, the capability of a CME scenario to drive a Moreton wave, considering the chromosphere and a stratified corona. We find that given a typical flux rope magnetic configuration, the larger the magnetic field and the lighter (and hotter) the flux rope, the larger the amplitude and the speed of the chromospheric disturbance, which eventually becomes a Moreton wave. Analysing Mach number we find that only fast magnetosonic shock waves would be able to produce Moreton events. In these cases an overexpansion of the flux rope is always present and it is the main responsible for the Moreton generation. Finally, we show that this scenario could give account of the Moreton wave of the December 06, 2006 event.

E-mail: *cecere@oac.unc.edu.ar*

Contributed talk

Do Sunspots Bubble?

M.V. Sieyra[1,2], G. Stenborg[3], A. Esquivel[4], A. Vourlidas[5], A. Costa[1,6]

[1]Instituto de Astronomía Teórica y Experimental (IATE, UNC – CONICET), Argentina
[2]Facultad de Matemática, Astronomía, Física y Computación, Universidad Nacional de Córdoba, Argentina
[3]Space Science Division, US Naval Research Laboratory, USA
[4]Instituto de Ciencias Nucleares, Universidad Autónoma de México, México
[5]The Johns Hopkins University Applied Physics Laboratory, USA
[6]Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Argentina

Abstract. On July 6, 2011, high spatial resolution images of the solar corona recorded in the extreme ultraviolet (EUV) channels of the Atmospheric Imaging Assembly (AIA) instrument onboard the Solar Dynamics Observatory (SDO) detected a recurrent, arc-shaped emission over a sunspot in NOAA AR 1243. The emission fronts propagated along a coronal loop bundle rooted in a small area of the dark umbra. No flaring or coronal mass ejection was associated with this phenomenon. Preliminary analysis suggests that the fronts propagate with an average phase velocity of 50 km/sec, exhibit a periodicity 3 minutes, and appear to be rooted in an umbral dot. In this work, we investigate (1) the nature of these quasi-periodic fronts that look like 'bubbles' (*i.e.*, are they bubbles or are they signatures of magnetosonic waves?), and (2) the driver of this recurrent phenomenon. To shed light into the physical nature of these 'bubbles' we run a 2D MHD simulation using a magnetic field based on a potential field extrapolation of the sunspot in a gravitationally stratified atmosphere. Here we report on the kinematical properties and frequency characterization of the event, and describe the details of the simulation along with some early outcomes from initial tests.

E-mail: *vsieyra@oac.unc.edu.ar*

Contributed talk

A Thermodynamics Interpretation of Electron and Temperature Description in the Sun's Corona

D.B. Berdichevsky[1], J.M. Rodríguez Gómez[2]

[1]Instituto de Física Rosario (IFIR, UNR – CONICET, Argentina)
[2]Instituto Nacional de Pesquisas Espaciais (INPE), Brazil

Abstract. We reach a thermodynamic interpretation to a model study of electrons density and temperature grounded on the physics of hydro magnetism in global equilibrium. This is the Coronal Density and Temperature (CODET) model of the Sun K-Corona, see bottom sentences. The thermodynamic interpretation finds consistency of the model with a magneto-matter medium that is diamagnetic, in the context of ideal magneto-hydrodynamics. To achieve the result in a quantitative way we propose that this medium possess an underlying structure that was earlier described to explain the adsorption process, *i.e.* in this case to be a 3-D Langmuir amorphous lattice in thermodynamic equilibrium. In this way constitutive properties of the medium –magnetic permeability, the non-dispersive acoustic speed, the expected equilibration time for the 1.1 to 1.3 solar radius region are here discussed–, which are determined quantitatively for a portion of the quiescent corona in a near solar minimum that extends for most of years 2008 and almost all 2009.
(The CODET model uses as input photosphere magnetic field, this magnetic field is extrapolated through the solar atmosphere from Potential Field Source Surface (PFSS) model. Also, a flux transport model, an emission model and an optimization algorithm are used.)

E-mail: *dbberdi@gmail.com*

Contributed talk

Three-Dimensional Reconstruction and Temporal Evolution of Plasma Parameters Along AR Loops

F.A. Nuevo, A.M. Vásquez, C.H. Mandrini, M. López Fuentes

Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina

Abstract. Due to their characteristic temperature and density, some magnetic flux tubes in active regions (ARs) can be directly seen as bright structures in extreme ultraviolet (EUV) and soft X-ray images. For these structures a background subtraction method can be applied to isolate the intensity of the loop from that of the background. Background subtraction allows the observational determination of plasma parameters (electronic density and temperature) along the loop using a differential emission measure (DEM) technique analysis that can be applied to EUV images. The 3D structure of the magnetic field that corresponds to the observed EUV loops is modeled using linear force-free field (LFFF) extrapolations that use AR magnetograms obtained with the Helioseismic and Magnetic Imager (HMI) instrument. In this work we reconstruct the three-dimensional (3D) distribution of plasma parameters for an ensemble of EUV loops identified in images obtained with the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO). The temporal evolution of these parameters is studied while the loop is observable in AIA images. The studied loops are approximately isothermal and overdense, consistent with previous studies of loops observed in the EUV range with another instruments. We discuss our results in the context of coronal heating models.

E-mail: *federiconuevo@gmail.com*

Contributed talk

Spectral Signature of Solar Active Regions in Submilimeter Wavelengths

J.F. Valle Silva[1], C.G. Giménez de Castro[1,2], C. Selhorst[3]

[1]CRAAM, Universidade Presbiteriana Mackenzie, Brazil
[2]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[3]NAT, Universidade Cruzeiro do Sul, Brazil

Abstract. During the evolution of the active solar regions, the associated diffuse and compact radio sources produce an increase in the observed microwave fluxes. The emission mechanisms attributed to these sources are typically thermal (free-free and gyroresonance), without ruling out the occurrence of non-thermal emission mainly associated with polarity reversal and other complex magnetic configurations. The Solar Submillimeter-wave Telescope (SST) and ALMA are able to observe the solar atmosphere deepest in the chromosphere, the upper photosphere and the low transition region. A group of active regions in the long decay stage were studied in order to compare the spectral signatures of morphologically different regions, plages and emergent flux areas. This work also shows the capabilities of SST to produce maps in 212 and 405 GHz, that along with Nobeyama and ALMA maps can contribute to understand the physics of the solar chromosphere.

E-mail: *jfvallesilva@gmail.com*

Contributed talk

Polarised Millimeter Observations of Solar Flares

A. Valio, R.F. Hidalgo Ramirez, D.F. Silva

CRAAM, Universidade Presbiteriana Mackenzie, Brazil

Abstract. The POEMAS (POlarization Emission of the Millimeter Activity of the Sun) telescopes, installed at CASLEO - Argentina, continuously monitor the Sun at 45 and 90 GHz. The novelty of this instrument is the circular polarization measurements that allow the study of nonthermal phenomena in solar flares. A total of 28 solar flares were observed at millimeter wavelengths during the years of 2011 and 2013 by the polarimeters. The polarization measurements were used to investigate the flare intensity and degree of polarization as a function of heliocentric angle to check for directivity effects such as those observed from the X-ray emission of solar flares. A correlation was found between the bursts flux density and their heliocentric angle, *i.e.* solar bursts with higher flux density tend to occur closer to the limb. The burst degree of polarization also varied with the heliocentric angle. To interpret these observational results, we applied a numerical simulation of the polarization degree spectra for gyro-synchrotron emission. The conclusion was that the polarization degree of the bursts throughout the solar disk matches that predicted by the gyro-synchrotron theory.

E-mail: *adrivalio@gmail.com*

Contributed talk

A Comparative Study of Oscillations of a Sunspot and a Filament and the Associated Dynamic Evolution of Filament

M. Rojas-Quesada[1], L. Taliashvili[2], H. Gutiérrez[2], R. Carboni[2]

[1]School of Physics/Instituto Tecnológico de Costa Rica, Costa Rica
[2]Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica

Abstract. We study short- and long-term oscillations of the intensity of two equatorial filaments, one quiescent and another one located near a sunspot. Based on SDO/AIA, SDO/HMI and GONG multi-wavelength data, we intended to identify the inter-correlation between the sunspots and the filament's oscillations, as well as the independent oscillations of each of them and the associated phenomena. We analyzed the evolution of the sunspots and filament's oscillations just prior to the filament eruption and onset of subsequent Coronal Mass Ejections (CMEs). In order to achieve these, we selected some small regions of the filament body, computed the average intensities inside each region, and obtained the relative oscillation with respect to the Savitzky-Golay filter. Additionally, Morlet wavelet power spectrum was obtained in order to deduce the frequencies of these oscillations and they evolution. The same process was applied to the sunspot. Preliminary results of this study provide a better insight about the implication of sunspots and filament's oscillations on the filament dynamic evolution and the associated CME.

E-mail: *miguel.rojas@tec.ac.cr*

Session 2

Solar Wind

Conveners:

Alisson Dal Lago
Ernesto Aguilar-Rodríguez
Hebe Cremades

Invited talk

Investigating Solar Wind Structures Using the UCSD 3-D Heliospheric Tomography with Observations of Interplanetary Scintillation (IPS) and Visible-Light Heliospheric Imaging

M.M. Bisi[1], B.V. Jackson[2], R.A. Fallows[3], O. Chang[4], H.-S. Yu[2], D. Barnes[1], M. Tokumaru[5]

[1]STFC RAL Space, UK
[2]CASS-UCSD, CA, USA
[3]ASTRON, The Netherlands
[4]UNAM/SCiESMEX/MEXART, Mexico
[5]ISEE, Nagoya University, Japan

Abstract. For over half a century, interplanetary scintillation (IPS) has been used to investigate the solar wind flowing through the inner heliosphere and was the technique that first allowed observations out of the ecliptic, that showed that there was more than one type of solar wind, and also that showed that features could be transient or co-rotate with the solar rotation. In addition to IPS, visible-light heliospheric imaging can also be undertaken via imaging instruments such as, historically, the Solar Mass Ejection Imager (SMEI) on board the Coriolis Satellite, and presently using the Heliospheric Imagers on the STEREO spacecraft. Both of these heliospheric imaging techniques can be used individually, or collectively, to observe solar-wind outflow, but investigations can also be enhanced by their input to the UCSD 3-D Heliospheric Tomography. Here, we will provide examples of science investigations using these various observing and tomography techniques and what they can tell us about the solar wind flowing through the inner heliosphere, and with implications for space-weather studies in the wider context.

E-mail: *Mario.Bisi@stfc.ac.uk*

Invited talk

Modeling Heliospheric Flux-ropes

T. Nieves-Chinchilla

Heliophysics Science Division, Goddard Space Flight Center – NASA, USA
Department of Physics, The Catholic University of America, USA

Abstract. In this work is presented an analytical flux-rope model, which establishes the different levels of complexity starting from a circular-cylindrical geometry. The framework of this series of models was established by Nieves-Chinchilla et al. 2016 with the circular-cylindrical analytical flux rope model. The model attempts to describe the magnetic flux rope topology with distorted cross-section as a possible consequence of the interaction with the solar wind. In this model, the flux rope is completely described in the non-orthogonal geometry. The Maxwell equations are solved using tensor calculus consistently with the geometry chosen, invariance along the axial direction, and with the assumption of no radial current density.
The model is generalized in terms of the radial dependence of the poloidal current density component and axial current density component. The misalignment between current density and magnetic field is studied in detail for the individual cases of two different pairs of indices for the axial and poloidal current density components. This theoretical analysis provides a map of the force distribution inside of the flux-rope.
For reconstruction of the heliophysics flux-ropes, the circular-cylindrical reconstruction technique has been adapted to the new geometry and applied to in situ ICMEs with a flux-rope entrained and tested with cases with clear in situ signatures of distortion. The model adds a piece in the puzzle of the physical-analytical representation of these magnetic structures that should be evaluated with the ultimate goal of reconciling in-situ reconstructions with imaging 3D remote sensing CME reconstructions. Other effects such as axial curvature and/or expansion could be incorporated in the future to fully understand the magnetic structure.

E-mail: *Teresa.Nieves@nasa.gov*

Contributed talk

Kinetic Properties of Solar Wind Heavy Ions Measured with SOHO/CELIAS/C and ACE/SWICS

N.P. Janitzek, L. Berger, R.F. Wimmer-Schweingruber

University of Kiel, Germany

Abstract. We analyze solar wind heavy ions (with atomic number Z¿1) measured at the Lagrangian point L1 by the Charge Time-Of-Flight sensor (CTOF), which is part of the Charge, Element, and Isotope Analysis System (CELIAS) experiment onboard the Solar and Heliospheric Observatory in 1996, and compare it with measurements of the Solar Wind Ion Composition Spectrometer (SWICS) onboard the Advanced Composition Explorer spacecraft between 2001 and 2010. Both instruments are linear time-of-flight mass spectrometers which are capable of measuring the ionsŕadial 1D Velocity Distribution Functions (VDFs) with a cadence of 5 and 12 minutes, respectively. In our study we focus 1) on the radial differential velocity ("differential streaming") between the heavy ions and the solar wind bulk protons measured by the SOHO/CELIAS Proton Monitor (PM) and the ACE Solar Wind Proton Alpha Monitor (SWEPAM), and 2) on the radial thermal velocities of the heavy ion samples. We find the following results:
1) Both experiments measured an increasing differential streaming with increasing proton bulk speeds up to mean values between 15 and 40 km/s in the fast solar wind for all investigated ions, which is equivalent to a significant fraction of the local Alfvén speed at 1 AU. Furthermore, the differential streaming shows the expected behavior of being largest along the local interplanetary magnetic field, measured by the ACE Magnetometer (MAG) instrument, while it vanishes completely for B-field configurations perpendicular to the measurement axis.
2) Both experiments measured equal radial thermal velocities for all heavy ions and protons in the collisionless solar wind with collisional age $A_c \ll 1$, while for higher values of $A_c \geq 1$ a clear trend towards equal kinetic temperatures is observed. Interestingly, comparing both nonthermal features on the collisional timescale we find that the differential streaming already decreases significantly within solar wind regimes of relatively low collisional age in which the phenomena of equal thermal velocities still persists.

E-mail: *janitzek@physik.uni-kiel.de*

Contributed talk

Interplanetary Flux Ropes: Importance and Limitations to Determine their Orientation from in 'situ' Observations

S. Dasso[1,2], P. Démoulin[3], M. Janvier[4]

[1]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[1]DCAO-DF/FCEN-UBA, Argentina
[2]Observatory of Paris, Meudon, France
[3]IAS, Orsay, France

Abstract. Flux ropes (FRs) in the solar wind are key interplanetary structures with strong influence on the Sun-Earth coupling level. In particular, the FR axis orientation can be obtained from 'in situ' local observations of magnetic and plasma properties. This orientation is crucial to make estimations of several physical quantities of FRs, such as the content of magnetic flux and helicity, which are very useful to track them in the interplanetary medium, and to link them with their solar sources. However, all the current methods to get the axis orientation require to assume global properties of the FR, such as to assume it as a 2.5D MHD structure in equilibrium, or to assume a given static model for its magnetic structure, etc. These assumptions are idealizations of real flux ropes, which can be in expansion while observed in the solar wind, or can have a magnetic structure different to the one assumed. In this work, we revise the importance of knowing the orientation of interplanetary FRs to estimate their main physical properties from 'in situ' observations in the solar wind, and we also analyze synthetic FRs to study the limitations of the two most commonly used methods to obtain the FR orientation: Minimum-Variance and Grad-Shafranov methods. We quantify the uncertainty of the axis orientation for different FR expansion rates and for different impact parameters (*i.e.*, minimum distance reached between the spacecraft that measure the FR and its axis).

E-mail: *sdasso@iafe.uba.ar*

Contributed talk

Geoeffectiveness Generated by the Geometry of the Stream Interface Associated to the SIRs

E. Sánchez-García[1], E. Aguilar-Rodríguez[2], J.A. González-Esparza[2], E. Romero-Hernández[3]

[1]PCT, Universidad Nacional Autónoma de México, México
[2]IGUM, Universidad Nacional Autónoma de México, México
[3]FCF-M, Universidad Autónoma de Nuevo León, México

Abstract. The stream interaction regions (SIRs) are generated in the interplanetary medium when a fast solar wind stream overtakes a slower one. The boundary between fast and slow solar wind flows is known as a stream interface (SI). If these large-scale phenomena interact with the Earth's magnetosphere, they can give rise to geomagnetic storms (GSs). In this study we analyzed the geoeffectiveness of a set of GSs that were generated by SIRs during the cycle 23 – 24. Their geoeffectivity is measured using magnetic indices at different latitudes: PCN (Polar Cap North) and PCS (Polar Cap South), aa (antipodal amplitude), AE (Auroral Electrojet), Kp (estimated global index), and SYM-H (symmetric disturbance component in H). We analyzed the geoeffective region within the SIRs with respect to the relative position of the SI. In addition, we present an analysis of the geoeffectivity generated by the geometry of the SI.

E-mail: *elsasg@igeofisica.unam.mx*

Contributed talk

Study of Small-scale Solar Wind Irregularities in the Inner Heliosphere from Interplanetary Scintillation

J. Mejía-Ambriz[1,2], J. González-Esparza[2], P. Villanueva-Hernández[2], E. Andrade-Mascote[2], E. Aguilar-Rodríguez[2], P. Corona-Romero[1,2], V. de la Luz[1,2], P. Reyes-Marín[3], O. Chang[2], G. Casillas-Pérez[2]

[1]Cátedras CONACyT, México
[2]LANCE, Universidad Nacional Autónoma de México, México
[3]Universidad Michoacana de San Nicolás de Hidalgo, México

Abstract. The interplanetary scintillation (IPS) is the observed flux fluctuation of astronomical radio sources when their signals cross through density irregularities in the solar wind. By IPS analyses it is possible to explore solar wind characteristics as speed, density, turbulence level, and the evolution of small-scale solar wind irregularities whose scales range from tens to hundreds of kilometers. The understanding of these irregularities can improve models of the inner heliosphere for space weather purposes. In this work we show the evolution of the small-scale solar wind irregularities from 0.1 to 0.6 AU by using IPS at different frequencies and assuming isotropic and quiet solar wind. We also give an introduction to the Mexican Array Radio Telescope (MEXART), a dedicated instrument of the Mexican Space Weather Laboratory (Laboratorio Nacional de Clima Espacial – LANCE) to IPS observations.

E-mail: *jcmejia@geofisica.unam.mx*

Contributed talk

Geoeffective Events Through the Solar Cycles

B. Schmieder[1], K. Bocchialini[2]

[1]LESIA, Observatoire de Paris, Meudon, France
[2]IAS, Orsay, France

Abstract. Extreme solar storms are well known in the historical databases. Since the modern era, it has been possible to associate clearly geomagnetic disturbances with solar events (flares, SEP, CMEs). In the recent solar cycles the geoeffective events (number and strength) are decreasing . As an exemple we will show, in one recent solar maximum activity year, how many flares, CMEs were geoeffective. Based on observations and theory, we will review the main ingredients for the built up of the electric current, free energy in active regions to get X-ray class flares and large Interplanetary Corona Mass Ejections and what we can predict in the near future.

E-mail: *brigitte.schmieder@obspm.fr*

Session 3

Planetary Magnetospheres

Conveners:

Walter González
Xochitl Blanco-Cano
César Bertucci

Invited talk

NASA's Juno Mission to Jupiter: What is Inside the Giant Planet?

F. Bagenal

LASP, University of Colorado, USA

Abstract. Juno's principal goal is to understand the origin and evolution of Jupiter. Underneath its dense cloud cover, Jupiter safeguards secrets to the fundamental processes and conditions that governed our solar system during its formation. As our primary example of a giant planet, Jupiter can also provide critical knowledge for understanding the planetary systems being discovered around other stars. With its suite of science instruments, Juno is investigating the existence of a solid planetary core, mapping Jupiter's intense magnetic field, measuring the amount of water and ammonia in the deep atmosphere. JUNO is also the first spacecraft to fly over Jupiter's aurora and measures both the energetic particles raining down on the planet and the bright "northern and southern lights" they excite. NASA's JUNO mission was launched in August 2011 and was put into orbit over Jupiter's poles on 4th July 2016.

E-mail: *bagenal@colorado.edu*

Invited talk

The Bow Shock and External Chapman-Ferraro Current Systems

R. López

University of Texas at Arlington, USA

Abstract. The typical picture of the boundary between the solar wind and the magnetosphere is that at the point where the solar wind pressure (mostly plasma dynamic pressure) balances the magnetospheric pressure (mostly magnetic pressure from Earth's dipole) a current called the Chapman-Ferraro current flows, forming the magnetopause and operating the magnetosphere from the solar wind. This simple picture glosses over the fact that the bow shock has a large current flowing on it, and for low Mach number solar wind flow, the JxB force from this current can be the largest for on the solar wind wind. In fact, there are times when the Chapman-Ferraro current exerts no force on the magnetosheath plasma, and up to half of the Chapman-Ferraro current flows on magnetosheath field lines, forming what is called the "external" Chapman-Ferraro current. This external current connects in part to the bow shock current, as do the Region 1 currents. In this talk I will present recent work that sheds new light on the current systems responsible for the force balance with the solar wind, and the implications for other space plasma systems.

E-mail: *relopez@uta.edu*

Contributed talk

Global ULF Response to the Sudden Changes of the Electric Field and Pressure in the Solar Wind

N. Romanova[1], J. A. Valdivia[2], M. Stepanova[1], O. Kozyreva[3]

[1]Universidad de Santiago de Chile, Chile
[2]Universidad de Chile, Chile
[3]Institute of the Physics of the Earth, Russian Academy of Science, Russia

Abstract. We monitor the propagation of a disturbance caused by isolated impulses or interplanetary shocks from the interplanetary space through the magnetosphere using magnetometer data from a world-wide arrays of magnetometers (SuperMAG, INTERMAGNET) and solar wind parameters from the OMNI data base and WIND satellite.
We have examined the propagation of the global spatial structure of ULF-waves around the Earth. This structure is associated with at least one of the possible sources of the ULF waves: sudden commencement impulses of the electric field (E=VxBs) and solar wind pressure (P). In particular, we compare the ULF global response for different scenarios: (a) after sudden changes in P for constant E, (b) after sudden changes in E for constant P, and (c) events where both E and P have sudden changes.
It was found that the propagation of ULF responses is different for each of the analyzed scenarios. We estimated the magnetic response as a function of magnetic latitudes and longitude around the Earth. We evaluated the time delay between the sudden increase in the solar wind parameters and the corresponding magnetospheric response. We found that this delay does not have a clear latitudinal/longitudinal dependence. It was also found that in the case of the sudden changes in the dynamic pressure, the signal seem to propagate with a super-Alfvenic speed.
Acknowledgments: This work has been supported by Project Conicyt Anillo ACT1405 (NR, JAV, MS), FONDECYT 1161356 (MS, JAV), FONDECYT 1150718 (JAV).

E-mail: *natalia.romanova@usach.cl*

Contributed talk

Magnetised stellar wind and their influence in the upper atmosphere of HD209458b

C. Villarreal D'Angelo[1], M. Jardine[1], J. LLama[2]

[1]University of St Andrews, Scotland
[2]Lowell Observatory, USA

Abstract. Lyman α observations during an exoplanet transit have proved to be very useful to study the interaction between the stellar wind and the planetary atmosphere. They have been extensively used to constrain planetary system parameters that are not directly observed, such as the planetary mass loss rate. In this way, Lyα observations can be a powerful tool to infer the existence of a planetary magnetic field, since it is expected that the latter will affect the escaping planetary material. To explore the effect that magnetic fields have on the Lyα absorption of HD 209458b, we run a set of 3D MHD simulations including dipolar magnetic fields for the planet and the star. We assume values for the surface magnetic field at the poles of the planet in the range of [0-5] G, and from 1 to 5 G at the poles of the star. Our models also include collisional and photo-ionisation, radiative recombination, and an approximation for the radiation pressure. Our results show that the magnetic field of the planet and the star change the shape of the Lyα absorption profile, since it controls the extent of the planetary magnetosphere and the amount of neutral material inside it. The model that best reproduces the absorption observed in HD 209458b (with canonical values for the stellar wind parameters) corresponds to a dipole planetary field of less than 1 gauss at the poles.

E-mail: *csdv@st-andrews.ac.uk*

Contributed talk

The Solar Wind interaction with Titan

C. Bertucci[1], D.C. Hamilton[2], W.S. Kurth[3], G. Hospodarsky[3], D. Mitchell[4], N. Sergis[5], N.J.T. Edberg[6], M.K. Dougherty[7]

[1]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[2]University of Maryland, USA
[3]University of Iowa, USA
[4]Applied Physics Lab., Johns Hopkins University, USA
[5]Academy of Athens, Greece
[6]Swedish Institute of Space Physics, Sweden
[7]Imperial College London, UK

Abstract. In this work we analyze the main features observed during the Cassini T96 flyby, where Saturn's major moon Titan was found in the supersonic Solar Wind. In particular, we analyze the properties of the plasma boundaries and regions and find that they bear strong similarities with features reported at Mars and Venus. Because of the upstream Solar Wind conditions during the encounter, Cassini observations may be also relevant to other bodies in the outer solar system such as Pluto, where kinetic processes are expected to dominate.

E-mail: *cbertucci@iafe.uba.ar*

Contributed talk

Numerical Modelling of Collisionless Perpendicular Shocks

D. Gómez[1], C. Bertucci[1], P. Dmitruk[2], L. Morales[3]

[1]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[2]Instituto de Física de Buenos Aires (IFIBA, UBA – CONICET), Argentina
[3]Instituto de Física del Plasma (INFIP, UBA – CONICET), Argentina

Abstract. Due to the low plasma density, collisionless shocks are ubiquitous in space physics. Examples of this are the bow shocks formed by the solar wind in front of the planets or the termination shock at the heliospheric boundary. The one-fluid magnetohydrodynamic framework provides an adequate description of the large scale structures of the upstream and downstream plasmas, but fails at describing the internal structure of these collisionless shocks.
A more comprehensive study of the inner and outer features of collisionless shocks would require the use of kinetic theory. Nonetheless, in the present contribution we show that a complete two-fluid model that includes the role of both ions and electrons, can properly capture some of the features observed in real shocks. For the specific case of perpendicular shocks, *i.e.* those for which the magnetic field is perpendicular to the shock normal, we numerically solve the one-dimensional two-fluid MHD equations to describe the generation of shocks and their spatial structure across the shock. Our preliminary numerical results show that finite amplitude fast-magnetosonic waves eventually evolve into stationary fast-magnetosonic shocks with a ramp thickness of the order of a few electron inertial lengths. Also, the parallel and perpendicular components of the self-consistent electric field are derived, and their role in accelerating particles is discussed.

E-mail: *dgomez@df.uba.ar*

Contributed talk

Plasma Turbulence at Sub-proton Scales: Two-fluid and Full-kinetic Plasma Description

C.A. González[1], T. Parashar[2], D. Gómez[3], W.H. Matthaeus[2], P. Dmitruk[1]

[1]Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires and IFIBA (UBA – CONICET), Argentina
[2]Bartol Research Institute and Department of Physics and Astronomy, University of Delaware, USA
[3]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina

Abstract. Plasma is a multi-scale problem which involves many spatial and temporal scales from wave up to particle phenomena. Turbulence is the process that connect all the scales on the system and is the way the energy is transported from the macro-scale and then dissipated in the micro-scale by non-ideal interactions. One can model the plasma as the temporal evolution of the ensemble of charged particles interacting with the electromagnetic fields under the Vlasov equation. Otherwise the plasma can be modeled as the average dynamic of the macroscopic quantities that are governed by the fluid equations. In plasma turbulence studies it is often assumed a single-fluid model where the large-scale of the system is well represented by the magnetohydrodynamics approach but the problem with that approach is that the physics at sub-proton scales can not be resolved. In order to study the plasma turbulence at sub-proton scales We employed systematic comparison of a two-fluid simulation which contains some kinetic effects (Hall and electron inertia effects) and also we used a full kinetic particle-in-cell simulation using the closest possible initial setup for both numerical schemes. We also studied the electric field at the corresponding scales through the breakdown of the generalized Ohm's law terms for both simulations with the aim to uncover which terms of the electric fields are important at sub-proton scales.

E-mail: *caangonzalez@df.uba.ar*

Session 4

Cosmic Rays

Conveners:

Hernán Asorey
José Valdés-Galicia
Carlos Navia

Invited talk

Determination of Spatial Diffusion Coefficients of Galactic Cosmic Rays in the Inner Heliosphere

J.J. Masías-Meza, S. Dasso

Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina

Abstract. One process of major importance involved in the transport of Galactic Cosmic Rays (GCRs) is the spatial diffusion due to the presence of magnetic irregularities in the medium. In order to characterize quantitatively these processes, we perform test-particle simulations with an in-house C++ code, to calculate the mean free paths associated to spatial diffusion in the turbulent interplanetary medium. We present some verifications of our code, and present results on the determination of the GCR mean free paths as a function of the radial distance to the Sun inside the heliosphere.

E-mail: *jimmy.ilws@gmail.com*

Invited talk

Anisotropy of Cosmic Rays during the Forbush Decrease Starting 2013 April 13

D. Ruffolo[1], U. Tortermpun[1], J.W. Bieber[2]

[1]Mahidol University, Thailand
[2]University of Delaware, USA

Abstract. Passage of a shock, sheath region, and/or magnetic flux rope associated with a solar storm can lead to a Forbush decrease (FD) in the Galactic cosmic ray (GCR) flux as well as strong GCR anisotropy. We have developed techniques to analyze data from the worldwide neutron monitor network to infer the 3D GCR anisotropy during a FD, for a case study of the event starting 2013 April 13. We consider the mechanisms that can generate anisotropy, including particle flows that provide remote sensing of distant physical processes. While studies using muon detectors sensing changes at ∼30 GeV have previously interpreted the perpendicular anisotropy in terms of particle gradients organized by the magnetic flux rope, we show that for this event the neutron monitor data (most sensitive to changes at ∼10 GeV) indicate diffusive effects on the anisotropy perpendicular and parallel to the large-scale magnetic field. In addition, we show evidence for a strong unidirectional parallel anisotropy inside the CME flux rope in the direction predicted by Krittinatham & Ruffolo (2009), based on a model of cosmic rays drifting inward along one leg and outward along the other. Thus our results favor a view that GCRs enter the CME sheath region by means of diffusion and enter the CME flux rope by guiding center drifts.

E-mail: *david.ruf@mahidol.ac.th*

Contributed talk

Antarctic Node of the Latin American Giant Observatory for Cosmic Rays Observations

A.M. Gulisano[1,2,3], S. Dasso[2,3,4], O. Areso[2], M. Ramelli[2], M. Pereira[2], U. Hereñú[2], H. Asorey[5], V.E. López[6], H. Ochoa[1], F. Iza[3], for the LAGO Collaboration*

[1]Instituto Antártico Argentino/DNA, Argentina
[2]Instituto de Astronomía y Física del Espacio (IAFE, UBA – CONICET), Argentina
[3]Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina
[4]Departamento de Ciencias de la Atmósfera y los Océanos, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina
[5]Laboratorio Detección de Partículas y Radiación, Instituto Balseiro y Centro Atómico Bariloche, Argentina
[6]Servicio Meteorológico Nacional, Argentina
*lagoproject.org, see the full list of members and institutions at lagoproject.org/collab.html

Abstract. The Latin American Giant Observatory (LAGO) project is formed by a collaborative network of Cherenkov detectors in water (WCDs) over the following ten Latin American countries: Argentina, Bolivia, Colombia, Chile, Ecuador, Guatemala, Mexico, Peru, Venezuela, and Brazil. The network Scientific Objectives include the study of the energy spectrum of the secondary particles generated by the primaries in the atmosphere, and the study of the integrated flux. LAGO has nodes at sites with different rigidity cut-offs and diverse altitudes and is able to monitor Space Weather conditions through the modulation of the cosmic ray flux among other scientific objectives. The Antarctic node will also permit to analyze energetic particles from solar origin, the so-called Ground Level Enhancements (GLEs), as well as decrements called Forbush decreases with higher sensitivity. The update of the state of the art on the implementation of the LAGO node in Antarctica, obtained at the campaign of November-December of 2017, is presented. The in-situ data telemetry testing for the meteorological station designed for the Marambio node, including the testing of the thermal control for the system was performed. Several improvements of the new design for the Antarctic LAGO WCD and the first associated results are also presented.

E-mail: *adrianagulisano@gmail.com*

Contributed talk

Analysis of the signal time series from three neutron monitors at different cutoff rigidity locations

J.F. Valdés Galicia, M. Pazos, J.G. López

Programa Espacial Universitario, Universidad Nacional Autónoma de México, México

Abstract. We studied the neutron monitor monthly data bases of Mexico City, Oulu, Finlad and Moscow, Russia from1990 to 2015 to find periodic variations in the intensity of the cosmic ray flux. We used the wavelet transform to identifiy mid-term variations present in the records. The corresponding confidence levels are given to the periodicities, as well as the contribution to the total power spectrum of such variations. Results are consistent to previous analysis done for other cosmic ray stations. As a reference, we compare these results with those of classical Fourier analysis based on the discrete Fourier transform, giving consistent results. This is the first time that a comparative analysis of this kind is done for these three neutron monitor series representing low, médium and high cutoff reigidities.

E-mail: *jfvaldesz@igeofisica.unam.mx*

Contributed talk

Detection Efficiency of the Solar Neutron Telescopes Installed at High Altitudes in Japan, China, Bolivia and Mexico

L.X. González[1], J.F. Valdés-Galicia[2], Y. Muraki[3], Y. Matsubara[3], T. Sako[4], K. Watanabe[5]

[1]LANCE/SCiESMEX IGUM, Universidad Nacional Autónoma de México, México
[2]IG, Universidad Nacional Autónoma de México, México
[3]ISEE, Nagoya University, Japan
[4]ICRR, University of Tokyo, Japan
[5]JAXA, Japan

Abstract. The solar neutron telescopes (SNTs) were designed especially to detect solar neutrons, but they can detect the galactic cosmic ray background. Four solar neutron telescopes (SNTs) are installed at high altitude in China (Tibet, 4300 m a.s.l.), (Japan, Mt Norikura, 2770 m a.s.l), Bolivia (Mt. Chacaltaya, 5250 m a.s.l) and Mexico (Mt. Sierra Negra, 4850 m a.s.l). The SNTs are composed by plastic scintillators (PS), photomultipliers tubes (PMT) are set on top of the PS. Proportional counters (PRC) surround the detector to discriminate between charged and neutral particles by anti-coincidence signal. Underneath the PS of the SNT an array of PRC is set to determine the arrival direction. The energy discriminator thresholds of the PMT are set at different energy levels in function of the PS thickness. The thickness of the PS is 40 cm (Tibet), 20 cm (Norikura), 30 cm (Sierra Negra) and 40 cm (Chacaltaya). Incoming particles produce recoil protons by nuclear interactions with the PS. The PMT measure the ionization energy loss of the protons. In this way, the SNTs can discriminate between incident charged and neutral particles, measure the energy, and determine the direction of the incoming particles. In this work, we present the experimental, GEANT3 and GEANT4 simulation results of the detection efficiency of the SNTs to solar neutrons impinging the top of the detectors.

E-mail: *xavier@geofisica.unam.mx*

Contributed talk

Neutron Detection Capabilities of Water Cherenkov Detectors

I. Sidelnik[1,2], H. Asorey[1,2,3], N. Guarin[1], F. Alcalde[1,2], L.H. Arnaldi[1,3], J. Lipovetzky[1,2,3], M. Pérez[1,3], M. Sofo Haro[1,2], M.Gómez Berisso[1,2], J.J. Blostein[1,2]

[1]Instituto Balseiro, Universidad Nacional de Cuyo, Argentina
[2]Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina
[3]Comisión Nacional de Energía Atómica, Argentina

Abstract. In this work we show the neutron detection capabilities of a water Cherenkov detector (WCD). This type of detector is used in different big observatories, such as The Pierre Auger Observatory in Argentina, and the Latin American Giant Observatory (LAGO) across the Andes, for the study of cosmic rays in a very wide energy range.
The experiments presented here were performed by using a single and simple, one PMT, WCD and 241AmBe and 252Cf neutron sources, using only pure water without additives as the detection volume. Different neutron moderators and shielding configurations and distances have been explored. We show that fast neutrons from the 241AmBe and 252Cf sources, as well as thermal neutrons coming from a neutron moderator and exhibiting different spectral characteristics, can be detected and identified over the flux of atmospheric particles background. The characteristic pulse-height histogram shapes are recorded as a clear signature of neutrons with energies lower than 11 MeV, which is the maximum neutron energy experimentally available with the sources we used. This was verified for different experimental conditions and even with detailed simulations based on Geant4, that corroborate neutron detection capabilities in the energy range from meV to GeV, depending only on the geometry of the active detection volume. Using a 1-ton detector, we estimate from our measurements a neutron detection efficiency at the level of (10±5).
Being the active volume a cheap and easily accessible material, the results obtained in this work are of great interest for the development of large neutron detectors for different applications, at a small fraction of the cost of current technologies. Of special importance are those related with space weather phenomena as well as those for the detection of fissionable or fusionable special nuclear materials.

E-mail: *sidelnik@cnae.gov.ar*

Contributed talk

Cosmic Rays and Inner Structure Colombian Volcanoes

H. Asorey[1,2,3], R. Calderón-Ardila[4], L.A. Núñez[4,5], J. Peña-Rodríguez[4], J. Pisco[4], J.D. Sanabria-Gómez[4], C. Sarmiento-Cano[3], D. Sierra-Porta[4,6], M. Suárez-Durán[4], A. Vásquez-Ramírez[4]

[1]Departamento de Física Médica, Centro Atómico Bariloche, Argentina
[2]Instituto Balseiro, CNEA-UNCuyo-CONICET, Argentina
[3]CNEA-CONICET-UNSAM Instituto de Tecnologías en Detección y Astropartículas, Argentina
[4]Escuela de Física, Universidad Industrial de Santander, Colombia
[5]Departamento de Física, Universidad de los Andes, Venezuela
[6]Centro de Modelado Científico, Venezuela

Abstract. Modeling volcano inner structure is crucial to evaluate their potential risk and can be achieved through powerful techniques such as muon tomography, which measures the atmospheric muon flux attenuation by rock volumes of different densities, allowing the projection of images of volcanic conduits at the top of the volcanic edifice.
We have simulated the cosmic ray background flux at 13 active volcanoes and developed a methodology to identify the most convenient sites to place a muon telescope in Colombia. Considering each particular volcano topography, we have calculated the muon flux crossing each structure and estimated the exposure time as a function of the acceptance of our hybrid muon telescope. Our simulation scheme considers three important factors with different spatial and time scales: the geomagnetic effects, the development of the extensive air showers in the atmosphere, and the detector response at ground level.
Our muon telescope combines two detection techniques: an hodoscope formed by two –30 X 30 scintillating strips– detection planes of plastic scintillator strips, and a water Cherenkov detector working as an active absorbent and as a third coincidence detector, constituting an innovative improvement which differentiates it from some other previous detectors.

E-mail: *mauricio.suarez@saber.uis.edu.co*

Contributed talk

Effects of Solar Flares and Solar Energetic Particle Events on the Atmospheric Electric Field

J.-P. Raulin, J. Tacza

CRAAM, EE, Universidade Presbiteriana Mackenzie, Brazil

Abstract. The AFINSA network (Atmospheric Electric Field Network in South America) is composed of eight sensors installed in Brazil, Argentina and Peru, and three new stations are planned for beginning of operation in 2018. AFINSA provides continuous measurements of the fair weather atmospheric electric field. In this paper, we present and discuss the comparison of the records obtained with AFINSA sensors in fair weather conditions with the "universal" Carnegie curves. Once obtained these template curves of the daily atmospheric electric field variations, we concentrate on their deviations obtained during solar and geomagnetic disturbed conditions. Namely, we study the effects of hundreds of solar flares as well of tens of Solar Energetic Particle (SEP) events on the atmospheric electric field. To increase the possible effects, a superimposed method was used in both cases. We find that no significant effects are observed during solar flares. On the other hand, during SEP events, a clear increase in the atmospheric electric field is detected of about 10 V/m in average. We discuss these results in terms of the electrical conductivity of the Earth's atmosphere and its time variability.

E-mail: *raulin@craam.mackenzie.br*

Contributed talk

Assessing the Geomagnetic Field Contribution During Three Forbush Decreases: May 2005, December 2006 and September 2017 at the Pierre Auger Observatory

M. Suárez-Durán[1,2], H. Asorey[2,3], S. Dasso[4,5,6], L.A. Núñez[1,7]

[1]Escuela de Física, Universidad Industrial de Santander, Colombia
[2]Instituto de Tecnologías en Detección y Astropartículas (CNEA, CONICET, UNSAM), Argentina
[3]Laboratorio Detección de Partículas y Radiación (CNEA, CONICET, UNCUYO), Argentina
[4]Departamento de Física (FCEN-UBA), Argentina
[5]Instituto de Astronomía y Física del Espacio (UBA – CONICET), Argentina
[6]Departamento de Ciencias de la Atmósfera y los Océanos (FCEN-UBA), Argentina
[7]Departamento de Física, Universidad de los Andes Mérida, Venezuela

Abstract. The flux of galactic cosmic rays (GCR) in the near-Earth environment is affected during the occurrence of transient solar phenomena, such as the arrival of an interplanetary Coronal Mass Ejections (iCME) producing a Forbush Decrease (FD). Several causes are associated with the observed changes in the flux during these phenomena, including the induced disturbances in the Geomagnetic field (GF). While some of these causes are well understood, some others need additional efforts, such as the relationship between GF perturbations and the observed flux variations at ground level. To estimate how much the GF can contribute to the variation of particles at the ground, we simulated the evolution of the local GF configuration at Malargüe, Argentina, during three FDs registered on May 15th, 2005; March 09th, 2012 and September 8th, 2017. For each GF configuration, we calculated how the flux of GCR is affected and evaluate the corresponding modulation of secondary particles at the ground. After that, we quantitatively compared our findings with the flux measured by the low energy modes of the Pierre Auger Observatory.
Evidence of GF effects on the GCRs modulation is clearly visible when the measured rates are compared with the simulated fluxes. Our analyses show that GF variations significantly affect the flux observed at the ground, even at low geomagnetic latitudes. This affectation could be dominant for some components of the flux, such as secondary neutrons. This analysis shows that by combining our method with the extended capabilities of Cherenkov detectors measured from ground level it is possible to discriminate the heliospheric disturbances occurred during the passage of the ICMEs from those originated on the GF perturbations.

E-mail: *mauricio.suarez@saber.uis.edu.co*

Session 5

Ionosphere and the Upper Atmosphere

Conveners:

Marco Milla
Maria Sergeeva
Inez Batista

Invited talk

Upper Atmosphere Response to 2015 St. Patrick Geomagnetic Storm

M.V. Klimenko[1,2], V.V. Klimenko[1], I.E. Zakharenkova[1,3], K.G. Ratovsky[4], A.M. Vesnin[4], R.Yu. Lukianova[5,6], I.V. Despirak[7], B.V. Kozelov[7], S.M. Chernyakov[7], A.V. Dmitriev[8], A.V. Suvorova[8], E.S. Andreeva[8], A.M. Padokhin[8], R.V. Vasilyev[4], D.S. Kotova[1], M. Sergeeva[9]

[1]West Department of Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (IZMIRAN) RAS, Russia
[2]I. Kant Baltic Federal University, Russia
[3]Institut de Physique du Globe de Paris, France
[4]Institute of Solar-Terrestrial Physics SB RAS, Russia
[5]Geophysical Center RAS, Russia
[6]Space Research Institute (IKI) RAS, Russia
[7]Polar Geophysical Institute, Russia
[8]Lomonosov Moscow State University, Russia
[9]Instituto de Geofísica, Unidad Michoacán, Universidad Nacional Autónoma de México, México

Abstract. Morphology of ionospheric disturbances and their formation mechanisms are the most important and complex issues of the ionospheric physics. In the recent years, to address these questions, the theoretical models of the Earth's upper atmosphere are increasingly in use along with the experimental data and empirical models. In this contribution, we present an overview of the upper atmospheric response to strong geomagnetic storm occurred on March 17-23, 2015. The results are obtained from both the satellite and ground-based observations, and from the computer simulation using the Global Self-consistent Model of the Thermosphere, Ionosphere, and Protonosphere (GSM TIP). The following problems are considered: (1) comparison of the model results with observations of ionospheric parameters using different radio physical methods; (2) formation mechanisms of temporal variations in the ionospheric disturbances at different altitudinal, latitudinal, and longitudinal regions of the upper atmosphere; (3) possible causes of mismatch in disturbances obtained from the modeling and from the observations (model input parameters, physical statements, etc.). In particular, during the storm recovery phase the model results show an increase in the n(O)/n(N2) ratio and a decrease in the n(N2) that results in the daytime positive effects in the foF2. Comparison is made of the storm-time effects in the ionosphere, and at the plasmaspheric heights, and in total electron content. The obtained differences are explained by competitive electrodynamical and chemical processes. A strong positive storm at low latitudes above the Pacific and in the South Atlantic Anomaly region on the main and recovery phases could not be predicted by the model and could be explained by ionization effect of energetic electron enhancements. In addition we discuss the possible role of vertical thermospheric wind in ionospheric disturbances.
This investigation was performed with the financial support of the Russian Science Foundation grant (no. 17-17-01060 and 17-77-20009).

E-mail: *maksim.klimenko@mail.ru*

Invited talk

Radar Imaging Equatorial Spread F Events

F.S. Rodrigues[1], E.R. de Paula[2], M.A. Milla[3]

[1]The University of Texas at Dallas, USA
[2]Instituto Nacional de Pesquisas Espaciais (INPE), Brazil
[3]Jicamarca Radio Observatory, Peru

Abstract. Equatorial spread F (ESF) is the name given to signatures of ionospheric electron density irregularities observed by different types of ground- and space-based sensors. ESF irregularities have a wide spectrum of horizontal and vertical scale sizes, ranging from hundreds of km down to cm. Large-scale ESF structures are believed to be produced by the so-called ionospheric Generalized Rayleigh-Taylor (GRT) instability. This instability finds favorable conditions around sunset hours, near the magnetic equator when large vertical density gradients and enhanced upward plasma drifts are known to occur. Therefore, it explains the high occurrence of ESF irregularities in the post-sunset hours, and during periods when a pre-reversal enhancement of the upward ExB plasma drifts occur. Most of the main features of ESF, including its seasonal and longitudinal variability have been well studied and reported. Recent efforts have focused on advancing our understanding of the conditions leading to the short-term (day-to-day) variability in ESF. We also seek a better understanding, for instance, of unusual ESF events occurring outside typical ESF periods. Those include quiet-time events observed in the post-midnight sector, daytime, and during June solstice. Advances in numerical modeling of ESF have allowed us to better understand thermospheric and ionospheric conditions leading to ESF development and suppression. To keep up with numerical developments, new techniques and data sources need to be put in place to confirm theories and projections. New radar measurements and techniques can provide insights with that respect. In this presentation, we will talk about two-dimensional views of ESF events using observations made by relatively small radar systems. In the first part of the talk, we will present results of interferometric in-beam interferometric coherent scatter radar observations made in the Brazilian sector using a small, low-power radar system. In the second part of the talk, we will then present new coherent scatter observations of ESF events using measurements made by a 14-panel version of the AMISR system at the Jicamarca Radio Observatory in Peru. While the interferometric measurements provide high resolution observations of ESF scattering structures, they are limited in field-of-view. We show that the limitation in field-of-view can be overcome with AMISR-14 phased-array observations at the expense of zonal resolution. We will present and discuss results of both types of observations in light of current ESF theories and modeling.

E-mail: *fabiano@utdallas.edu*

Invited talk

Ionospheric Studies Using the Boston University Network of All-sky Imagers from Equatorial to Sub-auroral Latitudes

C. Martinis[1]

[1]Boston University, USA

Abstract. The Boston University Imaging Science Group has established a network of all-sky-imagers (ASIs) to study processes in the thermosphere-ionosphere from low latitudes to sub-auroral latitudes. Bymeasuring variations in the brightness of airglow emissions at different wavelengths we can investigate the dynamics of the upper atmosphere. The processes discussed here include low latitudeperturbations, associated with equatorial spread-F (ESF), medium scale travelling ionospheric disturbances (MSTIDs), occurring at midlatitudes , and, during geomagnetic storms, stable auroral red (SAR) arcs, at sub-auroral latitudes. Our ASIs are situated at four magnetically conjugate pairs in North and South America, plus one pair linking Europe and South Africa. Additional ASIs are located in Texas, USA, Mount John, NZ, and Jicamarca, Peru. This presentation will summarize our studies using ASIs, as well as in-situ satellite data, with the goal of achieving a global understanding of thermosphere/ionosphere processes when different local conditions at magnetically conjugate locations are taken into account.

E-mail: *martinis@bu.edu*

Contributed talk

The Southern Argentina Agile Meteor Radar (SAAMER): 6 Years Survey of the Meteoroid Environment

D. Janches[1], J. Hormaechea[2], P.Pokorny[3], I. Bibbo[4], C. Brunini[4] and D. Fritts[5]

[1]Goddard Space Flight Center, NASA, USA
[2]Estación Astronómica Río Grande, Argentina
[3]Catholic University of America, USA
[4]Dept. of Astronomy and Geophysics, University of La Plata, Argentina
[5]Gats, Inc., USA

Abstract. The Southern Argentina Agile Meteor Radar (SAAMER) is a new generation system deployed in Rio Grande, Tierra del Fuego, Argentina (53^o S) in May 2008. SAAMER transmits 10 times more power than regular meteor radars, and uses a newly developed transmitting array, which focuses power upward instead of the traditional single-antenna-all-sky configuration. The system is configured such that the transmitter array can also be utilized as a receiver. The new design greatly increases the sensitivity of the radar enabling the detection of large number of particles at low zenith angles. The more concentrated transmitted power enables additional meteor studies besides those typical of these systems based on the detection of specular reflections, such as routine detections of head echoes and non-specular trails, previously only possible with High Power and Large Aperture radars. In August 2010, SAAMER was upgraded to a system capable to determine meteoroid orbital parameters. This was achieved by adding two remote receiving stations approximately 10 km away from the main site in near perpendicular directions. In January 2017, we upgraded the system by adding a third remote receiving station. The upgrades significantly expands the science that is achieved with this new radar enabling us to study the orbital properties of the interplanetary dust environment. Because of the unique geographical location, the SAAMER allows for additional inter hemispheric comparison with measurements from Canadian Meteor Orbit Radar, which is geographically conjugate. To date, SAAMERs survey has collected more 2.5 million orbits, showing a very strong contribution of the South Toroidal Sporadic meteor source, of which limited observational data is available. In addition, SAAMER offers similar unique capabilities for meteor showers and streams studies given the range of ecliptic latitudes that the system enables to survey. It can effectively observe radiants from the ecliptic south pole to approximately 30^o N, and thus enable detailed study of showers at high southern latitudes (e.g July Phoenicids or Puppids complex), which are unobservable from the CMOR's location. To date about 30 new showers have been identified in SAAMER's dataset which mostly have radiants within the South Toroidal region. Finally, SAAMER is ideal for the deployment of complementary instrumentation in both, permanent and campaign, operational mode. Results from various radar meteor investigations as well as radar/optical observation campaign will be presented in this paper as well a summary of current upgrades underway which include the addition of a third remote receiving station as well as a chain of all-sky cameras.

E-mail: *diego.janches@nasa.gov*

Contributed talk

The LITES Experiment Aboard the ISS: Remote Sensing of the Upper Atmosphere and the Ionosphere in the Extreme and Far Ultraviolet

S. Chakrabarti[1], A. Stephan[2], S. Finn[1], G. Gedddes[1], T. Cook[1], S. Budzien[2]

[1]LoCSST/UML, USA
[2]NRL, USA

Abstract. The Limb-Imaging Ionospheric and Thermospheric Extreme-ultraviolet Spectrograph (LITES), an imaging spectrograph covering 60 – 140 nm wavelength range at 0.4 nm resolution, was launched as part of the Space Test Program Houston #5 (STP-H5) payload. It was subsequently installed on the International Space Station (ISS) and samples tangent altitudes 150 – 350 km with 0.25^o angular resolution. LITES in combination with the GPS Radio Occultation and Ultraviolet Photometry – Colocated (GROUP-C) experiment, which includes a GPS receiver and a nadir-viewing 135.6 nm photometer, jointly collect new information on the thermosphere and the ionosphere using simultaneous UV and radio emissions.
LITES has observed altitude profiles of day and night airglow emissions that are being used to infer thermospheric and ionospheric density profiles in a self-consistent manner. Furthermore, , geomagnetic storm effects on its UV emissions can be used to remotely sense their effects on the upper atmospheric morphology. These ISS observations complement to the upcoming ICON and GOLD NASA missions, focused on ionosphere-atmosphere coupling and global-scale atmospheric response to space weather observed from higher altitudes. In this talk, we will present an overview of the LITES instrument and some early results from the first few months of operations.

E-mail: *Supriya_Chakrabarti@uml.edu*

Contributed talk

Peculiarities of TEC Distribution over the American Sector in Both Hemispheres

M. Sergeeva[1], O. Maltseva[2], J.-A. González-Esparza[1], T. Nikitenko[2], P. Corona-Romero[1], J. Mejía-Ambriz[1], V. De la Luz[1], L.X. González[1], E. Romero-Hernández[3], M. Rodríguez-Martínez[4], V. Gatica-Acevedo[5], E. Aguilar-Rodríguez[1]

[1]SCiESMEX/IGUM, Universidad Autónoma de México, México
[2]IP, Siberian Federal University, Russia
[3]Universidad Autónoma de Nuevo León, México
[4]ENES, Universidad Autónoma de México, México
[5]IPN, México

Abstract. Large changes in the Earths ionosphere can occur during geomagnetic disturbances altering behaviour of ionospheric parameters, for example of Total Electron Content (TEC). Study of ionosphere during disturbances is a challenging task itself and seems to be more complicated in the vicinity of Equatorial Anomaly (EA) and other known structures of the ionosphere. In this work variations of TEC were studied over the American sector (both hemispheres) along the longitude of 100° W within the geographical latitude range between +60° and -60° that corresponds to geomagnetic latitudes between +69.2° and -47.7°. The region of equatorial anomaly was of a particular interest. TEC behaviour was analyzed during geomagnetic disturbances of different intensity. Absolute TEC values observed during the particular days were compared to the reference TEC values defined by different methods. The influence of choice of these reference values on the results of comparison is discussed. It was found that TEC responses to weak geomagnetic disturbances can be similar to TEC responses to intense disturbances especially if they include positive Dst values. This fact proves the need of the continuous ionosphere monitoring with use of TEC obtained from local GNSS receiver networks. The presence of positive short-lived TEC disturbances was detected over Mexico in the previous works of the authors. This study reveals that these positive disturbances prevail along the whole meridian both at day- and night-time. EA crests presence was confirmed not only for the particular days but also in the median values with the hemispheric asymmetry in the most cases. EA crest disappearance in the cases of disturbances of different intensity was found. Possible physical mechanisms of TEC behavour were discussed for each case considered in the study (geomagnetic field changes, O/N2, neutral winds).

E-mail: *maria.a.sergeeva@gmail.com*

Contributed talk

Towards the Long-term Variability of the Mesosphere Using Low Frequency Radio Waves Observation over Latest 5 Solar Cycles

D.H.W. Peters[1], G. Entzian[1], C. Kalicinsky[2], and J.L. Chau[1]

[1]Leibniz-IAP, University of Rostock, Kuehlungsborn, Germany
[2]Institute for Atmospheric and Enviromental Research, University of Wuppertal, Germany

Abstract. Since the end of 1950s, that means over more than 5 solar cycles, field strength measurements of the broadcasting station, Allouis (about 1000 km distance; Central France), have been performed at Kuehlungsborn (54° N, 12° E, Mecklenburg, Northern Germany). These so-called indirect phase-height measurements of low frequency radio waves (here with a frequency of 162 kHz) are used to study the long-term variability and trends of the mesosphere over Europe. The advantages of the method are the low costs and the simplicity of operation, with a loss rate of data lower than 10 %. For the new reanalyzed forth release, results of the standard-phase height (SPH) and that of plasma scale height (PSH) series, both defined by Peters and Entzian (2015) are presented, and discussed for the period 1959-2016.
The SPH-series are anti-correlated to the solar cycle because stronger photo-ionization is linked with higher number of electrons, which reduces the SPH. Furthermore the statistical analysis of the SPH-series shows a significant overall trend in the order of hundred meters per decade mainly induced by a shrinking stratosphere due to global warming, but with strong intra-decadal variability in winter, like ENSO and QBO.
Further, we compared the PSH-series over the Eifel mountain region (D layer; about 80 km altitude; 50° N, 6° E; Western Germany) observed from Kuehlungsborn (Northern Germany) in the time period 1959 – 2016 and OH* temperatures (center altitude 87 km) observed from Wuppertal (51° N, 7° E; Western Germany) in the time period 1988-2016. In summer months both time series show a dominant oscillation of about two decades (20 to 26 years) with amplitudes of about 180 m and 3 K, respectively. These two observed oscillations are anti-correlated to each other, because the two observation altitudes are located above and below the temperature minimum in the mesopause region in summer, respectively.
Furthermore, the derived thickness temperature of the mesosphere decreased statistically significant over the period 1959-2016 after pre-whitening with summer means of solar sun spot numbers. The trend value is in the order of about -1.06 K/ decade, if the stratopause trend is excluded. The linear regression is stronger (-0.8 K/ decade) for SCs 20/21, but weaker (-0.5 K/ decade) for SCs 22/23, but stronger (-1.6 K/ decade) for SCs 23/24.

E-mail: *peters@iap-kborn.de*

Contributed talk

A Global Study of Ionosheric Winter Anomaly Rate of Occurrence Using GPS-TEC from the Last Two Solar Cycles

F. Azpilicueta[1], B. Nava[2]

[1]Facultad de Ciencias Astronómicas y Geofísicas, UNLP – CONICET, Argentina
[2]Abdus Salam International Centre for Theoretical Physics, Italy

Abstract. Since the first report of its existence by Berkner and colleagues in the 30s, the winter anomaly (or non-seasonal variation as named by Berkner) has been subject of continue study and modeling. As it is the case with other ionospheric phenomena (*e.g.* semi-annual anomaly) the aeronomy community has not reached to a complete formulation of the physics involved in this phenomenon. Even there isn't a clear definition of the anomaly in terms of the effects expected to observe in the presence of the winter anomaly. The criterion used for this work was that the winter anomaly is present when the maximum NmF2 (or equivalently the TEC - Total Electron Content) value during the local winter is higher than the corresponding value during local summer over a single station. This definition highlights the anomalous characteristic since local summer values would be expected higher than winters. For this contribution we have processed the complete GPS data files from set of IGS stations (International GNSS Service) with LPIM software, resulting on a database of TEC (Total Electron Content) for almost the last two solar cycles. The chosen stations provide a good coverage in latitude and reasonable good in longitude. Comparing the results obtained for winter/summer seasons, we were able to identify the presence of the winter anomaly and to produce a latitude-year scheme covering solar cycles 23 and 24. The main conclusions of the work can be summarized as follows: 1) the winter anomaly was found to occur in several northern hemisphere and southern equatorial stations, only one station at southern mid-latitude shows signs of winter anomaly; 2) the rate of occurrence during cycle 23 was significantly higher than during cycle 24, confirming the relation between the rate with the solar ionization level (cycle 23 level was approx. 40 % higher than cycle 24); 3) for non equatorial stations the winter anomaly is absent for low solar activity years. These results are in agreement with already published researches and support the idea of a non-seasonal (annual anomaly) rather than a seasonal anomaly.

E-mail: *azpi@fcaglp.unlp.edu.ar*

Contributed talk

TEC Measurements over the Peruvian Sector Using Low Earth Orbit Satellite Beacons and Software-defined Radio Receivers for Ionospheric Studies

E. Pacheco[1], F. Villanueva[1], J. Verástegui[1], and C. Valladares[2]

[1]Instituto Geofísico del Perú, Radio Observatorio de Jicamarca, Perú
[2]The University of Texas at Dallas, USA

Abstract. Total electron content (TEC) measurements have been successfully used to investigate the ionosphere variability and occurrence of irregularities such as spread F and scintillation as well as the ionospheric plasma density behavior as a function of local time, seasonal, solar activity, latitude and longitude. Radio beacons onboard Low Earth Orbit (LEO) satellites are currently used to obtain TEC measurements by transmitting usually two radio waves at different frequencies from space to ground-based receivers. The phase difference of these two signals can be used to obtain the relative TEC of the ionosphere. Here, we will present the scientific mission, the description of the system and the current progress and advancements of a project that is been developed at the Instituto Geofísico del Perú (IGP) - Jicamarca Radio Observatory (JRO) that consists in the development of a dual-frequency radio beacon instrument for nanosatellites and a receiver system based on software-defined radio technology to obtain TEC measurements over the Peruvian region. Recent TEC preliminary observations from 2016, 2017 using beacon radio waves propagating from LEO satellites (DMSP F15 and CASSIOPE) to ground-based stations will be shown to illustrate the behavior of the ionosphere at the low latitudes and will be compared with ground-based instrumentation such as GPS and radar measurements at the JRO. The TEC measurements have the potential to provide relevant information of the ionospheric plasma density variation and occurrence of plasma depletions and irregularities and therefore can be utilized as inputs for models to obtain a more detailed specification of the ionosphere.

E-mail: *edgardo.pacheco@jro.igp.gob.pe*

Contributed talk

Impacts of the Next Southern Total Solar Eclipses (2019 and 2020) on the Conjugate Point: Coordinated Scientific Efforts

A.A. Pacini[1], C.G.M. Brum[2]

[1]APL/JHU – Arecibo Observatory – InSpace LLC
[2]Arecibo Observatory

Abstract. In the following years, South America will experience two Total Solar Eclipses on Jul 02nd, 2019 and Dec 14th, 2020. The totality path will cross Chile and Argentina both times and a partial eclipse will be also visible in Brazil, Uruguay, Paraguay, Bolivia, Peru, Ecuador, Venezuela and Colombia. It is known that the shadow casted by the moon during a solar eclipse drives dramatic changes in the terrestrial atmospheric properties. Thus, besides the natural potentiality for solar coronal studies, total solar eclipses brings also special opportunities for investigations of the mechanisms of the generation and propagation of ionospheric localized changes and also large-scale effects of these disturbances. Although the aforementioned eclipse paths will cross only South America countries, ionospheric changes will be induced also in the Central and North America, due to the electrons inter-hemispherical transport along the geomagnetic field lines. Interestingly, these eclipses will provide the first opportunities for investigating the ionospheric effects induced around the Arecibo Geomagnetic Conjugate Point (AGCP, located near Santa Teresita, a city of the Argentinean Province of Buenos Aires) having the Arecibo Observatory Incoherent Scatter Radar (ISR) on the other end of the magnetic field line. In this talk, we will present and discuss the availability and observing plans of Arecibo and in situ observations of the upper atmospheric response during both eclipses, discussing the potential scientific conjugate point coordinated observations as well.

E-mail: *cbrum@naic.edu*

Contributed talk

F-region incoherent scatter medium power radar observations at the Jicamarca radio observatory

M. Milla[1], J.L. Chau[2]

[1]Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, Perú
[2]Leibniz-Institute of Atmospheric Physics, Germany

Abstract. Incoherent scatter radar observations of the F-region ionosphere were conducted at the Jicamarca Radio Observatory using 100 KW transmitters. The goal of these observations was to study the possibility of using medium-power, rather than high-power, transmitters in routine radar operations. The use of high-power transmitters, that typically delivered a power of the order of a few megawatts, requires continuous human supervision as well as the need of additional logistics and resources. Because of this, high-power measurements are limited only to a few campaigns during the year (about 1000 hours of operation every year). The use of medium-power (100 KW) transmitters would, in principle, avoid the need of human supervision reducing the electrical costs, and thus, facilitating the operation of the radar for more hours during a year, which is relevant for ionospheric modeling and forecasting. In the present work, we will present the results obtained with the Jicamarca radar operating in an alternative medium-power mode. Antenna diagrams, pulse and receiving configurations will be presented. The quality of F-region ionospheric plasma parameters measured with this mode will be discussed in comparison with standard high-power measurements.

E-mail: *mmilla@igp.gob.pe*

Contributed talk

Semimonthly Oscillations Observed in the Start Time of Equatorial Spread-F

I. Paulino[1], A.R. Paulino[2], R.Y.C. Cueva[3], R.A. Buriti[1], C.M. Wrasse[4], H. Takahashi[4]

[1]UFCG, Brazil
[2]UEPB, Brazil
[3]UEMA, Brazil
[4]INPE, Brazil

Abstract. An extensive study on the start time of equatorial plasma bubble, observed by an all sky imager deployed at São João do Cariri (36.5° W, 7.4° S), and equatorial spread-F, observed by a coherent back scatter deployed at São Luís (44.3° W, 2.5° S) was conducted from 2001 to 2009. Oscillation of 14.5 days was clearly observed in three month (September 2003, October 2005 and January 2008) in the airglow images with amplitudes of 45-60 min. Furthermore, using the data from the radar range time integration (RTI) maps, several events were observed with dominant period of 14.5 days in September 2001, November 2002, January-February 2003, October-December 2005 and November 2008. In such case, the amplitude of the oscillation were from 3 min up to 60 min. This oscillation could be related to the semidiurnal lunar tide, which appear as an important contributor to the time of occurrence of equatorial spread-F.

E-mail: *igopaulino@gmail.com*

Session 6

Plasma Physics and Nonlinear Processes in Space Geophysics

Conveners:

Abraham Chian
Alejandro Valdivia
Daniel Gómez

Invited talk

Multifractal Analysis of Interplanetary and Ionospheric Turbulence

R.A. Miranda[1], A.C.-L. Chian[2,3,4], J.R. Abalde[3], E.L. Rempel[3]

[1]UnB, Brazil
[2]UAdel, Australia
[3]ITA, Brazil
[4]INPE, Brazil

Abstract. Intermittent turbulence is ubiquitous in space plasmas and is characterized by departures from self-similar scaling laws due to the presence of large-amplitude coherent structures at small scales. We quantify the degree of multifractality in interplanetary turbulence using time series of the modulus of the magnetic field |B| detected by ACE and Cluster on 1 February 2002. This event is characterized by three interplanetary magnetic flux ropes, a bifurcated current sheet, and evidence of rope-rope magnetic reconnection. In addition, we quantify multifractality of ionospheric plasma bubbles using all-sky images of nightglow emissions in the South Atlantic Magnetic Anomaly during a multiple bubble-bubble reconnection event. Our results indicate that reconnection can lead to an enhancement of intermittency and multifractality, and can offer new insights on the origin of turbulence in space plasmas.

E-mail: *rmiracer@gmail.com*

Invited talk

Field Line Random Walk and Energetic Particle Transport in Magnetic Turbulence

D. Ruffolo

Mahidol University, Thailand

Abstract. We summarize our recent theoretical and computational results about the random walk of field lines and energetic particles in space plasmas with magnetic turbulence. Theories based on Corrsin's approximation, which relates a Lagrangian correlation to Eulerian quantities such as the turbulent power spectrum, provide a reasonable match to computer simulations of the ensemble average diffusion of field lines and energetic particles perpendicular to the mean magnetic field. We also discuss an explanation of observed dropouts in energetic particles from impulsive solar flares in terms of the 2D+slab model of solar wind turbulence, including the effect of temporary topological trapping, and present full orbit calculations of energetic particle trajectories in spherical geometry.

E-mail: *david.ruf@mahidol.ac.th*

Invited talk

Compressible MHD and Kinetic Scale Turbulence in the Terrestrial Magnetosheath: Recent Results from the Cluster and Themis Spacecraft

F. Sahraoui[1], L.Z. Hadid[1,2], S.Y. Huang[3], S. Galtier[1], N. Andrés[1]

[1]Laboratoire de Physique des Plasmas, LPP/CNRS-Ecole Polytechnique-Sorbonne Univ.-Paris-Sud-Obs. Paris, France
[2]Institute of Space Physics, IRF, Sweden
[3]School of electronics, Wuhan University, China

Abstract. In comparison with the solar wind, plasma turbulence in the magnetosheath remains far less explored. This is essentially due to the complexity of the magnetosheath dynamics that challenges any "realistic" theoretical modeling of turbulence in it. This complexity is due to various reasons such as the confinement of magnetosheath plasma between two dynamical boundaries, namely the shock and the magnetopause; the highly variable solar wind pressure that "shakes" and compresses continuously the magnetosheath plasma; and the presence of temperature anisotropies that generate various instabilities and plasma modes. I will show recent statistical results that reveal new aspects about the nature and scaling of the magnetosheath turbulence using the Cluster data. I will show as well the first estimation of the energy dissipation rate for compressible magnetosheath turbulence using the start-of-art compressible MHD theories and compare those results to recently published ones about solar wind turbulence. I will discuss some implications of the results on modeling of dissipation at kinetic scale and their possible application to distant astrophysical plasmas non accessible to in-situ observations.

E-mail: *fouad.sahraoui@lpp.polytechnique.fr*

Contributed talk

The Universality of the Thermally Induced Electromagnetic Fluctuations in Quasi-stable Plasmas

J.A. Valdivia[1], P.S. Moya[1], C. Espinoza[2], M. Stepanova[2], R. Navarro[3]

[1]Departamento de Física, Facultad de Ciencias, University of Chile, Chile
[2]Departamento de Física, Universidad de Santiago de Chile, Chile
[3]Departamento de Física, Universidad de Concepción, Chile

Abstract. Recently, it has been found that thermally induced electromagnetic fluctuations in plasmas play an important role in the laboratory, space, and astrophysical setting; where the plasma reaches a state of relaxation. This is the so-called quasi-equilibrium state to which non-collisional plasmas seems to stay for very long times. The thermal motion of charged particles naturally produces fluctuations that the system tries to dissipate, reaching a state with a finite level of fluctuations that are balanced by the dissipation. In these systems, such as the solar wind, the Earths magnetosphere, or the magnetosphere of pulsars, it is possible to study the production of these electromagnetic fluctuations in the so called β-A diagram; with β as the ratio between the thermal parallel energy and the magnetic energy, and A as the thermal anisotropy. Hence, the kinetic physics seem to play an important role regulating the global turbulent state of the plasma. We propose that a relevant component of these fluctuations can be produced by the random motion of particles in the plasma so that their understanding requires a kinetic treatment that relies on an extension of the fluctuation-dissipation theorem for anisotropic plasmas [Navarro et al., PRL, 2014]. We have found that this processes is quite general and that appear in a number of plasma settings; from the solarwind to the magnetosphere to astrophysical environments, suggesting the universality of the processes.

E-mail: *alejo@macul.ciencias.uchile.cl*

Contributed talk

How Collisionless Are Solar Wind Electrons? The Role of Non-thermal Skewed Anisotropic Kappa Distributions

P.S. Moya[1], A.F. Viñas[2], M.L. Adrian[2]

[1]Universidad de Chile, Chile
[2]NASA/GSFC, USA

Abstract. The solar wind electron velocity distribution function (eVDF) displays a great variety of non-thermal features that deviate from thermal equilibrium (*e.g.*, core, halo and strahl electron populations; with superposition of different temperatures, thermal anisotropies, suprathermal tails, beam-like features, etc.). Electron thermal conduction in the solar wind provides an important source of energy transport and regulates in part the radial electron temperature profile. It is also the source for the electron whistler heat-flux instabilities. In particular, the skewness related with halo and strahl populations can provide the free energy necessary to drive these micro-instabilities. Here, considering Vlasov calculations of collisionless plasma instabilities driven by the full electron distribution as a single eVDF without regard of separation of the various electron components, we present preliminary observational evidence showing that collisional and collisionless effects can coexist and share dominance in the regulation of the heatflux depending on the temperature gradient scale heights and solar wind speed. Numerical results suggest that the electron heatflux whistler instability threshold, of a non-thermal skew-kappa distribution plasma, marginally bounds solar wind magnetic fluctuations in fast speed streams, and that for slow solar wind collisional effects statistically increases, constraining both the whistler-cyclotron.

E-mail: *pablo.moya@ug.uchile.cl*

Contributed talk

Interplay Between Alfvén and Magnetosonic Waves in Compressible Magnetohydrodynamics Turbulence

N. Andres[1], P. Clark di Leoni[2], P.D. Mininni[3], P. Dmitruk[3], F. Sahraoui[1], W.H. Matthaeus[4]

[1]LPP, Ecole Polytechnique, France
[2]Department of Physics, University of Rome, Italy
[3]Department of Physics, University of Buenos Aires, Argentina
[4]Bartol Research Institute, University of Delaware, USA

Abstract. Using spatio-temporal spectra we show direct evidence of excitation of magnetosonic and Alfven waves in three-dimensional compressible magnetohydrodynamic turbulence at small Mach numbers. For the plasma pressure dominated regime, or high β regime (with β the ratio between fluid and magnetic pressure), and for the magnetic pressure dominated regime, or low β regime, we study magnetic field fluctuations parallel and perpendicular to a guide magnetic field B0. In the low β case we find excitation of compressible and incompressible fluctuations, with a transfer of energy towards Alfvenic modes and to a lesser extent towards magnetosonic modes. In particular, we find signatures of the presence of fast magnetosonic waves in a scenario compatible with that of weak turbulence. In the high β case, fast and slow magnetosonic waves are present, with no clear trace of Alfven waves, and a significant part of the energy is carried by two-dimensional turbulent eddies.

E-mail: *nahuel.andres@lpp.polytechnique.fr*

Contributed talk

A New Compact and Low Cost Langmuir Probe and Associated Onboard Data Handling System for CubeSat

P. Muralikrishna, S. Domingos, A.F.P. Horna, W.A. dos Santos

Instituto Nacional de Pesquisas Espaciais, Brazil

Abstract. A new compact and low cost Langmuir Probe and associated onboard data handling system are being developed at Instituto Nacional de Pesquisas Espaciais for launching on board one of the future 2U CubeSat missions. The system is a simplified and compacted version of the Langmuir Probe payloads launched on board several Brazilian SONDA III rockets and also developed for the Brazilian scientific satellites SACI-1 and SACI-2. The onboard data handling system will have the dual functions of preprocessing the data collected by the Langmuir Probe and acting as the interface between the experiment and the on board computer. The Langmuir Probe sensor in the form of two rectangular stainless steel strips of total surface area of approximately 80 cm^2 will be deployed soon after the injection of the CubeSat into orbit. A sweep voltage varying linearly from 0 V to 3.0 V in about 1.5 seconds and then remaining fixed at 3.0 V for 1 second will be applied to the LP sensor to obtain both the electron density and electron temperature. A high sensitivity preamplifier will be used to convert the sensor current expected to be in the range of a few nano amperes to a few micro amperes into a varying potential. In order to cover the large dynamic range of the expected sensor current the preamplifier output will be further amplified by a logarithmic amplifier before being sampled and sent to the data handling system. The data handling system is projected to handle 8 analog channels and 4 digital words of 8 bits each. The incoming data will be stored in a RAM and later sent to the on board computer using a serial RS422 communication protocol. The interface unit will process the telecommands received from the on board computer. The interface is also projected to do FFT analysis of the LP sensor data and send the averaged FFT spectral amplitudes in place of the original unprocessed data. The system details are presented here.

E-mail: *polinaya.muralikrishna@inpe.br*

Session 7

Space Weather

Conveners:

Joaquim Rezende Costa
Sergio Dasso
Américo González-Esparza

Invited talk

Influence of Geophysical Parameters on the Geomagnetically Induced Currents in Power Grids and Pipelines

L. Trichtchenko

Canadian Space Weather Forecast Centre, Natural Resources Canada

Abstract. Extensive use of long conducting networks *i.e.* power grids and pipelines, for energy supply and distribution requires the detailed assessment of the impacts of geomagnetically induced currents on their operations. Due to the insufficient direct measurements of GIC in the networks, such measurements cannot be the only source of the estimations, thus making numerical modelling an essential part of the GIC assessment. In the commonly used approach, the GIC model has two parts, which executes consequently, the first is "geophysical", *i.e.* modelling the geoelectric field, and the second is technological, *i.e.* modelling the currents (driven by the calculated geoelectric field) in a particular network. The results are then used to assess the vulnerability of the system in order to mitigate the impacts. This presentation demonstrates the important role of the geophysical parameters in estimation of GIC in different networks. It consists of two parts, the first presents the results of GIC modelling for the theoretical benchmark network for various geophysical conditions corresponding to different geomagnetic latitudes and different earth conductivity structures. The second part is dedicated to the estimation of the telluric current impacts on a pipeline, when realistic laterally non-uniform geoelectric field is used and the results of the modelling are compared with field measurement on the pipeline. The results of both cases lead to the same conclusion that the geophysical parameters are of the primary importance in the correct estimation of the geomagnetically induced currents in any technological network.

E-mail: *larisa.trichtchenko@canada.ca*

Invited talk

Space Weather and the Community Coordinated Modeling Center

Y. Collado-Vega, M. Kuznetsova, L. Mays, Y. Zheng, A. Pulkkinen, A. Chulaki, K. Muglach, A. Taktakishvili, B. Thompson, C. Weigand, R. Mullinix, J. Boblitt, S. Bakshi, M. Mendoza, L. Rastaetter, P. Macneice, K. Patel

Goddard Space Flight Center, NASA, USA

Abstract. The Community Coordinated Modeling Center (CCMC) provides a variety of services to the space science community. The mission for the CCMC's Space Weather Research Center (SWRC) is to address the space weather needs of NASA's robotic mission by conducting customized space weather services to NASA end-users. The team leverages CCMC tools/resources, carries out prototyping activities for the next space weather tools and follows communications/interactions with the users. We provide space weather forecasts, notifications, analysis and also education. This presentation will describe the SWRC concepts of operations, notification processes, anomaly analysis, and the tools used for space weather forecasting. The tools include a system that are completely open and available to the public's use like the Integrated Space Weather Analysis (iSWA) tool and the Database of Notifications, Knowledge and Information (DONKI). We will also discuss the education and training activities and how events like solar eclipses are important for the improvement and validation of different space weather models.

E-mail: *Yaireska.M.CalladoVega@nasa.gov*

Invited talk

Review on Space Weather in Latin America

C.M. Denardini, S. Dasso, J.A. González-Esparza

[1]Embrace/INPE, Brazil
[2]IAFE/UBA-CONICET & DCAO-DF/FCEN-UBA, Argentina
[3]SCiESMEX/UNAM, Mexico

Abstract. The present work is a review on space weather in Latin America. It comprises the evolution of several Latin American institutions investing in space science since the 1960's, focusing on the solar-terrestrial interactions, which today is commonly called space weather. Despite recognizing advances in space research in all of Latin America, this review is restricted to the development observed in three countries in particular (Argentina, Brazil and Mexico), due to the fact that these countries have recently developed operational centers for monitoring space weather. The review starts with a brief summary of the first groups to start working with space science in Latin America. This is followed by the author's view of the current status and the research interests of these groups, which are described in relation to the most significant works and challenges of the next decade in order to aid in the solving of space weather open issues. Thereafter, it is provided a summary of scientific challenges in space weather research that are considered to be open scientific questions and how they are being addressed in terms of instrumentation by the international community, including the Latin American groups. We also provide an inventory of the networks and collaborations being constructed in Latin America, including details on the data processing, capabilities and a basic description of the resulting variables. These instrumental networks currently used for space science research are gradually being incorporated into the space weather monitoring data pipelines as their data provides key variables for monitoring and forecasting space weather, which allow these centers to monitor space weather and issue warnings and alerts. Then it presents the decision process for the spinning off of space weather prediction centers from space science groups with our interpretation of the reason/opportunities that leads to this. Lastly, the constraints for the progress in space weather monitoring, research, and forecast are listed with recommendations to overcome them, which we believe will lead to the access of key variables for the monitoring and forecasting space weather, which will allow these centers to better monitor space weather and issue warnings and alerts.

E-mail: *clezio.denardin@inpe.br*

Contributed talk

Mexican Space Weather Service (SCiESMEX)

A. González-Esparza[1], V. De La Luz[2], P. Corona-Romero[2], J. Mejía-Ambriz[2], L.X. González-Mendez[2], M. Sergeeva[2], E. Aguilar-Rodríguez[1], M. Rodríguez-Martínez[3], E. Romero-Hernández[4], O. Chang-Martínez[1]

[1]LANCE/IGF, Universidad Nacional Autónoma de México, México
[2]LANCE/CONACYT, Universidad Nacional Autónoma de México, México
[3]LANCE/ENES, Universidad Nacional Autónoma de México, México
[4]LANCE, Universidad Autónoma de Nuevo León, México

Abstract. The Mexican Space Weather Service (SCiESMEX in Spanish) was created in 2014. The aim was to provide real-time space weather conditions and an early warning system of space weather events on the Mexican territory. In 2016 was established the National Laboratory of Space Weather (LANCE in Spanish). LANCE comprises SCIESMEX and a network of ground based instruments with space weather applications. This network includes: the Mexican Array Radiotelescope (MEXART) to perform IPS observation of solar wind disturbances; the Mexico City Cosmic Rays Observatory; a CALLISTO station to detect solar radio burst; a network of GPS receivers to produce TEC maps of ionospheric disturbances; and a magnetometer. At this moment we are expanding the network to include five ionosondes and five magnetometers. The data of these networks are analyzed in near real time to identify space weather hazards and the effects on the Mexican territory. We report the first events detected by this network indicating the necessity of measuring and tracking space weather phenomena in Mexico. The country requires to estimate the risk and vulnerability of its key technological systems to space weather hazards.

E-mail: *americo@igeofisica.unam.mx*

Contributed talk

Operative Products Offered by LAMP (Laboratorio Argentino de Meteorología del esPacio) in Argentina

V. Lanabere[1], S. Dasso[1,2,3], A.M. Gulisano[2,3,4] and V.E. López[1,5]

[1]Departamento de Ciencias de la Atmósfera y los Océanos, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina
[2]Instituto de Astronomía y Física del Espacio (UBA – CONICET), Argentina
[3]Departamento de Física, Universidad de Buenos Aires, Argentina
[4]Instituto Antártico Argentino/DNA, Argentina
[5]Servicio Meteorológico Nacional, Argentina

Abstract. The number of countries that carry out operative Space Weather (SWx) activities has been growing significantly in recent years. Several international institutions, as for instance the World Meteorological Organization (WMO), the International Civil Aviation Organization (ICAO), the United Nations Office for Outer Space Affairs (UNOOSA), have began to develop programs and activities on Space Weather, some of them with the aim of having answers to the negative effects of extreme SWx events.
At the beginning of 2016, our laboratory on SWx in Argentina (LAMP: Laboratorio Argentino de Meteorología del esPacio) started to develop activities on operative SWx. These activities are being developed by the following institutions: Departamento de Ciencias de la Atmósfera y los Océanos & Departamento de Física at Universidad de Buenos Aires (DCAO/DF-UBA), Instituto de Astronomía y Física del Espacio (IAFE), Instituto Antártico Argentino (IAA), and Servicio Meteorológico Nacional (SMN). These SWx activities started in 2014 with a programme of courses on operative SWx.
In 2015, a website at DCAO started to offer the first operative products in Space Weather (spaceweather.at.fcen.uba.ar), offering information about the current conditions of the energetic proton flux arriving to the terrestrial environment, online information about the flux of radiation at two X-rays bands near Earth (GOES), and also information of the Kp index. A forecasting service of SWx is also provided. Since 2016, we started to develop a daily monitoring of real-time information on the SWx conditions, in particular, the conditions of the Sun, the interplanetary medium, the magnetosphere, and the ionosphere. The information is analyzed by each participant and discussed later on, during monthly briefings. A weekly report is done as a resume of the space weather activity and it is posted on the website. Also from a collaboration between DCAO and EMBRACE-INPE, a product showing the total electron content in the Argentine ionosphere is also included in the portal. We present here an example of the activities on operative Space Weather developed in Argentina, a summary of the products we develop in the LAMP group as well as our next steps.

E-mail: *vlanabere@at.fcen.uba.ar*

Contributed talk

Space Weather Observations at Tucumán Low Latitude Observatory for Upper Atmosphere

M.G. Molina[1,2], F.A. Miranda Bonomi[1], M. Fagre[1,3], J.E. Ise[1], J.I. Cangemi[1], M.A. Cabrera[1,4], R.G. Ezquer[3,4,5], L.A. Scidá[4,5], G. Aceñolaza[6]

[1]Laboratorio de Telecomunicaciones, Dpto. de Electricidad, Electrónica y Computación, Facultad de Ciencias Exactas y Tecnología (FACET), Universidad Nacional de Tucumán (UNT), Argentina
[2]Departamento de Ciencias de la Computación, FACET, UNT, Argentina
[3]Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina
[4]Centro de Investigación sobre Atmósfera Superior y Radiopropagación, Facultad Regional Tucumán, Universidad Tecnológica Nacional (UTN), Argentina
[5]Laboratorio de Ionósfera, Departamento de Física, FACET, UNT, Argentina
[6]Instituto Superior de Correlación Geológica (INSUGEO, UNT – CONICET), Argentina

Abstract. The ionosphere is a sector of the terrestrial upper atmosphere where free ions and electrons can be found in sufficient amount so that, they can affect radio waves propagation. Studying ionosphere morphology and dynamics is essential for sub-ionospheric and trans-ionospheric telecommunications. Our ionosphere exhibits regular variations in different time and space scales depending strongly on the solar activity and the geographic position. To these regular variations, one should add variations forced by tropospheric and space origins. In particular, space weather events with solar origin and with consequences on the geospace, can also trigger adverse effects on space and ground based technologies due to disturbances in the ionosphere. Telecommunications based on radio, precise positioning systems, and other space based technologies are specially affected by the ionosphere conditions. This is especially important in current modern life and may affect different socio-economic sectors that depends on those technologies. The continuous monitoring of the ionosphere is crucial to study and even, in some cases, establish preventive or remediation procedures to avoid problems in technology. Thus, it is important the deployment and use of multiple instrumentation to obtain different ionospheric parameters. These parameters have special importance for now casting or forecasting modelling. In this work, instruments deployed and currently open to scientific community at the Tucumán Low Latitude Observatory for Upper Atmosphere (26° 51' S, 65° 12' W) are presented. The mentioned observatory is placed at Facultad de Ciencias Exactas y Tecnología de la Universidad Nacional de Tucumán. The instrumentation has been installed and its data accessibility is maintained by means of national and international collaboration. Monitoring data is public available offering a wide information of atmospheric parameters. One of the most remarkable characteristics of the Observatory is that it is placed closed the south crest of the equatorial anomaly and it is influenced by the South Atlantic anomaly. These features confer to the observatory placement a special site for ionospheric observations and for space weather studies in general.

E-mail: *gmolina@herrera.unt.edu.ar*

Contributed talk

The International Space Weather Meridian Circle Program and The development of China-Brazil Joint Laboratory for Space Weather

Guotao Yang, Zhengkuang Liu, Shengyi Huang

National Space Science Center, CAS, PR China
China-Brazil Joint Laboratory for Space Weather, Brazil

Abstract. The International Space Weather Meridian Circle Program (IMCP), which is the extension of Chinese Meridian Project, is proposed to connect ground-based monitoring devices around 120° E and 60° W meridian region, which will enhance the ability of worldwide space environment monitoring in a significant way. The IMCP has obtained extensive supports from those countries on the meridian circle. So far, some research institutes and universities, like Canadian Space Agency, Russian Institute of Solar-Terrestrial Physics, Massachusetts Institute of Technology, the University of Adelaide, have signed cooperation agreements with the Meridian Project. As early as in 2011,the preparation meeting of IMCP has already been held at Sanya, China and the Science Committee of the IMCP has been established since then. Also, the Coordinating Conferences have been held twice in Xi'an in Nov. 2014 and in Qingdao in May 2017 successively. Up to now, MOST has highly valued IMCP, which is expected to be launched in the near future in consequence.
As a significant observatory of International Space Weather Meridian Circle Program (ISWMCP), the China-Brazil Joint Laboratory for Space Weather, held by the National Space Science Center (NSSC) of Chinese Academy of Science (CAS) and National Institute of Space Weather (INPE) of Brazil, has completed the fundamental construction during the first period. Several observation tools (lidar, Dps4F, etc) also have been developed by both sides. Based on the well running Joint Laboratory, the detect equipments and data center can serve for the East-West and South-North Semi-sphere's joint monitoring and studies in the field of space weather research next step. Good achievements have been obtained under the efforts of both side of China and Brazil, which will deeply facilitate the regional space weather exploring and obtaining the global space weather information, and show us a good prospect of further joint research and the bright future for the International Space Weather Meridian Circle Program.

E-mail: *gtyang@swl.ac.cn*

Contributed talk

Space Weather Research Activities Performed at CRAAM, São Paulo, Brazil

J.-P. Raulin, C.G. Giménez de Castro, A. Valio

CRAAM, EE, Universidade Presbiteriana Mackenzie, Brazil

Abstract. In this paper we focus on the scientific research activities performed using the facilities at the Heliogeophysical Mountain Laboratory (HML) located at CASLEO and OAFA observatories, San Juan, Argentina. Since the beginning of the 2000s, the CRAAM operates numbers of instruments installed in the Argentinean Andes to study the physics of solar flares, their impacts on the Earth atmosphere, as well as other atmospheric processes. These facilities include the Solar Submillimeter Telescope (SST; 212 and 405 GHz), the POEMAS radio polarimeters (45 and 90 GHz), a mid-infrared solar telescope (30 THz), the charged particle detector (CARPET), the Solar Neutron Telescope (ND), four Hard X-ray spectrometers, two receiver bases of the SAVNET network, and two Electric Field Monitor (EFM) sensors part of the AFINSA network.

The above instrumentation allows a good description of the high frequency part of solar flare spectra giving new insights on the radiation mechanism, and on the development of solar flare phenomena. Many debates in the last fifteen years have been related to the presence of an unusual spectral component above 100 GHz with increasing solar fluxes with frequency. These results will be discussed as well as the new findings obtained with the SOLAR-T stratospheric balloon experiment.

Part of the instrumentation operated by CRAAM in Argentina is also used to study the modulation of the primary solar cosmic ray flux in different timescales from short transient (seconds, minutes) variations associated with large solar flares, hours to days variations during Coronal Mass Ejections interactions with the Earth magnetosphere (Forbush events), and longer periodic flux time variations related to the solar cycle.

The instruments installed at the HML also allow the study of the impacts of solar X-ray radiation in the lower ionosphere of the Earth during changes of the electrical conductivity there. The use of the ionospheric plasma as a huge sensor of incoming ionizing radiation can also be utilized to study bursts of remote galactic and extra-galactic sources, for which satellite observations may not be available. The instrumentation at HML is also devoted to study the Global Atmospheric Electric Field Circuit (GAEC) and its time variations. This is done by monitoring the fair-weather atmospheric electric field which could reveal the regime of lightning activity on a global scale. Local atmospheric electricity events are also under study since they could be involved in the production of neutrons and 1-10 MeV X-rays. The final goal of this presentation is to consolidate actual scientific collaborations, and to foster new ones between the CRAAM and interested Argentinean and Latin American groups.

E-mail: *raulin@craam.mackenzie.br*

Contributed talk

First Steps for Deriving DIX Maps over South America

P.F. Barbosa Neto[1,2], C.M. Denardini[1], P.A.B. Nogueira[3], G.A.S. Picanço[4], L.C.A. Resende[1], J. Moro[5], A.V. Bilibio[4], S.S. Chen[4], T.O. Bertollotto[4,6]

[1]Embrace/INPE, Brazil
[2]UNISAL, Brazil
[3]IFSP, Brazil
[4]DIDAE/INPE, Brazil
[5]CRS/INPE & NSSC/CAS, Brazil-China
[6]UNITAU, Brazil

Abstract. In the present paper, we present the first steps for deriving the DIXMAP over South America, which is an index primarily dedicated to express the response of the ionosphere to magnetic disturbances. In addition, we show the preliminary results for the study of the intense geomagnetic storm occurred on 08 September 2017 using the TEC Map data processed and made available by the Brazilian Studies and Monitoring of Space Weather (Embrace) Program of the National Institute for Space Research (INPE). A DIX Map covers the latitudinal range between 10° N and 60° S and the longitudinal range between 90 and 30° W, with 5° or range resolution in both coordinates. It is built at the rate of one map every 10 minutes based on the deviation of the TEC over the same area, which in turn is derived from 180 GPS receivers from 4 different networks (RBMC - Brazilian GNSS, RAMSAC, LISN and IGS). The results are presented and discussed in terms of the latitudinal evolution of the DIX with respect to the Dst index, representing the geomagnetic storm.

E-mail: *pafraneto@terra.com.br*

Contributed talk

Solar Activity Cloudiness Effect on NH Warming for 1980 – 2095

B. Mendoza, V. M. Mendoza, R. Garduno

Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, México

Abstract. We use a climate model (CM) to compute the Northern Hemisphere temperature anomaly for the period 1980 – 2095. We include two forcings, the atmospheric CO2 and the Total Solar Irradiance (TSI) which is the climate driver and a manifestation of the solar activity. This TSI model shows a secular minimum with its deepest part around the year 2029. Moreover, the solar activity modulates the flux of galactic cosmic rays (GCR), which in turn, we assume, modify the cloud cover. We found a global warming due to the atmospheric CO2, which is diminished as a consequence of the negative anomaly of the TSI, giving a warming reduction. The CM includes a new effect: the warming due to the release of cloud vapor condensation, related to GCR, which causes a decrease in the magnitude of the warming reduction. Two IPCC CO2 emission scenarios are used: the high A1FI and the low A1T. Emphasis is made on the results for two particular years: one corresponding to the deepest part of the proposed TSI grand solar minimum in the year 2029, and the other to the end of the century, 2095.

E-mail: *blanca@atmosfera.unam.mx*

Contributed talk

The Semiannual Variation in the Van-Allen probes data

F. L. Poblet, F. Azpilicueta

FCAGLP, Universidad Nacional de La Plata, and CONICET, Argentina

Abstract. The semiannual variation is one of the most recurrent variations in the Earth's magnetic activity and can be detected in many parameters *e.g.*, geomagnetic storm annual distribution (Echer et al., 2011) and many geomagnetic indices as the aam (Cliver et al., 2004). It is characterized by maximums around the equinoxes and minimums near the solstices. Over the decades, several explanations have been proposed, being the main ones the axial hypothesis, the equinoctial hypothesis and the Russell-McPherron effect (R-M) (Cortie, 1912; Bartels, 1932; McIntosh, 1959; Svalgaard, 1977; Russell and McPherron, 1973). These three hypotheses consider the geometrical changes along the year between the solar wind parameters and the Earth's dipole as the main responsible of the changes in the magnetospheric energization that led to the semiannual behavior detected in the surface of the Earth. However, the semiannual variation has not been fully explored in the magnetospheric particle populations itself to the present days.

In this work we investigate the semiannual pattern in the radiation belts utilizing data from the Van Allen probes mission. The highly elliptic and near equatorial orbit of the RBSPa and RBSPb probes allows the study of charged particle fluxes over a wide range of McIlwain L-parameter (L) values. The distribution of the daily averaged fluxes at 2-6 MeV in a L against Day of Year (DOY) graphic shows a 27-day pattern as the most noticeable characteristic in every year. When a 27-day running average is calculated, the semiannual maximums come up but lagged in time with respect of the equinoxes. The maximums are centered around $L = 4$.

The DOY-UT dependence of the controlling parameters over the year for the three theories mentioned, *i.e.*, the heliographic latitude of the Earth in the axial hypothesis, the angle between Earth-Sun line and the dipole axis of the Earth in the equinoctial hypothesis and the angle between ZGSM axis and YGSEQ axis in the R-M hypothesis are often utilized to associate a semiannual pattern in a given parameter to a specific theory. A comparison with the DOY-UT dependence of the semiannual pattern found in the Van Allen belts could serve in identifying which of the three is the dominant mechanism behind.

The present inquiry would help to better understand the relationship between the semiannual anomaly detected in the ground and the system of currents in the magnetosphere that could generate it.

E-mail: *fpoblet@fcaglp.unlp.edu.ar*

Poster Contributions

Solar Physics

S1P01

Geoeffectiveness generated by the geometry of the stream interface associated to the SIRs

E. Sanchez-Garcia (PCT/UNAM, Mexico), E. Aguilar-Rodriguez (IGUM/UNAM, Mexico), J.A. Gonzalez-Esparza (IGUM/UNAM, Mexico), E. Romero-Hernandez (FCF-M/UANL, Mexico)

Abstract. The stream interaction regions (SIRs) are generated in the interplanetary medium when a fast solar wind stream overtakes a slower one. The boundary between fast and slow solar wind flows is known as a stream interface (SI). If these large-scale phenomena interact with the Earth's magnetosphere, they can give rise to geomagnetic storms (GSs). In this study we analyzed the geoeffectiveness of a set of GSs that were generated by SIRs during the cycle 23-24. Their geoeffectivity is measured using magnetic indices at different latitudes: PCN (Polar Cap North) and PCS (Polar Cap South), aa (antipodal amplitude), AE (Auroral Electrojet), Kp (estimated global index), and SYM-H (symmetric disturbance component in H). We analyzed the geoeffective region within the SIRs with respect to the relative position of the SI. In addition, we present an analysis of the geoeffectivity generated by the geometry of the SI.

S1P02

Non-Linear Convergence of Solar-like Stars Atmospheres using Semi-Empirical Models of the Solar Chromosphere

Francisco Tapia-Vazquez (Instituto de Geofísica, Unidad Michoacán/ UNAM, México), Victor De la Luz-Rodriguez(CONACyT/ Instituto de Geofísica, Unidad Michoacan/ UNAM, México), Jose Juan Gonzalez-Aviles(Instituto de Geofísica, Unidad Michoacán, UNAM, México)

Abstract. Recent observations at sub-mm wavelengths of solar-like stars allow to compute for first time the temperature profile structure using this wavelengths. For the case of alpha centaury a and b, both shows temperature minimum. The process to compute an atmospheric model involves three steps: i) small modifications in an initial temperature profile, ii) compute the density and pressure requiered to guarantee hydrostatic, hydrodynamic or magnetohydrodinamic equilibrium, and iii) compute the synthetic spectrum to compare with observations. Differences between synthetic and observed spectrum are solved making changes in the atmospheric temperature profile at different altitudes until synthetic and observed spectrums converges. In this work we present a new non-linear model to converge automatically observed and synthetic spectrum of solar-like chromospheres at radio-infrared wavelength.

S1P03

The Active Region 12673 X9 flare observed from submillimeter to mid-IR

G. Giménez de Castro [1], J.-P. Raulin [1], J.F. Valle Silva [1], P.J.A. Simões [2], A.S. Kudaka [1], A. Valio [1] [1] CRAAM/UPM [2] SUPA/UofG

Abstract. Active Region 12673 produced the most intense event of the solar cycle 24: in a few days of early September 2017, four X-class and eight M class flares occurred. SOL2017-09-06T12:00, a GOES X9.3 flare, that also produced a two-ribbon white-light emission across the sunspot detected by SDO/HMI, was observed at 212 and 405 GHz with the arcminute-size beams of the Solar Submillimeter Telescope focal array while making a solar map, and at 30 THz, with a 17 arcsec difraction-limited IR camera. SST was observing far from the source when the maximum of the impulsive phase occurred and did not detect a significant flux excess. When the antenna was pointing close enough to the source, we derived the excess brightness temperatures by comparing with the quiet Sun and obtained 5900 and 1800 K at 212 and 405 GHz respectively. Images at 30 THz revealed that the sunspot gradually increased in brightness while the event proceeded, reaching a temperature similar to quiet Sun values. From the images we derive a 180 K flare peak excess brightness temperature assuming 5000 K for the quiet Sun. The peak occurred tens of seconds before the Soft-X Rays peak observed by GOES, afterwards the 30 THz source cooled following a similar time profile as GOES.

S1P04

The Lu & Hamilton Solar Flare model revisited: clustering properties

Laura F. Morales(1,2) & Noelia Santos(1,2) 1 Universidad de Buenos Aires. Facultad de Ciencias Exactas y Naturales. Departamento de Física. Buenos Aires, Argentina 2 CONICET-Universidad de Buenos Aires. Instituto de Física del Plasma (INFIP). Buenos Aires, Argentina

Abstract. Since Lu and Hamilton (1991, 1995) developed their seminal work stating that the solar corona could be in a state a Self Organized Criticality (SOC) and that Parker's picture of corona heatring could be represented by means of a cellular automaton in a SOC regime. Recent observations on rain precipitation, brain activity and forest fire models have suggested that SOC systems might wander around the vicinity of criticality and that critical behavior could be interpreted in terms of peaked susceptibilities. In this work we study the clustering properties emerging by typical Lu & Hamilton 2D model for several lattice sizes and thresholds. We focus on studying the residence time distribution, the order parameter and the dynamics of the active clusters as well as its statistical properties. Moreover we characterize the type of order transition observed.

S1P05

A Comparative Study of Oscillations of a Sunspot and a Filament and the Associated Dynamic Evolution of Filament

M. Rojas-Quesada (School of Physics/Instituto Tecnológico de Costa Rica, Costa Rica), L. Taliashvili (Space Research Center (CINESPA)/University of Costa Rica, Costa Rica), H. Gutierrez (Space Research Center (CINESPA)/University of Costa Rica, Costa Rica); R. Carboni (Space Research Center (CINESPA)/University of Costa Rica, Costa Rica)

Abstract. We study short- and long-term oscillations of the intensity of two equatorial filaments, one quiescent and another one located near a sunspot. Based on SDO/AIA, SDO/HMI and GONG multi-wavelength data, we intended to identify the inter-correlation between the sunspots and the filament's oscillations, as well as the independent oscillations of each of them and the associated phenomena. We analyzed the evolution of the sunspots and filament's oscillations just prior to the filament eruption and onset of subsequent Coronal Mass Ejections (CMEs). In order to achieve these, we selected some small regions of the filament body, computed the average intensities inside each region, and obtained the relative oscillation with respect to the Savitzky-Golay filter. Additionally, Morlet wavelet power spectrum was obtained in order to deduce the frequencies of these oscillations and they evolution. The same process was applied to the sunspot. Preliminary results of this study provide a better insight about the implication of sunspots and filament's oscillations on the filament dynamic evolution and the associated CME.

S1P06

Joy's Law determination for emerging active regions

M. Poisson (IAFE/UBA-CONICET, Argentina), M. Lopez Fuentes (IAFE/UBA-CONICET, Argentina), C.H. Mandrini (IAFE/UBA-CONICET, Argentina), P. Demoulin (Observatoire de Paris/LESIA, France)

Abstract. We study the process of emergence of solar active regions (ARs) to determine the relation between the latitude of emergence and the tilt angle formed with respect to the E-W direction. The relation between the tilt and the latitude, established by Joy's law, is a fundamental element for dynamo models to explain the mechanisms involved during the inversion of the poloidal magnetic field. Recent studies based on the observations of the line-of-sight (LOS) magnetic field and the automatic detection of bipoles show a strong dispersion on the obtained law (Stenflo & Kosovichev 2012; Wang et al. 2015). We consider that the dispersion can be due to the stage of evolution of the analyzed ARs. The LOS projection of the twisted magnetic field of the emerging structures that form ARs produces an elongation of the magnetic polarities known as magnetic tongues. As we have shown in Poisson et al. (2016, Solar Phys., 291, 1625-1646), magnetic tongues affect the photospheric field distribution observed in LOS magnetograms and, consequently, impact on the determination of the tilt angle. In this work we analyze the evolution of the tilt angle during the emergence of 186 bipolar ARs using LOS magnetograms. We test a novel method to correct the effect of the magnetic tongues on the determination of the tilt angle. Furthermore, we estimate the latitudinal dependence of the corrected tilt angle considering different ARs properties such as the magnetic helicity sign, the hemisphere of emergence, and the sense of rotation of the bipole. Finally, we quantify the effect of the twist on the dispersion found when determining the Joy's law.

S1P07

Two Step Filament Eruption

R. Chandra 1, B. Filippov 2, R. Joshi 1, B. Schmieder 3 1. Department of Physics, Kumaun University, DSB Campus, Nainital 263001, India 2. Pushkov Institute of Terrestrial Magnetism, Ionesphere and Radio Wave Propagation, Russian Academy of Sciences, Troitsk, Moscow, Russia 3. Observatoire de Paris, LESIA, UMR8109 (CNRS), 92195 Meudon Principal Cedex, France

Abstract. Filament eruptions are usually associated with the Coronal Mass Ejection (CMEs), which can directly impact the heliosphere and our terrestrial environment. Therefore their studies are very crucial. We present here an interesting two-step filament eruption during 14 - 15 March 2015. The filament was located in NOAA AR 12297 and associated with a halo Coronal Mass Ejection (CME). We use observations from the Atmospheric Imaging Assembly (AIA) and Heliospheric Magnetic Imager (HMI) instruments onboard the Solar Dynamics Observatory (SDO), and from the Solar and Heliospheric Observatory (SOHO) Large Angle and Spectrometric Coronagraph (LAS- CO). We also use Hα; data from the Global Oscillation Network Group (GONG) telescope and the Kanzelhoehe Solar Observatory. The filament shows a first step eruption on 14 March 2015 and it stops its rise at a projected altitude $\sim$125 Mm on the solar disk. It remains at this height for $\sim$12 hrs. Finally it erupts on 15 March 2015 and produces a halo CME. The decay index is calculated to un- derstand this two-step eruption. The eruption could be due to the presence of successive instability- stability-instability zones as the filament is rising.

S1P08

LYMAN CONTINUUM EMISSION IN SOLAR FLARES, NEW RESULTS AND PERSPECTIVE

Marcos E. Machado, CONAE, Argentina Ryan O. Milligan, School of Physics and Astronomy, University of Glasgow, G12, Scotland

Abstract. We shall concentrate on the analysis of LyC continuum observations obtained by the SDO/EVE full in a sample of the observed events, while at the same time exploring the limitations due to the full Sun character of the recorded data, with respect to those of e.g. the HCO/Skylab spatially resolved observations of the 1970's. We conclude that the data provides new insights regarding energy transport and dissipation during the impulsive a gradual phases os solar flares.

S1P09

Solar Radius at Subterahertz Frequencies and its Relation to Solar Activity

F. Menezes and A. Valio Center for Radio Astronomy and Astrophysics (CRAAM), Mackenzie Presbyterian University, Sao Paulo, Brazil

Abstract. The Sun emits radiation at several wavelengths of the electromagnetic spectrum. In the optical band, the solar radius is 695,700 km and this is what defines the photosphere,

the visible surface of the Sun. However, as the altitude increases, the electromagnetic radiation is produced at other frequencies, causing the solar radius to change as function of wavelength. These measurements enable a better understanding of the solar atmosphere and the radius dependence on the solar cycle is a good indicator of the changes that occur in the atmospheric structure. We measure the solar radius at the subterahertz frequencies of 0.212 and 0.405 THz - i.e., the altitude where these emissions are primarily generated - and also analyze the radius variation over the 11-year solar activity cycle. For this, we used radio maps of the solar disk for the period between 1999 and 2017, reconstructed from daily scans made by the Solar Submillimeter-wave Telescope (SST), installed at El Leoncito Astronomical Complex (CASLEO) in the Argentinean Andes. Our measurements yield radii of $966.5' \pm 2.8'$ for 0.2 THz and $966.5' \pm 2.7'$ for 0.4 THz. This implies a height of 5.0 ± 2.0 Mm above the photosphere. Furthermore, we also observed strong anti-correlation between the radius variation and the solar activity at both frequencies.

S1P10

Multi-wavelength tomography of the global solar corona: present and future.

Alberto M. Vásquez (IAFE/UBA-CONICET), Richard A. Frazin (CLASP/University of Michigan), Enrico Landi (CLASP/University of Michigan), Federico A. Nuevo(IAFE/UBA-CONICET), Diego G. Lloveras (IAFE/UBA-CONICET) and Cecilia Mac Cormack (IAFE/UBA-CONICET)

Abstract. Solar rotational tomography (SRT) is an observational technique for the global solar corona that allows construction of three-dimensional (3D) maps of some of its fundamental physical parameters. Electron density can be studied applying SRT to white light images, while both electron density and temperature can be determined based on EUV images. SRT based on, e.g., SOHO/LASCO-C2 in white light or SDO/AIA in EUV, is valuable as validation tool for magnetohydrodynamic 3D models of the global corona. Our SRT algorithms running on a single CPU deliver results in a few hours, with minimal human user interaction mainly focused on image selection. In this talk we summarize the current status of the technique and its results, as well as discuss future prospects and diagnostics based on new instrumentation.

S1P11

Variation of acoustic mode parameters with distance from a nearby active region

M.C. Rabello Soares (Universidade Federal de Minas Gerais, Brazil) and R.S. Bogart, P.H. Scherrer (Stanford University, California, EUA)

Abstract. In a previous paper (Rabello-Soares, Bogart & Scherrer 2016, ApJ), we quantified the influence of magnetic fields on acoustic mode parameters and flows in and around active regions by comparing the differences in the parameters in magnetically quiet regions when there is an active region in their vicinity with those of quiet regions at the same disc locations for which there are no neighboring active regions. Here we detail further our analysis by estimating how these differences vary with distance from the active region. We use ring diagram analysis

from almost five years of HMI observations. In our first paper, we observed that the power reduction has a strong dependence on the wave direction but the amplitude enhacement (the 'acoustic halo effect') has a very weak dependence on the wave propagation direction. We find that the effect on the amplitude decreases as the distance increases as expected. However, the dependence on the wave direction seems to reach a peak around 70 Mm from the active region. Very near the active region, the amplitude effects are independent of the direction of mode propagation.

S1P12

BENCHMARKING GIC ESTIMATES AT LOW LATITUDES USING DATA BY SECOND: PROS AND CONS

Ramon Caraballo (Universidad de la República del Uruguay) L. Ribeiro Alves (Instituto Nacional de Pesquisas Espaciais (INPE/MCTI)) G. Hartmann (Universidade Estadual de Campinhas (UNICAMP)), Cleiton Barbosa(Observatório Nacional (ON/MCTI))

Abstract. Geomagnetic Induced currents (GIC) are becoming a common subject of study at low-to-mid latitude around the world. Also, a crescent observational evidence supporting the existence of significative GIC estimates or measures on several infrastructures. Several works have been published in the last four years addressing GIC modeling or measurements. Mostly of the GIC studies rely on three key inputs: geomagnetic data, geophysical data and electrical parameters of the system under study. From this point of view, geomagnetic data quality is rarely mentioned, maybe by the fact that the most used geomagnetic data comes in form of one-minute means. Usually, one-minute means can be obtained by a standard procedures mainly based on those provided by IAGA for all magnetic observatories around the world which are part of the INTERMAGNET network. Despite it is a great advantage to get data from more than 250 magnetic observatories around the world in a common format, one-second data it is still scarce and only available from a reduced number of observatories on South America under request. Geomagnetic variations at a one-minute sampling period is too slow to catch the high frequency parts of the geomagnetic spectrum. When dealing with the geomagnetic variations close to the storm onset, where sudden impulses are more prone to occur, one-minute data might not be sufficient faster to take account of the rapid change in the field components. As a result, the estimated GIC often underestimates the real one. As the geomagnetic variations are the first input in any GIC calculations, they exerts a great leverage on the final results. No matter the averaging method used to produce one-minute data, they produce a strong smoothing by filtering much of the rapid time variations on the original signal. Mostly of the fine grained structures on the magnetograms are lost in this process leading to a rather flattened version of the original signal. As the sampling frequency increases the more detailed structures in the geomagnetic variations leads to more weird peaks in the calculated GIC. Here, we address this problem intending to assess the fraction of signal power lost by the use of one-minute data. The methodology used consisted in assess the estimated GIC for two specific power grids in Uruguay and Brazil, respectively, during three major geomagnetic storms of the solar cycle 24. The GIC calculated using both one-minute and one-second data respectively, for those power grids was compared to study the effect in the final estimates. In this case, the round mean square (rms) of differences and the power spectral density of both results can provide and outlook of

the fraction of energy lost by the averaging process in the one-minute case. In order to provide the best estimation possible which result in a valuable tool for the forecasting GIC events.

S1P13

Energy Input Flux in the Quiescent Solar Corona: Comparing Observations with the AWSOM Model.

Cecilia Mac Cormack (IAFE/UBA-CONICET), Diego G. Lloveras (IAFE/UBA-CONICET), Federico A. Nuevo (IAFE/UBA-CONICET), Alberto M. Vásquez (IAFE/UBA-CONICET), Ward Manchester IV (CLASP/University of Michigan), Bart van der Holst (CLASP/University of Michigan), Enrico Landi (CLASP/University of Michigan), Richard A. Frazin (CLASP/University of Michigan).

Abstract. To remain stable, the million-Kelvin solar corona structures require a coronal heating rate efficient enough to compensate for radiative losses and the heat conductive flux. The energy provided by the (yet uncertain) coronal heating mechanisms are ultimately injected at the coronal base. The energy input flux required at the coronal base can be estimated by means of differential emission measure tomography (DEMT) of EUV images, which allows studying the inner quiescent corona on a global scale. In this work, we compare estimates of the energy budget obtained from DEMT with those derived from three-dimensional (3D) magnetohydrodynamic (MHD) simulations of the corona by means of the latest version of the Alfvén Wave Solar Model (AWSoM). We present here first results of such validation effort.

S1P14

Sun's impact on Earth using Hα data

Gutierrez M.V(IAFE/UBA-CONICET, Argentina), Cristiani G.D.(IAFE/UBA-CONICET, Argentina), Mandrini C.H.(IAFE/UBA-CONICET, Argentina) Ishitsuka J.K.(IGP, PERÚ)

Abstract. In recent years, several studies have shown that flares and coronal mass ejections occurring on the Sun have a significant impact on the terrestrial environment. These findings have encouraged researchers to understand how the impact of such explosions can spread through the interplanetary space within the solar system and what the consequences of these phenomena are. This work briefly describes the basics of the solar observations in $H\alpha$ line center and its wings to obtain information about mass motion in the chromosphere. Using the Doppler effect, it is possible to determine the velocities of the erupting filaments or similar structures from solar images obtained with the Flare Monitoring Telescope (FMT).

S1P15

Temperature and Electron Density in the Inner Solar Corona: a Global Validation of the AWSoM Model with Observations.

Diego G. Lloveras (IAFE/UBA-CONICET, Argentina), Cecilia Mac Cormack (IAFE/UBA-CONICET, Argentina), Federico A. Nuevo (IAFE/UBA-CONICET, Argentina), Alberto M.

Vásquez (IAFE/UBA-CONICET, Argentina), Ward Manchester IV (CLASP/University of Michigan, USA), Bartholomeus Van der Holst (CLASP/University of Michigan, USA), Richard A. Frazin (CLASP/University of Michigan, USA).

Abstract. In order to advance our understanding the physics of the solar corona and the solar wind, magnetohydrodynamic (MHD) three-dimensional (3D) models need to be validated with observations. To that end, differential emission measure tomography (DEMT) is a valuable tool to study the inner corona (1.0-1.25 Rsun). In that region DEMT provides global 3D maps of two fundamental plasma parameters: the electron density and temperature. We developed DEMT reconstructions and MHD modeling of two specific solar rotations selected from the last two solar minima. The MHD simulations were carried out using the latest version of the Alfvén Wave Solar Model (AWSoM) of the Space Weather Modeling Framework (SWMF). In this work we present the first DEMT validation study of the latest AWSoM simulations, with particular focus on different types of temperature structures observed within the streamer belt. The comparison, here focused on solar minima due to the relative simplicity of the large scale corona, will be extended in the future to periods of higher activity.

S1P16

Filament Eruption in the Active Region NOAA-1164 Observed by the Flare Motoring Telescope (FMT) on 2011 March 7

K.F. Lopez (Universidad San Luis Gonzaga de Ica, Peru) D.P. Cabezas, S. UeNo (Kyoto university) J. Huayna (Universidad San Luis Gonzaga de Ica, Peru)

Abstract. We present a study of a filament eruption that occurred on 2011 March 7, in the AR NOAA-1164. This event was captured in H-alpha line (Ha center, Ha -0.8A, Ha +0.8A) by the Flare Monitoring Telescope (FMT), located at National University San Luis Gonzaga of Ica, Peru. The filament eruption accompanied a solar flare classified as M3.7 on the GOES scale, later on a coronal wave and Coronal Mass Ejection (CME) was observed. We performed Dopplergrams by combining FMT Ha-wing observations to follow the evolution and the different stages of the filament eruption along the line-of-sight (LOS). On the basis of the Doppler characteristics and kinematics of the filament eruption, we discuss the role of it in the generation process of the CME.

S1P17

Precipitable water vapor and 212 GHz atmospheric optical depth correlation at El Leoncito site

M. M. Cassiano, D. Cornejo Espinoza, J.-P. Raulin, C. G. Giménez de Castro (Centro de Radio Astronomia e Astrofisica Mackenzie (CRAAM), Escola de Engenharia, Universidade Presbiteriana Mackenzie, Sao Paulo, Brazil)

Abstract. Time series of precipitable water vapor (PWV) and 212 GHz atmospheric optical depth were obtained in CASLEO (Complejo Astronómico El Leoncito), at El Leoncito site, Argentinean Andes, for the period of 2011-2013. The 212 GHz atmospheric optical depth data

were derived from measurements by the Solar Submillimeter Telescope (SST) and the PWV data were obtained by the AERONET CASLEO station. The correlation between PWV and 212 GHz optical depth were analyzed for the whole period, when both parameters were simultaneously available. A very significant correlation was observed. Similar correlation was found when data were analyzed year by year. The results indicate that the correlation PWV versus 212 GHz optical depth could be used as an indirect estimation method for PWV, when direct measurements are not available.

S1P18

Solar energetic particles observed at ground level: All Saints day's 2014

C.E. Navia and M.N. de Olveira Affiliations: Instituto de Física, Universidade Federal Fluminense, 24210-346, Niterói, RJ, Brazil.

Abstract. An increase in the proton flux was detected by the GOES 13 satellite on 1 November 2014. However, the origin has not yet been fully elucidated. Two hypotheses are possible: Firstly: the breaking of a solar filament close to the East solar limb producing a Hyder flare, whose X-ray emission reached C2.7 class, beginning at 04:44 UT. Secondly: the eruption of a C4.5 class flare beginning at 9:20 UT and whose origin was the sunspot AR2192 when it was close to the western limb of the Sun. However, the sunspot was no longer visible. The two hypotheses explore different transport mechanisms of solar particles: the first suggests the transport of the solar particles perpendicular to the interplanetary magnetic field (IMF), while the second take into account the Earth-crossing by the heliospheric current sheet (HCS) during the blast, allowing a special magnetic connection between the Sun and the Earth. A preliminary analysis suggests that the second hypothesis is more plausible. In addition, solar energetic particles (SEP) associated with the event triggered an excess of secondary particles in the atmosphere that could be observed by ground-level detectors, with an increase in excess of 2.0 % in the New-Tupi detector (scaler mode). The New-Tupi experiment is located in Niteroi, Rio de Janeiro, Brazil (22.53^o S, 43.13^o W). Other particle detectors such as neutron monitors stations located in the South Pole, Mexico and Nain could also observe an excess in coincidence with the signal of GOES 13. This shows that the excess of muons observed by New-Tupi detector is not a local effect, we are faced with an excess of particles on a global scale. Details from these observations are reported.

S1P19

On the origin of the eruptive events of February 2011: Magnetic field evolution and low corona structure

C.H. Mandrini (Instituto de Astronomía y Física del Espacio, UBA-CONICET), G.D. Cristiani (Instituto de Astronomía y Física del Espacio, UBA-CONICET), H. Cremades (Universidad Tecnológica Nacional, Facultad Regional Mendoza, Argentina), C. Francile (Observatorio Astronómico Félix Aguilar, UNSJ, Argentina), F.M. López (Instituto de Ciencias Astronómicas,

de la Tierra y del Espacio, Argentina), M.V. Gutiérrez-Escate (Instituto de Astronomía y Física del Espacio, UBA-CONICET, Argentina

Abstract. Active region (AR) NOAA 11158 produced several flares from 13 to 16 February 2011 accompanied by coronal mass ejections (CMEs) and subsequent EUV waves. AR 11158 was formed by two main bipoles that emerged almost simultaneously and a few minor ones, observed in vector magnetograms obtained with the Helioseismic and Magnetic Imager onboard the Solar Dynamics Observatory. Flares and CMEs originated and evolved along different portions of the photospheric inversion line (PIL) following the displacement of the main bipoles, their sustained rotation, and the built up of intense magnetic shear along the PILs where twisted flux ropes formed. We model the coronal magnetic field of the AR along the three days and study its topology. We find the presence of a persistent magnetic null point, whose height and location changed as the photospheric field evolved. We propose that magentic reconnection occurring at the null neighborhood, forced by the photospheric motions, could decrease the magnetic tension above the flux ropes giving their repeated eruptions.

S1P20

Magnetic flux emergence and solar activity in an active region cluster.

A. Minero-Garfias (Instituto de Geofísica, UNAM, México) G.D. Cristiani (Instituto de Astronomía y Física del Espacio, UBA-CONICET, Argentina) C.H. Mandrini (Instituto de Astronomía y Física del Espacio, UBA-CONICET, Argentina) A. Lara (Instituto de Geofísica, UNAM, México)

Abstract. We investigate the violent events that occurred in November 2010 in the cluster of two active regions (ARs), NOAA numbers 11121 and 11123, using instruments onboard the Solar Dynamics Observatory. Starting on 10 November and within one day the total magnetic flux increased by 70 % with the emergence of new groups of bipoles in AR 11123 that was accompanied by strong photospheric motions. During the flux emergence phase only very minor flares, with no associated coronal mass ejections (CMEs), were observed. Once the magnetic flux reached its maximum and the displacement of photospheric flux concentrations slowed down, flaring became more frequent with several related CMEs. Though magnetic flux emergence has been in general associated to flare and/or CME occurrence, for this particular set of events this does not seem to be the case. We follow the magnetic flux evolution, identify all the flares and CMEs during 10 - 11 November, and determine the location along the magnetic inversion lines of flare kernels and sites of CME initiation. We discuss the probable origin of the discrepancy between usually accepted assumptions and the evolution of activity in the analyzed active region cluster.

S1P21

Building an homogeneous set of sunspot areas from the observatories of the SOON network.

L. (F.C.E.F.y N.-U.N.S.J., Argentina), L. Balmaceda (George Mason University, EUA)y C. Francile (O.A.F.A.-U.N.S.J., Argentina)

Abstract. In this work we investigate in detail the differences in the sunspot area records from the different observatories of the Solar Optical Observing Network (SOON) in order to combine them into a single homogeneous dataset. The new dataset is created using appropiate calibration factors for both, the daily and group sunspot areas. The calibration factors are obtained with two approaches: 1) the direct comparison between the individual data files with the corresponding errors estimated using a *bootstrapping* technique and 2) the characterization of the sunspot areas distributions for each observatory by a single analytical function. Our results are relevant in the context of solar variability studies, from flux transport models to irradiance variations reconstructions.

S1P22

Tracking a long duration active region: flux evolution and ejective aspects

L. Merenda(CEDS/FRM/UTN, Argentina), H. Cremades(CEDS/FRM/UTN-CONICET, Argentina), C. Mandrini(IAFE/UBA-CONICET, Argentina), M. Fuentes(IAFE/UBA-CONICET, Argentina), F. López(ICATE/UNSJ-CONICET, Argentina), M. Poisson(IAFE/UBA-CONICET, Argentina), I. Cabello(CEDS/FRM/UTN-CONICET, Argentina).

Abstract. Abstract. Coronal Mass Ejections (CMEs) hold the number one place in threats to Earth due to their high capability of perturbing the fragile equilibrium of technology. Despite the fact that many CME triggering mechanisms have been proposed, space weather forecasts are so far not able to predict when a CME will take place in an active region. To improve our knowledge in this respect, we investigate a long-duration active region (AR) throughout its life, along five solar rotations between July and November in 2010, with regard to its ejective productivity and flux evolution. We beneﬁt from the wealth of solar remote-sensing data with improved temporal, spatial, and spectral resolution provided by the ground-breaking space missions STEREO, SDO, and SOHO. The ejective aspect could be uninterruptedly tracked along the entire life of the AR, because the STEREO spacecraft were in a quadrature position with respect to the SDO and SOHO missions, providing multi-viewpoint coronagraphic images . Flux evolution was investigated by means of SDO/HMI data, only possible when the AR was on the front side of the Sun. The ultimate goal of this work in progress is to identify common patterns in the ejective aspect that can be connected with the active region characteristics.

S1P23

Winking flux ropes after Moreton wave event

E. Zurbriggen (IATE/UNC-CONICET, Argentina), M. Cécere (IATE/UNC-CONICET, Argentina), G. Krause (IDIT/UNC-CONICET, Argentina), A. Costa (IATE/UNC-CONICET, Argentina) & C. Francile (OAFA/UNSJ-CONICET, Argentina)

Abstract. Moreton waves are large-scale solar perturbations propagating at chromospheric level, travelling distances of 500 Mm with speeds in the range of 500-2000 km/s. After the occurrence of Moreton events, some observations have reported high intensity oscillations of surrounding flux ropes (Francile et al. 2013, A&A 552, A3). Observations have also suggested

this flux rope winking is due to the passage of Moreton wavefront. We study whether the wink intensities is either caused by the flux rope oscillatory motions generated by the wavefront passage, or by changes in the flux rope plasma-parameters. By means of 2D MHD simulations considering a chromosphere and a stratified corona, we model a typical flux rope magnetic configuration in initial pseudo-equilibrium (Krause et al. 2017, MNRAS 474), we analyze different plasma-parametersv́alues and Moreton wavefront's intensities in order to reproduce the observations. A blast wave deposition is used to emulate a Moreton wavefront. The obtained results and comparison with observations are present.

S1P24

Study of a flare and associated surge on solar active region NOAA 11476

C. Bustos (FCAGLP/UNLP, Argentina), M.López Fuentes (IAFE/UBA-CONICET, Argentina), C. Mandrini(IAFE/UBA-CONICET, Argentina), M. Poisson (IAFE/UBA-CONICET, Argentina)

Abstract. We analyze an M4.1 flare and associated surge that occurred in active region (AR) NOAA 11476 on 9 May 2012, 21:01 UT. The flare took place at the same location and approximately 9 hr after the onset of a first more intense (M4.7) event that we studied in a previous work. The AR configuration is extended and mostly bipolar although with some degree of complexity. The site of both flares coincides with an emerging minor bipole (as observed in SDO/HMI line of sight magnetograms) located in between the two main AR polarities. This bipole is observed to rotate by around 150 deg during approximately 36 hs before the occurrence of the events, indicating a strong injection of twist into the overlying coronal magnetic structure. A preliminary study of the evolution of the event, using different EUV bands of the SDO/AIA instrument, suggests a classical quadrupolar configuration with the possible presence of a null point above the emerging twisted bipole. The succession and location of the flare brightenings and the surge ejection allows us to determine the approximate location of the site where the pre-existing structures interact, via magnetic reconnection, with the newly emerging bipole. We will complement our analysis of the event with X-ray data from the Hinode/XRT telescope and linear force-free extrapolations of the coronal magnetic structure, using as boundary conditions line of sight photospheric magnetograms obtained with SDO/HMI. We will analyze the magnetic model, identifying the presence and location of quasi-separatrix layers (QSLs), to interpret the role of the different interacting structures in the triggering and evolution of the event.

S1P25

Observatorio Astronómico de San José (OAS), Universidad de Costa Rica

L. Taliashvili (Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica), I. Calvo (Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica), H. Gutiérrez (Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica), C. Salas (Space Research Center (CINESPA), School of

Physics, University of Costa Rica, Costa Rica), L. Herrera (Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica), E. Sánchez (Space Research Center (CINESPA), School of Physics, University of Costa Rica, Costa Rica), L. Klein (LESIA UMR 8100 Observatoire de Paris, CNRS, Univ. Paris 6&7, F-92190 Meudon, France), Z. Mouradian (LESIA-UMR 8100-Observatoire de Paris, CNRS, Univ. Paris 6&7, F-92190 Meudon, France

Abstract. The Astronomical Observatory of San José of the University of Costa Rica (OAS), which is in the first stage of its development, has the 18 cm MEADE refractor telescope, with the Ha solar filter (656.28 nm), the fine tracking mount, the CCD camera (Sony NEX 5n; 16 Megapixel) and allows us to obtain high-resolution full-disk Ha images of the solar chromosphere. Most important objectives of OAS include: the implementation of the new digital treatment methods; the classification of chromospheric activities; the classification of filaments / prominences according to their dynamic evolution; the elaboration of chromospheric CR maps. OAS will contribute to the systematic, short and long-term study of the evolution of chromospheric dynamic activities, especially solar filaments or prominences. We hope to offer the scientific community an additional database for the study of general solar activity and its implication in the Space Weather.

S1P26

WAVELET ANALYSIS OF METRIC SOLAR BURSTS AND PARAMETERS OF ACTIVE REGIONS BY AN ANALOG RLC CIRCUIT MODEL

F. C. R. Fernandes (UNIVAP, Brazil), H. G. Macedo (UNIVAP, Brazil)

Abstract. In this work, 7 groups of type III solar emissions, recorded in the VHF band (32-278 MHz) in the years 2014 and 2016 by e-Callisto network spectrographs, were analyzed. Type III emissions are generated by the interaction between the electron beams accelerated during solar flares and the solar corona plasma in the active regions, which are characterized by the presence of magnetic arcs. Thus, by means of an analog RLC circuit model, which approximates the magnetic loops of emitting active regions, the associated electric currents can be estimated. Time series that represent the intensity of type III emissions were analysed by wavelet techniques of analysis and the their periodicities were determined. These emissions presented dominant periodicities varying between 8 and 128 seconds. The periodicities are related to possible oscillations in the physical properties of magnetic arcs present in active regions. Considering that the individual type III emission for each group recorded were associated with the same emitting active region, the average emission plasma density in the emitting region of 1010 cm-3 and typical values for the geometric parameters of each magnetic arcs, the electric currents were determined according to these assumptions of the analog RLC circuit model,. The electric currents obtained are between 0.781 x 1010 and 12.500 x 1010 A. The results are in agreement with the lower limit of the current values obtained in the literature for microwave emissions showing modulations of 0.7 - 17 seconds, suggesting that, probably, the approximations adopted are valid only for periodicities of the order of seconds. These results and implications will be presented and discussed.

S1P27

ANALYSIS OF PHOTOSPHERIC MAGNETIC FIELDS REORGANIZATION AND METRIC NOISE STORM RECORDED IN AUGUST 12, 2012

Z. A. L. Sodré (UNIVAP, Brazil), J. C. Santos (UTFP, Brazil), C. M. Wrasse (DGE-INPE, Brazil), F. C. R. Fernandes (UNIVAP, Brazil)

Abstract. Radio Noise Storms (RNS), also named as type I emissions, last from a few hours to several days. They are associated to the evolution of active regions (AR), as well as the occurrence of solar flares. However, recent studies show that RNS are not connect directly to flares, but mostly to reorganization of the magnetic fields of active regions. Considering that type I emissions is generated by the fundamental plasma emission, the reorganization of the scales in active region magnetic configuration was investigated as the possible process for maintenance of the RNS. On August 12, 2012, the BLEN7M (Switzerland) spectrograph of e-CALLISTO network, registered a RNS (14:08 - 15:35 UT); and the NOAA 11542 was in the centre of the solar disc, without the occurrence of intense flare (admitting only flares A and B Classes). The time evolution of the magnetic power spectra was used for identify in which length scales the reorganization of the photospheric magnetic fields occurs. The 481 line-of-sight (LOS) magnetograms recorded by HMI instrument (Helioseismic and Magnetic Imager) on board of the SDO (Solar Dynamics Observatory) were analysed to study the power spectra and the energy spectra. Here, we present the preliminar results of this analysis. The spectrum index, α;, was -2.29, greater than -5/3 (the Kolmogorov's index), indicating the possibility of energy transfer from small to large structures. Furthermore, increasing the value of the power law index causes a redistribution of energy along the power spectra. The reorganization of the photospheric magnetic fields occurred at values corresponding to scales greater than $\sim$ 20.9 Mm ($\sim$ 0.03 Rs), above the photosphere, beginning soon after the beginning of RNS ($\sim$ 10 min) and continuing after the end of that ($\sim$ 1h30min.). The time evolution of the dissipation spectra revealed that the power increased before the starting of the RNS for a wide range of wave numbers. These results will be presented.

S1P28

Search for solar neutrons using SciCRT

M. Anzorena (IGEOF-UNAM, México), J.F. Valdés-Galicia (IGEOF-UNAM, México), R. García (IGEOF-UNAM, México), E. Ortiz , L.X. Gónzalez, O. Musalem (IGEOF-UNAM, México), A. Hurtado (IGEOF-UNAM, México), M. Barrantes (IGEOF-UNAM, México), R. Taylor (IGEOF-UNAM, México), Y. Matsubara (ISEE-Nagoya University, Japón), Y. Itow (ISEE-Nagoya University, Japón), Y. Sasai (ISEE-Nagoya University, Japón), T. Mori (ISEE-Nagoya University, Japón), T. Kawabata (ISEE-Nagoya University, Japón), T. Sako (ICRR, Japón), K. Munakata (Shinshu University, Japón), C. Kato (Shinshu University, Japón), Y. Nakamura (Shinshu University, Japón), S. Uchida (Shinshu University, Japón), S. Kaimi (Shinshu University, Japón), S. Shibata (Chubu University, Japón), A. Oshima (Chubu University, Japón), H. Takamaru (Chubu University, Japón), H. Kojima (AIT, Japón), H. Tsuchiya (JAEA, Japón), K. Watanabe (NDAJ, Japón), M. Kozai (JAXA, Japón), T. Koi (SLAC, EUA)

Abstract. We had searched for solar neutron events produced by ions accelerated during solar flares using a new type of Solar neutron telescope, the SciBar cosmic ray telescope (SciCRT). Since its installation on Top of Sierra negra volcano, México, on September 2013, the SciCRT has been taking data continuously. In this work, we present the statistical analysis of the SciCRT data during the period 2015-2017 in search for signals related to solar neutrons.

S1P29

Determination of CME masses from the analysis of EUV dimmings

F. M. López (ICATE-CONICET, Argentina), H. Cremades (UTN/FRM-CONICET, Argentina), L. Balmaceda (George Mason University, USA), F. Nuevo (IAFE/UBA-CONICET, Argentina), A. Vásquez (IAFE/UBA-CONICET & UNTREF, Argentina)

Abstract. Coronal mass ejections (CMEs) are one of the most spectacular transient events that can be observed in the solar atmosphere. They carry large amounts of plasma and magnetic fields from the low corona into the interplanetary medium. Under certain conditions these events can perturb the terrestrial magnetosphere, producing intense geomagnetic storms. For this reason, the study of fundamental parameters of CMEs, such as their mass, is crucial to estimate their impact on our planet. Unfortunately, the determination of CME masses when the events propagate along the observer's line-of-sight involve large errors, both due to the nature of the Thomson scattering effect and to the lack of knowledge of the density distribution within real CMEs. In this work, we analyzed 32 dimming events for which we determined the temporal evolution of the mass loss, as well as the evolution of the mass of the associated CMEs. The mass loss from the dimmings was obtained applying a Differential Measure Technique (DEM) on data obtained by the Atmospheric Imaging Assembly onboard the Solar Dynamics Observatory. The mass of the associated CMEs is determined from images by the coronagraph COR2 onboard the Solar-Terrestrial Relations Observatory. By combining both analyses, we developed a method to estimate the evolution of the mass of CMEs as a function of height. This method is solely based on the determined EUV evacuated masses, and does not rely on white-light coronagraphic data. To evaluate the success of our method, the results are contrasted against the mass of CMEs measured on quadrature images from COR2.

S1P30

Expansion of coronal mass ejections from the low corona and beyond

Cremades, H.(1,2), Merenda, L.A.(1), Cabello, I. (1,2), López, F.M. (3), Balmaceda, L.A. (4), Iglesias, F. (5) (1) Universidad Tecnológica Nacional - Facultad Regional Mendoza, CEDS, Mendoza, Argentina (2) Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina (3) Instituto de Ciencias Astronómicas, de la Tierra y del Espacio (ICATE), CONICET-UNSJ, San Juan, Argentina (4) George Mason University, Fairfax, VA, USA (5) Max-Planck Institut fr Sonnensystemforschung, Gttingen, Germany

Abstract. Coronal mass ejections (CMEs) are key players in driving space weather and modifying heliosphere's conditions. Although great discoveries have been made since their first detections more than 40 years ago, several pieces of the full puzzle are missing, being one

of them how CMEs are structured and how this structure evolves from the low corona into the heliosphere. The exceptional ongoing solar missions provide a unique opportunity to shed light into this aspect, which would ultimately benefit not only space weather predictions but also the understanding of the underlying physics. The stereoscopic-view images provided by the STEREO/SECCHI suite in combination with images from Earth's perspective recorded by SDO/AIA and SOHO/LASCO allow the analysis of CME events in detail from their origins in the low corona. A small set of CMEs observed by these instruments is selected according to specific time spans and birth locations, with a preference toward spacecraft quadrature situations. These events are carefully analyzed from their birth low in the corona by means of simultaneous observations of STEREO/EUVI and SDO/AIA and followed into the fields of view of the STEREO and SOHO coronagraphs. In particular, the attributes of self-similarity, expansion rate and ratios, as well as the presence and direction of flux ropes are examined.

S1P31

Atmospheric opacity at 212 and 405 GHz at the CASLEO site

D. Cornejo Espinoza (CRAAM,Mackenzie Presbyterian University, So Paulo, Brazil) and Jean-Pierre Raulin (CRAAM,Mackenzie Presbyterian University, So Paulo, Brazil) Atmospheric opacity at 212 and 405 GHz at the CASLEO site

Abstract: The detailed knowledge of the solar explosive mechanisms generating radiation at high frequency radio waves depends on the interpretation of the flux density (S) spectrum. For this purpose, a reliable estimation of S is essential. Therefore, the determination of the atmospheric opacity is important to correct the observed solar radiation flux recorded by ground-based radio-telescopes. The water vapor is the first responsible for sub-millimeter and infrared wavelengths attenuation, and radiation can be attenuate up to two orders of magnitude (e.g 405 GHz). We use the solar brightness method to determine the zenith opacity at 212 GHz, τ212 and 405 GHz, τ405, over the CASLEO site at 2552 m altitude. Compared with other methods, the brightness method allows to determine the atmospheric opacity up to high values, and only depends on one parameter. Namely, the product P = ηT, where T is the brightness temperature of the Sun and η is the beam efficiency. We assume that P is constant even though T and η are not known individually. We used approximately thirteen thousand solar scans recorded by the Solar Sub-millimeter Telescope (SST). The selected data correspond to clear days between February 2002 and September 2013. We estimated the mean value P̄ for each SST beams, using observed solar scans during clear days and low atmospheric opacity (i.e., τ212 ≤ 0.10 nepers and τ405 ¡ 0.80 nepers). These opacities (τ212 and τ405) were estimated earlier by the tipping method. Once P̄ is estimated, the atmospheric opacities τ212 and τ405 were re-calculated using the solar brightness method. A linear regression between opacity at 212 and 405 GHz was performed: τ405 = 0.04 + 6.98τ212 along the period. The linear coefficient is approximately 7. Thus, we can estimate the opacity at 405 GHz, even when the sky is opaque at this frequency. In addition, a clear seasonal variation is observed to the obtained opacities, i.e. low opacity during the winter period (median of 0.142 and 1.023 nepers at 212 and 405 GHz, respectively) and vice versa for the summer period (median of 0.188 and 1.369 nepers at 212 and 405 GHz, respectively). Finally, we found an excellent cor-

relation between the atmospheric opacity at sub-millimeter waves and the precipitable water vapor (PWV).

S1P32

Studying the Stochasticity of Type I Solar Storms with Gradient Spectra

M.A.U. CINTRA (UNIVAP, BRAZIL), F.C.R. FERNANDES (UNIVAP, BRAZIL), R.R. ROSA (INPE, BRAZIL), Z. A. L. SODRE (UNIVAP, BRAZIL).

Abstract. It is known that Type I solar emissions are generated by non-thermal electrons accelerated by structural variations in the active region's magnetic configuration. Most of the Type I bursts is recorded as a sequence of individual bursts characterizing the so-called chains of Type I. They, also, could be associated with solar flares. In this case, the flare dissipative energy is added to the energy released by small changes in magnetic distribution, which increases the duration of Type I storms. One of the major challenges to this context is to characterize the underlying stochastic process best suited to describe the noise patterns of Type I storms. We consider that a first step in this direction is to find or discard similarities with type 1/f noises. In this work, by applying the Gradient Pattern Analysis (GPA), we compared the gradient spectra of Type I storms with canonical gradient spectra generated by White, Pink and Red Noises. The data are time series of Type I bursts recorded in metric wavelengths (65 - 865 MHz) by the Compound Astronomical Low cost Low frequency Instrument for Spectroscopy and Transportable Observatory (CALLISTO) spectrographs. The results accurately indicate that the gradient spectra of Type I solar noise storms captured from CALLISTO are distinct from all type 1/f noises. Thus, considering the results presented here, purely stochastic mechanisms can be discarded as being the major underlying process associated with the plasma dynamics of the phenomenon. In addition, we discuss, from a technical perspective, the advantages of applying GPA over Power Spectral Density (PSD) due to its greater robustness for short series.

S1P33

EUV waves associated to the 14 February 2011 flare and coronal mass ejection

Luoni M. L., Francile C. and Mandrini C. H.

Abstract. In association with an M2.2 GOES-class flare, which occurred on 14 February 2011, a coronal mass ejection (CME) and multiple coronal EUV waves were seen to originate from active region NOAA 11158. A chromospheric Moreton wave was also detected following the flare. We study the relation between the CME and the EUV and H-alpha waves using ground-based and space observations (HASTA, GONG, SDO/AIA, STEREO, LASCO/SOHO).

S1P34

Scaling laws of quiet-Sun coronal loops

C. Mac Cormack (IAFE/UBA-CONICET), M. Lopez Fuentes(IAFE/UBA-CONICET), C. H. Mandrini(IAFE/UBA-CONICET), A. M. Vasquez (IAFE/UBA-CONICET)

Abstract. Different coronal heating models predict particular relations between physical parameters of magnetic loops, such as temperature, density, loop length and magnetic field. These relations and the expected scaling laws obtained from them have been previously compared with observations in the case of coronal loops from active regions (ARs) (see Mandrini, Demoulin and Klimchuk 2000, ApJ, 530, 999). Until recently, the lack of a direct identification of loops in observations of the quiet-Sun corona made it very difficult to perform this kind of studies outside ARs. In a series of recent works (see the review by Vasquez 2016, AdSpR, 57, 1286), a novel coronal tomography procedure was developed that provides, integrated from EUV observations along a solar rotation, the three-dimensional distribution of the mean temperature and density in the coronal volume between 1.02 and 1.225 solar radii. The tomographic results are combined with potential magnetic field extrapolations to obtain the mean temperature and density of the plasma along field lines integrated from the magnetic model. In this preliminary work, we study the scaling laws between observed and inferred parameters of coronal loops reconstructed from the tomography and magnetic model combination for Carrington rotation 2081 (see Mac Cormack et al. 2017, ApJ, 843, 70). The obtained scaling laws are compared with expected relations according to the most widely known models of coronal heating.

S1P35

Configuration of a coronal mass ejection from birth and throughout the inner heliosphere

I. Cabello (UTN-FRM and CONICET, Argentina), H. Cremades (UTN-FRM and CONICET, Argentina), L. Balmaceda (George Mason University, USA)

Abstract. Coronal mass ejections (CMEs) are a consequence of the solar magnetism, being expeled as large amounts of plasma from the Sun into the heliosphere and are considered the main triggers of geomagnetic storms. Since their discovery decades ago, the morphology and evolution of CMEs have been an important issue of concern. Moreover, the interpretation and analysis of observations of CMEs from a single point of view are difficult and ambiguous. The Solar Terrestrial Relations Observatory (STEREO) mission offers images from different vantage points that, combined with those from Earth's view, provide a unique opportunity to analyze the morphology and evolution of CMEs by taking into account their three-dimensional structure. We study the size and orientation of an Earth-directed CME from birth and along its propagation in the corona and the inner heliosphere. No significant changes in orientation are observed, but size and morphology do vary along its evolution.

S1P36

Scaling laws of quiet-Sun coronal loops

C. Mac Cormack (IAFE/UBA-CONICET), M. Lopez Fuentes(IAFE/UBA-CONICET), C. H. Mandrini(IAFE/UBA-CONICET), A. M. Vasquez (IAFE/UBA-CONICET)

Abstract. Different coronal heating models predict particular relations between physical parameters of magnetic loops, such as temperature, density, loop length and magnetic field. These relations and the expected scaling laws obtained from them have been previously compared with observations in the case of coronal loops from active regions (ARs) (see Mandrini, Demoulin and Klimchuk 2000, ApJ, 530, 999). Until recently, the lack of a direct identification of loops in observations of the quiet-Sun corona made it very difficult to perform this kind of studies outside ARs. In a series of recent works (see the review by Vasquez 2016, AdSpR, 57, 1286), a novel coronal tomography procedure was developed that provides, integrated from EUV observations along a solar rotation, the three-dimensional distribution of the mean temperature and density in the coronal volume between 1.02 and 1.225 solar radii. The tomographic results are combined with potential magnetic field extrapolations to obtain the mean temperature and density of the plasma along field lines integrated from the magnetic model. In this preliminary work, we study the scaling laws between observed and inferred parameters of coronal loops reconstructed from the tomography and magnetic model combination for Carrington rotation 2081 (see Mac Cormack et al. 2017, ApJ, 843, 70). The obtained scaling laws are compared with expected relations according to the most widely known models of coronal

Solar Wind

S2P01

On the dispersion properties of Kinetic Alfvén Waves in the Solar Wind

Beatriz Zenteno (Departamento de Física, Facultad de Ciencias, Universidad de Chile, Santiago, Chile) and Pablo S. Moya (Departamento de Física, Facultad de Ciencias, Universidad de Chile, Santiago, Chile)

Abstract. Kinetic Alfvén Waves (KAW) are plasma waves that propagate oblique to the mean magnetic field, have frequencies in the proton gyrofrequency and require such plasma conditions that the wavelength is similar to the ions gyroradius. One of the main properties of these waves is that they have a right-handed polarization in the plasma frame, which differs from the Alfvenic cyclotron left-handed modes. KAWs have been proposed as a possible mechanism that allows energy transference towards electron scales because, in general, KAW wave-particle interactions are resonant with electrons and non-resonant with ions. Most of KAW properties have been studied considering proton-electron plasmas. However, most astrophysical and space plasmas are multispecies, then itś expected that the properties of the KAW in these systems will not depend only on the proton and electron, but also on the parameters of heavier ions. In this work, we solve the Vlasov linear dispersion relation of KAW in a solar-wind-like plasma, composed by protons, electrons and helium ions. We also study dispersion properties such as the electric field perturbations, polarization and density fluctuations for different sets of parameters, focusing on the effect of the He+2 ions concentration and the drift velocity between species

S2P02

Comparative study between four methods to calculate entropy in the interplanetary magnetic field components

A. Ojeda-González (IP&D/UNIVAP, Brazil), M. G. A. de Souza (IP&D/UNIVAP), Brazil), R. A. R. Oliveira (IP&D/UNIVAP, Brazil), V. Klausner (IP&D/UNIVAP, Brazil), A. Prestes (IP&D/UNIVAP, Brazil)

Abstract. Spatio-temporal entropy (STE) analysis applied in the Interplanetary Magnetic Field (IMF) data is useful to identify possible magnetic cloud (MC) candidates [1, 2]. The calculation of STE is performed using Eugene Kononovs Visual Recurrence Analysis (VRA) software. VRA software has a limitation because the source code is not open to use it. Therefore, the comparison with other entropy methods in order to identify MC regions is a necessary study to be done to continue developing this research topic. In this study are adopted three methods (Spectral Entropy (SE), Recurrence Period Density Entropy (RPDE) and Entropy (ENT-which is a characteristic parameters of the Recurrence quantification analysis) to calculate the Shannon entropy via time series analysis in the IMF components. The four methods (STE, SE, RPDE and ENT) are applied to the IMF components of the time intervals corresponded to observations by Advance Composition Explorer (ACE) from 1999 to 2001. Next, the results are compared between themselves using statistical methods.

S2P03

Behavior of the ULF mean power spectral density on the electron flux variation related to CME and HSS structures during the Van Allen Probes era

Jose Paulo Marchezi (National Institute for Space Research - INPE, Brazil), Livia Ribeiro Alves (National Institute for Space Research - INPE, Brazil), Ligia Alves da Silva (National Institute for Space Research - INPE, Brazil)

Abstract. The ULF frequency range are know to play a significant role on the energy changes of the Van Allenś outer radiation belt electron flux, violating the third adiabatic invariant, through a resonant interaction. The main mechanism involved is the radial diffusion, it is an stochastic process that take account the wave and the particle drift frequencies. There are some proposed models to explain the ULF-particle interaction deriving the radial diffusion coefficients. All the models consider the polarization modes of the ULF waves on the efficiency of the interaction. The contribution of the fluctuation of the magnetic and electric field are computed taking account the power spectrum density (PSD) of the signal. This work aims to estimate the behavior of the integrated ULF wave PSD amplitude, in the frequency range of the Pc3 and Pc5 geomagnetic pulsation on the magnetic field data recorded ground based stations from the Churchill line disposition of the Canadian Array for Realtime Investigations of Magnetic Activity (CARISMA) magnetometer network, for all the cases that have an increase on the 2.10 MeV electrons recorded by the Relativistic Electron Proton Telescope (REPT) instrument, on board of the Van Allen Probes, related to Coronal Mass Ejection (CME) and High Speed Streams (HSS) events, during the October 2012 to December 2016 period. This arrangement allows the verification of the PSD according to the radial distance in the magnetosphere, covering all the external radiation belt region.

S2P04

North Atlantic Oscillation variability linked to the auroral electrojet index, AE

Gerardo L. Flores Ivaldi (1,2), Teresita Heredia (1) and Ana G. Elias(1,3) (1) Universidad Nacional de Tucuman, Facultad de Ciencias Exactas y Tecnologia, Dpto. de Fisica, Tucuman, Argentina (2) Ministerio de Educación de la Provincia de Tucuman, Argentina (3) Consejo Nacional de Investigaciones Cientificas y Tecnicas, CONICET, Argentina

Abstract. The possible association between the North Atlantic Oscillation (NAO) variability and the auroral electrojet index, AE, is analyzed. The NAO is the dominant pattern of variation in atmospheric circulation in the North Atlantic basin. This oscillation results in a large-scale modulation of the normal patterns of heat and moisture transport, especially in winter, which determines changes in temperature and precipitation in a great area from eastern North America to Central Europe. A positive correlation between long-term variations in the NAO and geomagnetic activity has already been shown in several studies, using the aa index. In the present work, the AE index is used instead, which monitors the auroral electrojets in the Northern hemisphere (a measure of global electrojet activity in the auroral zone).

An explanation of our result is given through the upper atmosphere processes induced by geomagnetic storms followed by coupling mechanisms among the different atmosphere regions, reaching finally the troposphere, in the context of an overall increasing trend which may be due to anthropogenic activity. A possible process would be that the NAO decrease due to geomagnetic storms is highly localized in time at daily scales and the high positive correlation between geomagnetic activity indices and NAO, specially after 1970, is due merely to a coincidence of increasing trends in both parameters.

S2P05

Study of the diffraction pattern of interplanetary scintillation at 140 MHz to identify solar wind speeds

P. A. Reyes-Marín (FCFM/UMSNH, México), J. C. Mejía-Ambriz (CONACYT-LANCE-IGUM-UNAM, México), A. González-Esparza (LANCE-IGUM-UNAM, México), E. Aguilar-Rodríguez (LANCE-IGUM-UNAM, México), E. Andrade-Mascote (LANCE-IGUM-UNAM, México), P. Villanueva-Hernández (LANCE-IGUM-UNAM, México), O. Chang (LANCE-IGUM-UNAM, México), V. De La Luz (CONACYT-LANCE-IGUM-UNAM, México)

Abstract. The interplanetary scintillation (IPS) is the observed flux fluctuation of astronomical radio sources when their signals pass across solar wind density irregularities. This phenomenon produce a diffraction pattern at Earth that moves with the solar wind. In this work we looking for the evolution of the scales of the diffraction pattern at different elongations for quiet solar wind, the finding of the scales could provide the speed of the solar wind. For this study we use IPS observations of the Mexican Array Radio Telescope (MEXART) at 140 MHz, also we apply a model of the power spectra of IPS and the autocorrelation function of the time series to figure out the scales.

S2P06

Mean shape of interplanetary shocks deduced from in situ observations

C.A. Perez-Alanis (IGF/UNAM, MEXICO), E. Aguilar-Rodriguez (IGF/UNAM, MEXICO), T. Nieves-Chinchilla (NASA GSFC, USA)

Abstract. The interplanetary shock are observed frequently observed by spacecraft over all the interplanetary space. However, the observations in situ do not provided direct information about its properties. In this work we associated a set of shocks detected over the period 2011-2014 with a sample of ICMEs over the same period. We use observations in situ from the spacecrafts WIND, STEREO and MESSENGER to analized this set of data. We analized the general shape of ICMEs shocks with a statistical study about of shock orientations.

S2P07

Micro-turbulence alpha parameter behaviour in nominal and CME-related solar wind using IPS observations

E. Aguilar-Rodriguez (IGEF/MICHOACAN-UNAM, México, J.C. Mejia-Ambriz (CONACYT-IGEF/MICHOACAN-UNAM, México), O. Chang (CONACYT-IGEF/MICHOACAN-UNAM, México)

Abstract. The interplanetary scintillation (IPS) phenomenon is due to the scattering that a radio signal experiences while travelling through the electron density micro-irregularities (known as micro-scales) in the solar wind. It has been shown that several solar wind properties can be estimated from the temporal power spectra of observations of IPS. Of particular importance is the micro-turbulence behaviour that follows a power law determined by the alpha parameter which is related with the scale size of density irregularities in the solar wind. This parameter has been studied, mainly, with radio observations at different frequencies using IPS. Some studies have shown that the alpha parameter has a different values in low-speed and high-speed regions of the solar wind, and is also influenced by changes in solar wind speed, and by the solar cycle. In this contribution we analyze the behaviour of the alpha parameter in nominal and CME-related solar wind using IPS observations in the metric-wavelength domain, where we find a significant change related to the undisturbed solar wind.

S2P08

The third science flight of the SUNRISE balloon-borne solar observatory

F. A. Iglesias (UTN-CONICET-MPS, Argentina-Germany) , A. Feller (MPS, Germany), P. Barthol (MPS, Germany), S. K. Solanki (MPS, Germany) and the Sunrise-3 team

The SUNRISE mission is a balloon-borne, stratospheric solar observatory fed by a 1 m Gregory-type reflector telescope. The combination of the large aperture, the unique observing conditions in terms of low atmospheric absorption and seeing, and the state-of-the-art instrumentation, has been essential for the great success of the first two SUNRISE flights in 2009 and 2013. One of the main goals of SUNRISE is the determination of faint solar magnetic fields at the highest spatial resolution. This is crucial to understand the dynamics and origin of the many phenomena present in the solar atmosphere. During the two first flights, SUNRISE investigated the magnetic fields only in solar photosphere, by acquiring high-spatial-resolution, spectropolarimetric measurements of the iron 525.02 nm spectral line using the imaging magnetograph IMaX. In addition, diffraction-limited, narrow-band images of the photosphere and part of the chromosphere were obtained in the UV between 214 and 397.6 nm, using the filter imager SuFI. Both IMaX and SuFI obtained numerous remarkable results which were, however, mainly restricted to the photosphere and the lower chromosphere. As a consequence, SUNRISE findings led to many open questions related to the influence of the observed small-scale dynamical features, in the higher layers of the atmosphere. The third science flight of SUNRISE, planned for 2021 and described in this poster, will include a new gondola and completely renewed payload to allow focusing on the small-scale magnetic phenomena occurring not only in the photosphere but also in the lower and higher chromosphere. Two new grating spectropolarimeters and an upgraded IMaX instrument are planned to cover the spectral range from 313 to 854 nm in

selected spectral bands. The ultraviolet spectropolarimeter and Imager SUSI, is a slit-scan spectrograph based on an Echelle grating that also includes a slit-jaw imager and covers the 313 to 430 nm spectral range. SUSI aims to acquire high-cadence spectropolarimetric data in the UV to both reduce the effects of instrumental jitter and facilitate the implementation of a novel slit-scan, image restoration technique. The chromospheric infrared spectropolarimeter SCIP is a slit-scan, Echelle-grating-based spectropolarimeter that includes a slit-jaw imager and covers the 765 to 854 nm wavelength range. The new version of IMaX, IMaX+, is a collimated, double-pass Fabry-Pérot filtergraph that can measure polarization in the 517 to 525 nm spectral range. The new payload will make the third SUNRISE science flight unique in basically two aspects. Firstly, SUSI will be able to explore the magnetic, temperature and velocity fields using the UV region below 430 nm, which is poorly known because it has not been covered by other solar observatory to date. The SUSI UV bands will also probe many (10 to 100) magnetically sensitive spectral lines simultaneously, this increases the information input of the inversion process which translates in to a larger signal to noise ratio of the inferred quantities. Secondly, the ability to perform co-spatial, simultaneous co-observations with the three instruments (including spectropolarimetry in the UV and infrared) will allow probing magnetic fields and other relevant atmospheric parameters all the way from the photosphere to the higher chromosphere; this is critical to understand energy transport processes among others.

Planetary Magnetospheres

S3P01

Juno Mission to Jupiter's Giant Magnetosphere

Fran Bagenal, University of Colorado, Boulder CO USA

Abstract. Jupiter is a planet of superlatives: the most massive planet in the solar system, rotates the fastest, has the strongest magnetic field, and has the most massive satellite system of any planet. These unique properties lead to volcanoes on Io and a population of energetic plasma trapped in the magnetic field that provides a physical link between the satellites, particularly Io, and the planet Jupiter. There are strong differences between the magnetospheres of Earth and Jupiter but there are also underlying basic physical principles that all magnetospheres share in common. This presentation provides a summary of the magnetosphere of Jupiter and presents the observations made by Juno of the planetś internal magnetic field, the structure and dynamics of the outer magnetosphere, plus the first observations of the polar region - both remote sensing of the dramatic aurora as well as in situ measurements of the particles and fields.

S3P02

Determination of the rotation period of the Karin family of asteroids

Pinares Vásquez Roy(DIAST,CONIDA, Perú), D. Gonzales Davalos Jorge A.

Abstract. Asteroids are bodies of irregular shape that could not accumulate enough mass to become planets, they are mainly composed of silicates and metals. Most are between the orbits of Mars and Jupiter known as the main asteroid belt. A family of asteroids are fragments created by a catastrophic collision process, which, due to gravitational perturbations and thermal mechanisms, their orbits as their rotational properties change over time. When older is a family, its rotational properties will be more eroded since its creation. Particularly, the Karin family of asteroids that has an age of 5.75 million years (Carruba et al., 2016), and it is believed that its rotational properties have not been totally modified since its creation. The objective of the work is to determine the properties rotations of the Karin family. In this opportunity the techniques to determine the period of rotation of the Karin family are presented.

S3P03

Geomagnetic and ionospheric response to SC on March 17, 2015, as observed by magnetometers and GPS/TEC technique

Bravo M. (University of Santiago de Chile, Chile), V.A. Pilipenko (Space Research Institute, Moscow, Russia), O.V. Kozyreva (Institute of Physics of the Earth of the Russian Academy of Sciences, Russia), N.V. Romanova (University of Santiago de Chile, Chile), P. Vega (De La Serena University, Chile), J. Marin (De La Serena University, Chile), L. Tamblay (De La Serena University, Chile) and S.N. Samsonov (Institute of Cosmophysical Research and Aeronomy, Yakutsk, Russia)

Abstract. We monitor the propagation of a disturbance, caused by an interplanetary shock on March 17, 2015, from the interplanetary space through the magnetosphere and ionosphere to the ground using data from satellites, world-wide arrays of magnetometers, and Global Positioning System (GPS) receivers that provide information about the Total Electron Content (TEC) of the ionosphere. Though we mainly attempt to find an ionospheric TEC response to sudden commencement (SC), using GPS data, we give a more comprehensive picture of the fine structure of the SC: preliminary (PI) and main (MI) impulses which are ground images of transient magnetospheric field-aligned current systems. While both MI and magnetospheric field compression were reliably detected by the magnetospheric satellites GOES and RBSP, and on geomagnetically conjugate stations, PI was seen on the ground only. This study confirms the ability to detect SC signatures with a GPS technique. Clear TEC response to MI was found at auroral latitudes, but not from every GPS satellite. TEC modulation may be related to supra-thermal electron precipitation into the bottom ionosphere, not monitored by the riometer technique.

S3P04

Radial diffusion driven by ULF waves during rapid dropout in the outer radiation belt after Coronal Mass Ejection

Da Silva, L. A.1; Alves, L. R.1; Souza, V. M.1; Jauer, P. R.1; Marchezi, J. P.1; Dal Lago, A.1, Vieira, L.E.1; Da Silva, G. B. 1; Medeiros, C.1; Rockenbach, M.1; Pádua, M. B.1; Sibeck, D.2; 1National Institute for Space Research INPE, São José dos Campos, SP, Brazil. 2NASA Goddard Space Flight Center, Greenbelt, MD, USA.

Abstract. Rapid decrease of high-energy electron flux in the outer radiation belt is observed after of the Coronal Mass Ejection (CME) reach the Earth's magnetosphere on July 19, 2016. The solar wind parameters confirm the strong perturbation on the interplanetary medium, which was followed by excitation of waves over a wide range of frequencies. The Ultra Low Frequency (ULF) waves activity was detected on the ground (CARISMA magnetometer network) and on the magnetosphere (Van Allen Probes fluxgate magnetometers). The Power Spectral Density (PSD) associated with ULF waves was calculated from both ground and in situ instruments during the event. Results show that the ULF waves activity was strong at the beginning of July 20. The efficiency of the ULF wave-particle interaction in the radial diffusion is investigated by means of DLL calculation through the rapid dropout. The CARISMA Network magnetometer spread from L 7 to L 4 in a roughly constant magnetic local time meridian, in such a way that we verify the efficiency of ULF waves-particle interaction as a function of L-shell, besides the geomagnetic activity. Thereby, we investigate the role of ULF radial diffusion to different L* using an empirical model. According to the satellite measurements, compressional and poloidal polarization modes are preferential during this dropout, which may contribute significantly with the loss of particles to outer magnetosphere.

S3P05

Study on the polarization and stability of Kinetic Alfvén Waves in the Earthś magnetosphere

Iván Gallo (Universidad de Chile, Chile), Pablo S. Moya (Universidad de Chile, Chile)

Abstract. Kinetic Alfvén Waves (KAWs) are a mode of propagation of plasma waves, that propagate oblique respect to the background magnetic field, and have frequencies in the range of the proton cyclotron frequency. One of the most important properties of the KAW, in contrast with left-handed EMIC Waves, is that KAWs waves have a right-handed polarization in the plasma frame. Thus, wave-particle interactions with KAWs tend to be non-resonant with ions and resonant with electrons. In fact, these waves are considerate as a possible channel to transfer energy to small electron scales, being of particular interest to the space plasma physics community. Here, guided by observations, we use Vlasov linear theory to obtain the dispersion relation and study the growth/damping rates and polarization of the waves. Considering different concentrations of the O+ ions, which may be relevant especially during geomagnetic storms, we study the dispersion properties of KAWs in multi-species plasmas composed by electrons, protons, and O+, with macroscopic plasma parameters relevant to the inner magnetosphere environment.

S3P06

Low frequency variations of Jovian radio emissions observed by Cassini

Magalhães, F.P. (INPE, Brazil) Zarka, P. (LESIA, France) Echer, E. (INPE, Brazil) Souza Echer, M.P. (INPE, Brazil) Gonzalez, W. (INPE, Brazil)

Abstract. Since the 1950s, Jupiter is known to be a major source of radio emissions. First, ground-based antennas obtained radio observations. Later the knowledge about plasma sources on Jupiter's magnetosphere were based on in-situ and remote sensing measurements onboard spacecrafts. The radio spectrum of Jupiter spanning the frequency range from 10 kHz to 3 GHz is dominated by strong non-thermal radiation. Jupiter's giant magnetosphere is mostly determined by internal interactions, primarily due to activity in Io's volcanoes, affecting the supply of plasma to all other regions. However, the Jovian magnetosphere dynamics is believed to be in part responsive changes in Solar Wind conditions. In the end of the year 2000, Cassini-Huygens spacecraft performed its closest approach to Jupiter, reaching a distance of ten million kilometers of the planet. During Cassini's flyby at the Jovian system, the Radio and Plasma Wave Science (the acronym RPWS) instrument measured Jovian's radio emissions during the inbound and outbound trajectories. The present work aims to investigate Jupiter's radio emissions long term variation (¿ 1 Jupiter rotation), analyzing the behaviour of the 10-hour integrated fluxes to the DAM, HOM, nKOM and bKOM bands. The data period used goes from October 2000 to March 2001. Averaged fluxes are compared for inbound and outbound orbits Correlation and Lomb-Scargle periodogram analyses were applied to RPWS data to investigate the correlation among different spectral ranges and the major periodicities.

S3P07

Effects of the Crustal Magnetic Fields and Changes in the IMF Orientation on the Magnetosphere of Mars: MAVEN Observations and LatHyS Results.

N. Romanelli (LATMOS, France), R. Modolo (LATMOS, France), F. Leblanc (LATMOS, France), J-Y. Chaufray (LATMOS, France), S. Hess (ONERA, France), D. Brain (LASP, USA), J. Connerney (NASA, USA) , J. Halekas (University of Iowa, USA), J. McFadden (SSL, USA), B. Jakosky (LASP, USA).

Abstract. The Mars Atmosphere and Volatile EvolutioN Mission (MAVEN) is currently probing the very complex and dynamic Martian environment. Although main structures arising from the interaction between the solar wind (SW) and the induced magnetosphere of Mars can be described using a steady state picture, time-dependent physical processes play a key role modifying the response of this obstacle. These processes result from temporal variabilities in the internal and/or external electromagnetic fields and plasma properties. For instance, the crustal magnetic fields (CF) rotation constantly modifies the intrinsic magnetic field topology relative to the SW. Moreover, the state of the magnetosphere is also modified by changes in the interplanetary magnetic field (IMF). In this work we analyze magnetic field and plasma measurements provided by MAVEN on 23 December 2014, between 06:00 UT 17 and 14:15 UT. MAVEN measurements suggest the external conditions remained approximately constant when the spacecraft was inside the magnetosphere during the first orbit. In contrast, MAVEN observed changes in the IMF orientation, before visiting the magnetosphere during the second orbit. To investigate the response of the Martian plasma environment to the CF rotation and IMF variability, we also perform LATMOS Hybrid Simulation runs, using MAVEN observations to set SW external conditions. Simulation results are compared with the MAVEN measurements and show good agreement. We also determine the timescales over which different regions inside the Martian magnetosphere adapt to changes in the IMF orientation. Finally, we perform estimations of the total planetary H+ and O+ escape fluxes at different times during this event.

S3P08

A Statistical Study of Correlation Length Around Venus

Adriane Marques de Souza Franco, Ezequiel Echer, Markus Fraenz, Mauricio Jose Alves Bolzan 1- National Institute for Space Research, Sao Jose dos Campos- Brazil 2- Max Planck Institute for Solar System Research, Goettingen- Germany 3- Federal University of Goias, Jatai- Brazil

Abstract. A statistical study of the correlation scale on structures around Venus was developed using magnetic field and electron density data obtained from the Magnetometer and the Analyzer of Space Plasmas and Energetic Atoms (ASPERA-4) instruments (respectively), on board of the mission Venus Express (VEX). The correlation scales have been calculated by the correlation length, which is a characteristic length over which fluctuations in a variable are correlated. We limited the study to the frequency range 8 to 50 mHz because previous studies have shown that ULF (Ultra Low Frequency) waves produced in the foreshock have highest power in this range. Frequencies below 8mHz were filtered out using the Fourier transform. In this study the correlation length was calculated by an exponential fit employed to the auto-correlation curve. The auto-correlation function was calculated lagged by a time between 0 and 60 seconds and sliding a window of 120s width across the data. We also converted the obtained correlation length from temporal to spatial scale by multiplying by the solar wind velocity. Here, the ASPERA-4/IMA (Ions Mass Analyzer) velocity was used. In order to find the size of the structure in different regions of the Venus magnetosphere, statistical maps showing the

median correlation length in spatial bins around Venus have been produced covering the all data from the VEX mission (May 2006 to September 2014).

Cosmic Rays

S4P01

Earthquake Studies Using a LAGO Water Cherenkov Detector in Ecuador

F. Navarro (Universidad San Francisco de Quito, Ecuador), Edgar Carrera (Universidad San Francisco de Quito, Ecuador,), Ricardo Escobar (Universidad San Francisco de Quito,Ecuador), Dennis Cazar (Universidad San Francisco de Quito, Ecuador), Mario Audelo (Escuela Superior Politecnica del Chimborazo, Ecuador)

Abstract. Several studies have suggested the possibility of an interrelation between the occurrence of earthquakes and local disturbances in the geomagnetic field. On April 16, 2016, Ecuador suffered one of the strongest earthquakes in its history. One of the Latin American Giant Observatory (LAGO) water Cherenkov detectors (WCD) located in the city of Riobamba, Ecuador, was acquiring data before, during and after this seismic event. LAGO is an observatory that consists of a network of WCDs located at different altitudes and latitudes throughout Latin America, with the main purpose of studying the physics related to cosmic rays. In this work, we revisit the idea, already explored by other LAGO groups, of using the data acquired by LAGO WCDs to study the interrelation between seismic phenomena and the geomagnetic field modulation of the flux of atmospheric muons originated in extensive air showers. To do this. after noise removal, an implementation of the moving windows average (MWA) algorithm was used to search for sudden flux changes within 5 minute intervals. No significant change was found around the time of the earthquake but the analysis method was put in place and it is susceptible of improvement.

S4P02

Cosmic ray cuttoff rigidity estimations based on the World Magnetic Model

D. Sapundjiev (Royal Meteorological Institute, Belgium) and S. Stankov (Royal Meteorological Institute, Belgium)

Abstract. The use of neutron monitor (NM) measurements in space weather monitoring applications requires an accurate estimation of the shielding effect of the geomagnetic field, i.e. the geomagnetic cutoff rigidity. The latter determines the minimum energy required by a charged particle to enable it to penetrate the geomagnetic field and arrive at a certain point on the Earthś surface. The cutoff rigidity offers a possibility to deduce useful information from the intensity of the galactic cosmic rays registered by the neutron monitors, e.g. the energy and spectrum of a Ground Level Enhancement (GLE) event. However, the rigidity estimates have to be re-calculated every few years due to the evolution of the geomagnetic field. Thus, an accurate estimation of the cuttoff rigidity for a given geographical location necessitates a detailed knowledge of the geomagnetic field. Since geomagnetic field models are used for the calculations, the estimated values depend on the quality of these models. This dependence appears to be greater at low and middle latitudes. In this work we utilise Monte-Carlo methods

and trajectory-tracing calculations employing the World Magnetic Field Model (WMM), epoch 2015, for calculations of the cutoff rigidities at several NM stations at low and middle latitudes. Results will be compared with similar calculations based on the traditionally-used International Geomagnetic Reference Field (IGRF) model. A thorough analysis will be presented in view of possible space weather monitoring applications.

S4P03

Analysis of the solar cycle modulation in the cosmic ray intensity observed at South America in the last decade

Rafael R. S. de Mendonça [1,2]; Jean-Pierre Raulin [1]; Carlos R. Braga [2]; Alisson Dal Lago [2]; Ezequiel Echer [2]; Kazuoki Munakata [3]. 1 - Center for Radio Astronomy and Astrophysics at Mackenzie, Brazil. 2 - National Institute for Space Research, Brazil. 3 - Shinshu University, Japan.

Abstract. Cosmic rays are energetic particles (mostly protons that can have energy from MeV to ZeV) which presented a practically isotropic flow in the space region close to the Earth. Solar and interplanetary phenomena affect the cosmic ray intensity observed at ground producing different transient and periodic variations. In this work, we analyze the 11 and 22-year cosmic ray intensity variation observed by three cosmic rays detectors. We compare the sunspot number and mean solar magnetic field obtained by the WSO (Wilcox Solar Observatory) with the cosmic ray intensity observed by the São Martinho da Serra (Brazil) and CARPET (Argentina) detectors between 2006 and 2017. In addition, we compare the results with that obtained comparing these solar activity parameters with the cosmic ray intensity observed by the Nagoya (Japan) detector between the last 4 decades (from 1971 until 2017).

S4P04

Variations in the Secondary Component of Cosmic Rays, Detected by the Cosmic Ray Observatory of Mexico City Attributed to Geomagnetic Storms.

S. Hernández-Anaya (FC-UNAM, México)

Abstract. Studies in solar physics, Sun-Earth relations, and interplanetary medium have allowed knowing that solar activity plays a predominant role in diverse phenomena that occur and we observe in the terrestrial environment; such as geomagnetic storms, northern lights, ionosphere, and significant variations in the intensity of cosmic radiation detected on the Earthś surface. This project aims to find the relationship between geomagnetic storms and variations of cosmic rays to provide information to the study of space weather; as well as to monitor the solar activity. Part of this study will be carried out with data collected during descending phase of the Solar Cycle 24 (2015-2017) by the Neutron Monitor belonging to the Cosmic Ray Observatory of Mexico City in charge of the Institute of Geophysics - UNAM.

S4P05

Simulation of Water Cherenkov Detector for neutron detection using Geant4

N. Guarin (IB/UnCuyo, Argentina), H. Asorey (CNEA-CONICET-IB/UnCuyo, Argentina, I. Sidelnik (IB/UnCuyo-CONICET, Argentina), M. Suarez Duran (Escuela de Física UIS/Instituto de Tecnología en Detección y Astropartículas CNEA/CONICET/UNSAM, Colombia), F. Alcalde (IB/UnCuyo-CONICET, Argentina), L. H. Arnaldi (IB/UnCuyo-CNEA, Argentina), J. Lipovetzky —(IB/UnCuyo-CONICET-CNEA, Argentina), M. Perez (IB/UnCuyo-CNEA, Argentina), M. Sofo Haro (IB/UnCuyo-CONICET, Argentina), J.J. Blostein (IB/UnCuyo-CONICET, Argentina), M. Gómez Berisso (IB/UnCuyo-CONICET, Argentina)

Abstract. Detailed simulations of water Cherenkov detectors (WCD) using Geant4 are widely used as a tool to study the performance of these detectors in cosmic ray research. In this work we present the simulation of the response of a single and simple, one PMT, WCD in the presence of neutron sources. To do this, a detailed model of the WCD has been implemented that includes a model of 241AmBe and 252Cf neutron sources spectra. The results of our simulations show the detailed mechanism for the detection of neutral massive particles using WCD and support the experimental evidences presented in this conference, were WCD were used to detect neutrons of different energies using the mentioned isotopic sources. In this work we compared the expected results from different WCD sizes, different active volumes and shields, and calculated the expected efficiency for each configuration. The sensitivity of WCD we obtained in our simulations for neutrons with energies ranging from meV to GeV, is a relevant result in the frame of the neutron detection system that is widely used for cosmic ray and space weather studies. We conclude that WCD used as neutron detectors can be a complementary tool for standard neutron monitors based on He3.

S4P06

Identification of particles by energy loss per unit path length in the SciBar Cosmic Ray Telescope SciCRT

R. García (IGEOF-UNAM, México), J.F. Valdés-Galicia (IGEOF-UNAM, México), M. Anzorena (IGEOF-UNAM, México), E. Ortiz (ICF-UNAM, México), L.X. Gónzalez (SCiESMEX, México), O. Musalem (IGEOF-UNAM, México), A. Hurtado (IGEOF-UNAM, México), M. Barrantes (IGEOF-UNAM, México), R. Taylor (IGEOF-UNAM, México), Y. Matsubara (ISEE-Nagoya University, Japón), Y. Itow (ISEE-Nagoya University, Japón), Y. Sasai (ISEE-Nagoya University, Japón), T. Mori (ISEE-Nagoya University, Japón), T. Kawabata (ISEE-Nagoya University, Japón), T. Sako (ICRR, Japón), K. Munakata (Shinshu University, Japón), C. Kato (Shinshu University, Japón), Y. Nakamura (Shinshu University, Japón), S. Uchida (Shinshu University, Japón), S. Kaimi (Shinshu University, Japón), S. Shibata (Chubu University, Japón), A. Oshima (Chubu University, Japón), H. Takamaru (Chubu University, Japón), H. Kojima (AIT, Japón), H. Tsuchiya (JAEA, Japón), K. Watanabe (NDAJ, Japón), M. Kozai (JAXA, Japón), T. Koi (SLAC, EUA)

Abstract. At the top of the Sierra Negra volcano in eastern México the SciBar Cosmic Ray Telescope (SciCRT) is installed, one of its main purposes is to detect solar neutrons to investi-

gate the ion acceleration process during intense solar flares. Furthermore, thanks to the design and construction of the SciCRT in the form of small and long scintillation bars, large active volume, high energy resolution, and a fast electronics for data processing, particle identification is possible through the analysis of tracks. In this work, we present the result of a particle identification method using data generated by Monte Carlo Simulation of SciCRT. Our method employs the measurement of energy loss per unit path length (dE/dx).

S4P07

Earthquake Studies Using a LAGO Water Cherenkov Detector in Ecuador

D. Cazar, F. Navarro, E. Carrera (Universidad San Francisco de Quito/LAGO Collaboration, Ecuador)M. Audelo (Escuela Superior Politécnica de Chimborazo/LAGO Collaboration, Ecuador)

Abstract. Several studies have suggested the possibility of an interrelation between the occurrence of earthquakes and local disturbances in the geomagnetic field. On April 16, 2016, Ecuador suffered one of the strongest earthquakes in its history. One of the Latin American Giant Observatory (LAGO) water Cherenkov detectors (WCD) located in the city of Riobamba, Ecuador, was acquiring data before, during and after this seismic event. LAGO is an experiment that consists of a network of WCDs located at different altitudes and latitudes throughout Latin America, with the main purpose of studying the physics related to cosmic rays. In this work we revisit the idea, already explored by other LAGO groups, of using the data acquired by LAGO WCDs to study the interrelation between seismic phenomena and the geomagnetic field modulation of the flux of atmospheric muons originated in extensive air showers. We present the analysis strategy and preliminary results.

S4P08

Secondary cosmic ray variations measured by the Mexico City Neutron Monitor attributed to atmospheric electric fields.

B. J. Newton Bosch (Instituto de Geofísica, UNAM), L.X. González (LANCE/SCiESMEX, IGUM-UNAM).

Abstract. The secondary cosmic rays measured by ground level detectors can be affected by atmospheric electric fields generated in thunderstorms. In this work, we present the variations of the counting rates of the cosmic ray nucleonic component detected by the 6-NM64 neutron monitor installed in Mexico City. The measurements of an electric field mill installed on the roof of the Geophysics Institute building were also used to determine the relationship between the strength and direction of the atmospheric electric field and the cosmic ray intensity variations. The most intense thunderstorms registered by the electric field mill during the year 2017 were selected for the data analysis. These thunderstorms produced electric fields with a magnitude of 20 kV/m.

S4P09

Stability analysis of the neutral particles detected by the Solar Neutron Telescope in Sierra Negra, Mexico.

Griselda Barón Martínez (Facultad de Ciencias - UNAM, México) D. Luis Xavier González Méndez (Instituto de Geofísica - UNAM, México) D. José Francisco Valdés Galicia (Instituto de Geofísica - UNAM, México)

Abstract. The Solar Neutron Telescope (SNT) is installed on top of Sierra Negra Volcano in México (19.0°N, 97.3°W) at 4580 m s.n.m. and is operating since 2004. The SNT has four energy deposition channels (E) of incident particles, corresponding to E $\geq$ 30 MeV, 60 MeV, 90 MeV and 120 MeV. In addition to measuring the galactic cosmic ray background, the SNT has the ability to detect the flux of solar neutrons, their energy and arrival direction. In this work, a detailed statistical stability analysis is presented of the four channels that register the neutral particles. A database of 11 years (2004-2015) is used, with a 10 second count ratio. The analysis shows the variations in the particle registers that have been presented, for the knowledge of the quality of the detected data and the different electronic, electrical influences and atmospheric activity phenomena that have generated changes in the annual statistics of the SNT. The total signal of the detector is known and how it has varied over time. In addition, it helps us to ensure that we are working with reliable data to perform the basic studies of solar physics and to know and differentiate the effects of electrical phenomena and other types.

S4P10

A statistical study about the effects of Forbush Decrease events on latitudinal temperature of the near-ground air

Williamary Portugal (INPE - National Institute for Space Research, Brazil); Ezequiel Echer (INPE - National Institute for Space Research, Brazil), Mariza Pereira de Souza Echer (INPE - National Institute for Space Research, Brazil) and Alessandra Abe Pacini (National Astronomy and Ionosphere Center - Arecibo Observatory, Puerto Rico).

Abstract. We present in this work a statistical study of the near-ground air temperatures in different latitudes during periods with decrease of atmospheric ionization induced by Galactic Cosmic Rays (GCR) on the Earth's atmosphere. These GCR fluxes reductions are called Forbush Decreases (FD), and they are mainly caused by interplanetary Coronal Mass Ejection (CME) deflection of GCR around Earthś orbit. This study was perfomed considering the possible influence of the cosmogenic atmospheric ionization on the water vapor condensation patterns (link GCR cloud condensation nuclei) as the main hypothesis to be tested. For that, we have conducted a study to analyze these possible effects on the air surface temperature, using superposed epoch analysis around the ten strongest FD events occurred between 1987 and 2015. GCR data were collected from Oulu neutron monitor (cosmicrays.oulu.fi), and air surface temperature data were obtained from NOAA - National Oceanic Atmospheric Administration / GSOD - Global Surface Summary of the Day (https://data.noaa.gov/dataset/global-surface-summary-of-the-day-gsod) of ten meteorological stations of three latitudinal ranges of Northern and Southern hemispheres (20 - 30, 40 - 50 e 60 - 70). We investigate here the variation of the daily average of the air temperature near ground during FD for each one of the three latitudinal

ranges. The possible climatic effects of GCR decrease were considered using linear and cross correlation methods. The comparison between the near ground air temperature daily averages during FD events periods and equivalent periods without FDs (during solar minima years of 1987, 1996 and 2008) was also performed. Some results for the Northern hemisphere have showed a latitudinal dependence of the induced ionization by GCR on the atmospheric parameters. It was possible to note the anti correlation between the surface temperature mean and the GCR flux, increasing from low to high latitudes. However, for the Southern hemisphere, the anti correlation between these data was only found for the high and medium latitudes, also with a poleward increase. From these results it seems that the FD effect on climate is more prominent in the Northern hemisphere and that there is increases with latitude.

S4P11

Variations in the flux of cosmic rays detected by the Solar Neutron Telescope at Sierra Negra attributed to geomagnetic storms

S. Perea (Instituto de Geofísica/UNAM, México), L.X. González (Instituto de Geofísica/UNAM, México)

Abstract. Geomagnetic storms may influence in the intensity of cosmic rays that reach the Earth. These variations may lead to a prediction of geomagnetic storms using cosmic ray readings. The Solar Neutron Telescope (SNT) at Sierra Negra, Puebla (19.0°N, 97.3°W and 4580 m.a.s.l.) is part of a worldwide web of telescopes specialized in detecting neutrons coming from solar flares, making this kind of detectors a very reliable source for these purposes. In this work, we will try to prove if there is any relationship between the most significative geomagnetic storms (using the Dst index to identify them) and the flux of cosmic rays detected by the SNT at Sierra Negra for the year 2015.

Ionosphere and the Upper Atmosphere

S5P01

Cross-validation between the La Plata Ionospheric Model (LPIM) and the JASON satellite mission

A. Volk (FCAG/UNLP and CONICET, C. Brunini (AGGO/CONICET-BKG and FCAG/UNLP)

Abstract. The La Plata Ionospheric Model (LPIM) describes the global spatial-temporal variability of the electron density in the ionosphere. The model relies on the parameters of the F2 peak, whose values are estimated from the assimilation of GNSS measurements collected from the earth and from space. As a by-product of the estimation of these parameters, LPIM allows the generation of global maps of the three parameters that characterize the F2 region: the density (NmF2) and height of the peak (hmF2), and scale thickness (HF2). This paper discusses the accuracy of the NmF2 and HF2 parameters estimated by LPIM through the indirect procedure of comparing the vertical total electron content (VYEC) calculated with the LPIM and the one provided by the JASON ocean altimetry satellite mission.

S5P02

Seasonal Characteristics of Small- and Medium-Scale Gravity Waves in the Mesosphere and Lower Thermosphere Region over Brazilian Equatorial Sector

Patrick Essien (INPE, Brazil); C. M. Wrasse (INPE, Brazil); Paulino I. (UFCG, Brazil); Medeiros, A. F. (UFCG, Brazil); Buriti R. A. (UFCG, Brazil), H. Takahashi (INPE, Brazil).

Abstract. This work reports the seasonal characteristics of small- and medium-scale gravity waves in the mesosphere and lower thermosphere region observed in the OH NIR airglow images over São João do Cariri (7.4oS, 36.5oW). Observations were made from September 2000 to December 2010, which corresponded to a total of 1496 nights. To investigate medium-scale gravity waves, sequences of images observed in each night was used to create 701 keograms. Two techniques were used to calculate for gravity waves parameters: Keo-FFT analysis for medium-scale gravity waves (MSGWs) and Fourier cross spectrum for small-scale gravity waves (SSGWs). The two analytical techniques resulted in 537 and 2343 MSGWs and SSGWs events respectively. The horizontal wavelengths of MSGWs were concentrated between 100 to 150 km, while that of the SSGWs were between 10 to 15 km. The observed periods for MSGWs ranged from 20 to 40 minutes, while the SSGWs had a maximum peak around 5 to 10 min. The observed horizontal phase speed of MSGWs was distributed between 60 to 80 10 m/s while the SSGWs showed a peak around 20 to 40 m/s. Except spring, which the wave events propagated in all directions, in summer, fall and winter were northeast and southeast. The horizontal propagation direction of MSGWs and SSGWs show clear seasonal variations based on the influence of the background atmospheric conditions such as wind. The anisotropy observed in the total propagation directions of MSGWs was northeast which can be attributed to either the source location of the gravity waves or the filtering process due to the wind system which depends fundamentally on the seasonal variations. However, there was no clear anisotropy in the total

propagation direction of the SSGWs which could be due to uniformly distribution of the sources or filtering processes by the wind system. Critical level theory for gravity wave filtering was applied to study the effects of middle atmospheric winds on the propagation path of the wave events while the average of daily mean Outgoing Long-wave Radiation (OLR) was used to study the possible seeding mechanism of the gravity waves. The SSGWs were found to be filtered out by the mean flow due to their least phase velocities. Deep Convection is the possible seeding mechanism for both MSGWs and SSGWs in the summer and fall over the Brazilian equatorial sector. MSGWs were found to be less susceptible to wind filtering effects due to their high phase velocities.

S5P03

INVESTIGATION OF NIGHTTIME MSTIDS OBSERVED BY OPTICAL THERMOSPHERE IMAGERS AT LOW LATITUDE: MORPHOLOGY, PROPAGATION DIRECTION, AND WIND FILTERING

C. A. O. B. Figueiredo (INPE, Brazil), H. Takahashi (INPE, Brazil), C. M. Wrasse (INPE, Brazil), Y. Otsuka (ISEE, Nagoya University, Japan), K. Shiokawa (ISEE, Nagoya University, Japan), D. Barros (ISEE, Nagoya University, Japan)

Abstract. Different types of MSTIDs have been observed over Cachoeira Paulista (22.4 °S; 45.0 °W), Brazil, from June 2013 to December 2015 using airglow images from OI 630.0 nm. During this period, 58 MSTIDs were classified as MSTIDs dark band(around 10 events), and periodic MSTIDs (48 events). Dark band MSTIDs present phase velocity between 50 and 200 m/s and propagation direction to Northwestward. On the other hand, periodic MSTIDs have a horizontal wavelength of 80 to 160 km, a period ranging between 5 and 45 minutes, the phase velocity of 50 to 200 m/s, and propagation direction mainly to North-Northeastward. The parameters indicate that the periodic MSTIDs have different characteristics when compared with dark band MSTIDs, suggesting that the periodic MSTIDs are not generated through the well-known instability Perkins; in addition, this study indicates that the spectral characteristics found in Brazil are different from other regions such as Japan and Indonesia. Therefore, this article intends to investigate the generation mechanisms of the periodic MSTIDs. The anisotropy observed in the periodic MSTID propagation direction can be explained by the wind filtering mechanism.

S5P04

First Evidence of the Effects of the South Atlantic Magnetic Anomaly on the quiescent reference height of the lower ionosphere D-region.

Magalhães, Antonio A. S. (CRAAM, Brazil) Raulin, Jean-Pierre (CRAAM, Brazil) Macotela, Edith L. (Sodankylä Geophysical Observatory, Finland)

Abstract. We analyse the ionospheric effects of solar flare events over two long and parallel VLF propagation paths between the transmitter NPM (21.4 kHz) at Lualualei, Hawaii, and the receiver stations Punta Lobos (PLO, Peru) and Atibaia (ATI, Brazil). A very remarkable

property is that one of these paths, NPM-ATI, is crossing nearly the center of the South Atlantic Magnetic Anomaly (SAMA). The phase variations of the VLF signals emitted at NPM and recorded at PLO and ATI were compared for fourteen solar events between 2007 March and 2011 September. The results suggest that the lower ionosphere quiescent reference height is different over the PLO-ATI portion of the propagation path, being few kilometers lower than that over the NPM-PLO propagation path. This difference will be discussed as probably due to the presence of the magnetic anomaly over the south american continent.

S5P05

The impact of geomagnetic storm of September 7-8, 2017 on high and mid latitude ionosphere

D. Blagoveshchensky (SUAI, Russia), M. Sergeeva (SCiESMEX/IGUM-UNAM, Mexico)

Abstract. The study was focused on ionospheric parameters variations obtained from vertical (critical and cutoff frequencies) and oblique ionospheric sounding (maximal useful frequency and propagation modes), GPS data (Total Electon Content) and absorption level during geomagnetic disturbance occurred on September 7-8, 2017. Dst, Kp, AE and PC indices were used to describe the disturbance. It consisted of two intense storms with the time interval between their maxima being 13 hours. The Dst-index reached its minimal value of -142 nT and then -122 nT. It was found that these two storms influenced differently on the ionosphere and HF propagation at high- and mid-latitudes at the Western sector of Russia. In particular, the absorption level increased during the first Dst minimum that was not observed for the second Dst minimum. The character of vertical and oblique sounding signals reflected during the first and the second storm showed different features. TEC increased during the first storm and almost was not changed during the second storm.

S5P06

IONOSPHERIC RESPONSE TO THE GEOMAGNETIC DISTURBANCES OF 21 AND 22 JUNE 2015 IN THE SOUTH AMERICAN SECTOR

Eduardo Perez Macho - Universidade Mackenzie Gabriel Campos Damasceno - Universidade Mackenzie Dra. Emília Correia - Universidade Mackenzie

Abstract. The ionospheric behavior during the geomagnetic disturbances of 21 and 22 June 2015 - south hemisphere winter solstice - is analyzed. These disturbances were caused by the arrival of three consecutive Coronal Mass Ejections (CMEs) from the same solar active region; the first two CMEs were caused by filament eruptions, and the third was a much larger full halo CME, associated with a M2.6 solar flare. This study shows the ionospheric response in the South American stations of Fortaleza, (near magnetic equator), Boa Vista (low latitude north), Sao Jose dos Campos (low latitude south), Rio Grande (high latitude south) and Antartica (very high latitude south) using instruments including GNSS receivers and ionosondes. The importance of this study is to understand the variation of the electronic density over this region, particularly over South America Magnetic Anomaly (SAMA), where communication system,

electrical power and navigation satellites might be affected by geomagnetic disturbances. Preliminarily results show that during the first hours of main phase of geomagnetic storm, the prompt penetration electric field (PPEF) was the main driver, intensifying the fountain effect at low latitudes, which increased the electronic density at the crest of Equatorial Ionization Anomaly (EIA).

S5P07

Analysis of systematic ionosphere variations over Mexico based on GPS data.

V.J. Gatica-Acevedo (IPN, Mexico), M. Sergeeva (SCiESMEX/IGUM-UNAM, Mexico), O. Maltseva (IP-SFU, Russia), J.-A. Gonzalez-Esparza (SCiESMEX/IGUM-UNAM, Mexico), M. Sánchez-Meraz (IPN, Mexico)

Abstract. The ionosphere state over the Mexican region was estimated based on data of Total Electron Content (TEC) that is one of the main parameters of the Earth's ionosphere. Data from global ionospheric maps, local networks of GPS stations and GPS receiver installed in the National Polytechnic Institute in Mexico were used for the analysis. Geomagnetic field data (global indices and local magnetometer data) and data from the low-orbit satellites were also used. Diurnal, day-to-day, seasonal and annual systematic TEC variations were revealed as well as TEC dependence on solar activity (represented by F10.7-index) and TEC anomalies. Local TEC variations were compared to TEC obtained from IRI-2012 and NeQuick models. GPS positioning errors were estimated during quiet and disturbed geomagnetic periods. The spatial correlation between TEC values from different local receivers was studied. The cases of low correlation were revealed that proves the diversity of ionospheric effects in the considered region.

S5P08

Response of earthś upper atmosphere to hard X-ray ionization: Investigation with SGR X-ray bursts as ionization impulses

S. Palit (CRAAM/Universidade Presbiteriana Mackenzie, Brazil), and J. -P. Raulin (CRAAM/Universidade Presbiteriana Mackenzie, Brazil)

Abstract. Ionization of earthś atmosphere by celestial and terrestrial sources of radiation is the driver of most of the significant physical and chemical evolution distributed over a large range of timescales. Part of the atmosphere, called ionosphere, owes itś existence to the ionization of neutral molecules by Cosmic ray and solar ultraviolet. Solar flares which are prominent mostly in Extreme ultra violet and soft X-rays modulate the lower part of the ionosphere for few minutes up to few hours. The influence of hard X-ray or gamma rays has been investigated in the context of ionization and after-effects during nuclear bursts. Currently plenty of signatures of hard X-ray and gamma ray effects on the middle and upper atmosphere due to terrestrial gamma ray flashes and celestial sources like, Gamma ray bursts (GRB), Short gamma repeaters (SGR) etc. has been observed. Most of such events are manifested in impulsive ionization of

neutrals and gradual decay due to atmospheric recombination processes. An ionization source-profile in form of delta function in time or a spike is an ideal candidate to investigate the basics of the ion-chemical interactions in the affected part of the atmosphere. Here we investigate numerically the effect of such ionization impulses at various layers of the earthś atmosphere and those on Very low frequency (VLF) radio wave propagation and compare them with VLF observation during X-ray ionization peaks of a SGR-X-ray burst, which roughly represent such delta function or spikes.

S5P09

Gravity Waves studies throughout the atmosphere in the lee of the Southern Andes

D. Janches(GSFC/NASA, USA), D.C. Fritts (Gats, Inc., USA), J.L. Hormaechea (EARG-CONICET, Argentina), B. Kaifler (DLR, Germany), P. D. Pautet (Utah State University, USA), A. de La Torre (Universidad Austral, Argentina), M.J. Taylor (Utah State University, USA), C. Brunini (AGGO-CONICET, Argentina), C. Martinis (Boston University, USA), S. Smith (Boston University, USA), M. Rapp (DLR, Germany), J. Salvador (CEILAP-UNIDEF, MINDEF-CONICET, Argentina) P. Alexander (IFIBA-CONICET, Argentina) P, Llamedo (Universidad Austral and CONICET, Argentina) and R. Hierro (Universidad Austral and CONICET, Argentina)

Abstract. The lee of the Southern Andes and Antarctic Peninsula is one of the largest seasonal Gravity Wave (GW) hot spots on the planet. The lack of observations in this highly dynamical region has been the driver for the operation of the Southern Argentina Agile METeor Radar (SAAMER), at the Estacion Astronomica Rio Grande in Tierra del Fuego (53.7°S, 67.7°W). Since its deployment in May 2008, SAAMER has been providing near-continuous high-resolution measurements of winds and high-frequency GW momentum fluxes of the 75-100 km altitude region. SAAMER's observations have shown this to be a key location to study GWs and their interaction with large-scale motions. Climatology studies collected thus far have shown large eastward GW momentum fluxes during local winter. These are particularly surprising since they cannot be explained by the direct upward propagation of expected large-amplitude mountain waves (MWs) through the eastward stratospheric jet. Instead, these results have been interpreted as secondary GWs propagating away from stratospheric sources over the Andes accompanying MW breaking over the Southern Andes. With the purpose to study in detail these complex processes we have begun in November 2017 a 2 year long international multi-instrumental campaign which will further-expand the measurement capabilities. These will include 1) all-sky airglow imaging performed by Boston University of GW and instability dynamics at the altitudes at which SAAMER measures large-scale dynamics and GWs, 2) new Rayleigh lidar measurements by the German Aerospace Center (DLR) of temperatures from 20-87 km, and 3) an Advanced Mesospheric Temperature Mapper (AMTM) by Utah State University which provides infrared digital imaging system that measures selected emission lines in the mesospheric OH (3,1) band to create intensity and temperature maps of the mesosphere. In this paper we present an overview of results obtained and planned measurements.

S5P10

Gravity Waves studies throughout the atmosphere in the lee of the Southern Andes

D. Janches (GSFC/NASA, USA), D. Fritts (Gats, Inc., USA), J.L. Hormaechea (EARG-UNLP-CONICET, Argentina), B. Kaifler (DLR, Germany), P.D. Pautet (USU, USA), A. de la Torre (Universidad Austral, Argentina), M.J. Taylor (USU, USA), C. Brunini (UNLP-AGGO-CONICET, Argentina), C. Martinis (BU, USA), S. Smith (BU, USA), M. Rapp (DLR, Germany), L. Salvador (OAPA-UNIDEF-CONICET, Argentina), P. Alexander (IFIBA-CONICET, Argentina), P. Llamedo (IFIBA-CONICET, Argentina) and R. Hierro (IFIBA-CONICET, Argentina)

Abstract. The lee of the Southern Andes and Antarctic Peninsula is one of the largest seasonal Gravity Wave (GW) hot spots on the planet. The lack of observations in this highly dynamical region has been the driver for the operation of the Southern Argentina Agile METeor Radar (SAAMER), at the Estacion Astronomica Rio Grande in Tierra del Fuego (53.7°S, 67.7°W). Since its deployment in May 2008, SAAMER has been providing near-continuous high-resolution measurements of winds and high-frequency GW momentum fluxes of the 75-100 km altitude region. SAAMER's observations have shown this to be a key location to study GWs and their interaction with large-scale motions. Climatology studies collected thus far have shown large eastward GW momentum fluxes during local winter. These are particularly surprising since they cannot be explained by the direct upward propagation of expected large-amplitude mountain waves (MWs) through the eastward stratospheric jet. Instead, these results have been interpreted as secondary GWs propagating away from stratospheric sources over the Andes accompanying MW breaking over the Southern Andes. With the purpose to study in detail these complex processes we have begun in November 2017 a 2 year long international multi-instrumental campaign which will further-expand the measurement capabilities. These will include 1) all-sky airglow imaging performed by Boston University of GW and instability dynamics at the altitudes at which SAAMER measures large-scale dynamics and GWs, 2) new Rayleigh lidar measurements by the German Aerospace Center (DLR) of temperatures from 20-90 km, 3) an Advanced Mesospheric Temperature Mapper (AMTM) by Utah State University which provides infrared digital imaging system that measures selected emission lines in the mesospheric OH (3,1) band to create intensity and temperature maps of the mesosphere, and 4) Differential Absorption lidar (DIAL) measurements of temperatures and ozone from 20-55 km at Río Gallegos (51.6S, 69.3W).. In this paper we present an overview of results obtained and planned measurements.

S5P11

Interannual variability on tides from meteor winds at 22.7°S

L. M. Lima (CCT/DF/UEPB, Brazil), L. R. Araújo (UEPB, Brazil), P. P. Batista (INPE, Brazil)

Abstract. Wind measurements from meteor radar obtained between 1999 and 2017 at Cachoeira Paulista (22.7°S, 45.0°W), Brazil, were used to investigate the behaviour of the interannual variability in the 24-, 12- and 8- h tide amplitudes. The results indicate that monthly

meridional amplitudes of diurnal tide are greater during the westerly phase of QBO at 20 hPa. The monthly diurnal tide amplitudes do not show signals of solar cycle effects, instead, the QBO modulation of the diurnal tide amplitude showed a quasi-decadal variation, in which the diurnal tide amplitude modulation by QBO is stronger during solar maximum. The semidiurnal and terdiurnal amplitudes did not shown a relationship with QBO, however, their amplitude tends follow the behavior of the solar flux, in which the amplitudes exceed their averages during solar maximum phase.

S5P12

Analysis of systematic ionosphere variations over Mexico based on GPS data.

V.J. Gatica-Acevedo (IPN, Mexico), M. Sergeeva (SCiESMEX/IGUM-UNAM, Mexico), O. Maltseva (IP-SFU, Russia), J.-A. Gonzalez-Esparza (SCiESMEX/IGUM-UNAM, Mexico), M Sanchez-Meraz (IPN, Mexico).

Abstract. The ionosphere state over the Mexican region was estimated based on data of Total Electron Content (TEC) that is one of the main parameters of the Earth's ionosphere. Data from global ionospheric maps, local networks of GPS stations and GPS receiver installed in the National Polytechnic Institute in Mexico were used for the analysis. Geomagnetic field data (global indices and local magnetometer data) and data from the low-orbit satellites were also used. Diurnal, day-to-day, seasonal and annual systematic TEC variations were revealed as well as TEC dependence on solar activity (represented by F10.7-index) and TEC anomalies. Local TEC variations were compared to TEC obtained from IRI-2012 and NeQuick models. GPS positioning errors were estimated during quiet and disturbed geomagnetic periods. The spatial correlation between TEC values from different local receivers was studied. The cases of low correlation were revealed that proves the diversity of ionospheric effects in the considered region.

S5P13

Climatology and modeling of quiet-time and storm-time ionospheric scintillations and irregularity zonal drifts at the equatorial anomaly crest region

M.T.A.H. Muella (UNIVAP, Brazil), M.H. Duarte-Silva (UNIVAP, Brazil), A.O. Moraes (IAE, Brazil), E.R. de Paula (INPE, Brazil), L.F.C. de Rezende (INPE, Brazil), L. Alfonsi (INGV, Italy), B.J. Affonso (Embraer, Brazil)

Abstract. In this study, the climatology of ionospheric scintillations and zonal drift velocities of scintillation-producing irregularities are depicted for a station located under the southern crest of the equatorial ionization anomaly. Then, the alpha-mu ionospheric fading model is used for the first- and second-order statistical characterization of amplitude scintillations. In the statistical analyzes are used data from single frequency GPS receivers acquired during geomagnetically quiet and disturbed days of 17 years (September, 1997 - November, 2014) of observation at Cachoeira Paulista (22.4 S; 45.0 W), Brazil. The results reveal that the nocturnal

occurrence of scintillations during quiet time follows the seasonal distribution of plasma bubble irregularities observed in the longitudinal sector of eastern South America. In addition to the solar cycle dependence, the results suggest that the occurrence climatology of scintillations is also modulated by the secular variation in the dip latitude of Cachoeira Paulista, since the maximum occurrence of scintillations during the peak of solar cycle 24 was 20

S5P14

Characteristics of Equatorial Plasma bubbles observed by TEC map over South America and numerical simulation of its development

D. Barros (INPE/Brazil), H. Takahashi (INPE/Brazil), C. M. Wrasse (INPE/Brazil), C. A. O. B. Figueiredo (INPE/Brazil), A. J. Carrasco (ULA/Venezuela), Marcos Hideki Inoue Júnior (INPE/Brazil).

Abstract. Ground-based network of GNSS receivers have been used to monitor Equatorial Plasma Bubbles (EPBs) by mapping the Total Electron Content (TEC map). Large coverage of the TEC map allowed us to monitor several EPBs simultaneously and get characteristics of the dynamics, extension and longitudinal distributions of the EPBs from the onset time until their disappearance. These characteristics were obtained by using TEC map analysis and keogram technique by using the data obtained during the period between November/2012 and January/2016. The zonal drift velocities of the EPBs showed a clear latitudinal gradient varying from 123 m/s at the equator to 65 m/s for 35°S of latitude. Consequently, observed EPBs are inclined against the geomagnetic field lines. Both zonal drift velocity and the inclination of the EPBs were compared with the thermospheric neutral wind, which showed a good agreement. Moreover, large coverage of TEC maps permit to study periodic EPBs with a wide longitudinal distance. This averaged values observed for the inter-bubbles distances also presented a clear latitudinal gradient varying from 920 km at the equator to 640 km at 30°S. On several occasions, the distances reached more than 2000 km. Inter-bubbles distances greater than 1000 km have not been reported in literature. Numerical model calculations, using different latitudinal gradients in zonal wind, showed a good agreement with the latitudinal gradient in the EPBs zonal drift observed by TEC map. Comparison of the observational results with the theoretical model calculations confirms that the EPB inclination against the geomagnetic field lines and the latitudinal gradient of inter-bubbles distances were originated due to a latitudinal gradient in the EPBs zonal drift.

S5P15

Reverse ray-tracing to investigate likely sources of gravity waves observed in Brazil.

O. Dare-Idowu (UFCG, Brazil), I. Paulino (UFCG, Brazil), C. M. Wrasse (INPE, Brazil), A. R. Paulino (UEPB, Brazil), R. A. Buriti (UFCG, Brazil), A. F. Medeiros (UFCG, Brazil)

Abstract. A Gravity wave (GW) event was observed using an all-sky airglow at Sao Joao do Cariri (7.4oS, 36.50W). These measurements were obtained on the 08 April 2005 after a total solar eclipse, and the reverse ray-tracing (RRT) was used to track their trajectories leading to the sources of these GWs. The wind database, an input parameter in this technique was estimated using measurements from HWM-93 (0-100km), and TIE-GCM model (100-400km); while the

vertical temperature profiles were obtained using the SABER measurements, NRLMSISE-00 model and TIE-GCM model as supplements at points where experimental data were unavailable. The spectral parameters of this GW were calculated using OI6300 images. The GW propagates 131 degrees from the North, it had a horizontal wavelength of 127 km and an observed period of 14.1 mins. Results from RRT showed that the likely sources of this GWs were in the troposphere-stratosphere, close to part of the eclipse sunshine in the northern part of the South American continent.

S5P16

Determination of the horizontal wind by observing quasi-orthogonal gravity waves

F. Chingarandi (UFCG,BRasil), I. Paulino (UFCG, Brasil), C. M. Wrasse (INPE, Brasil), A. R. Paulino (UFCG), A. F. Medeiros (UFCG), R. A. Buriti (UFCG)

Abstract. Nightglow images from an all-sky imager deployed at Sao Joao do Cariri (7.4 °S, 36.5° W), from January to December 2005 were used to study quasi-orthogonal gravity waves in the OH and OI5557 emissions.These gravity waves occurred simultaneously, propagating with phase fronts almost perpendicular each other. In this period, 135 nights were investigated and 19 such events have already been observed for the year 2005 in the OH emission. The goal of the research estimate the horizontal wind by calculating the parameters of these gravity waves (horizontal and vertical wavelength, propagation direction and observed period) and using Taylor-Goldenstein dispersion relation for gravity waves. Furthermore, comparison with meteor radar wind data will be done in order to check the efficiency of the method. Salient results and discussion will be present in this work.

S5P17

Observation of mesospheric bore in low latitudes over Brazil

E. Ogobor (UFCG,Brazil); I. Paulino (UFCG,Brazil); V. F. Andrioli (INPE,Brazil); R. A. Buriti (UFCG,Brazil); H. Takahashi (INPE,Brazil); A. F. Medeiros (UFCG,Brazil)

Abstract. On October 5, 2007 (1), October 9, 2007 (2), and September 3, 2008 (3), mesospheric fronts were observed over Cachoeira Paulista (23°S, 45°W) using an all-sky airglow imager. Images of OH, Na, O2(0,1) and OI557.7 nm airglow emissions were collected during the nights of observation. The mesospheric bores were found to be rear events as they were only observed thrice within a span of two years. The observed fronts were undular and a non-undular bore with dark fronts only. These suggest the absence of complimentary images which indicate that the bore would be centered below the airglow emission layers as proposed by Dewan and Picard, 1998. The fronts propagated from SW-NE for (1) and NW-SE for (2 & 3), dividing the sky into bright and dark halves. These events could also occur as a result of a sudden change in the normal temperature profile of the atmosphere. As a result of this, the background of the atmosphere was studied using LIDAR data measured at São José dos Campos (23.2°S, 46°W) so as to detect this abrupt change in temperature.

S5P18

Vertical Total Electron Content forecast model over Argentina

D. Pérez Bello (MAGGIA-UNLP/CONICET, Argentina), M.P. Natali (MAGGIA-UNLP/CONICET, Argentina), A. Meza (MAGGIA-UNLP/CONICET, Argentina).

Abstract. Total Electron Content (TEC) is an important parameter for monitoring the behavior of the ionosphere and indeed a magnitude of interest to understand the properties and behavior of the Sun-Earth System. The conditions of this medium, term as spatial meteorology have a direct impact on a growing variety of critical technological infrastructure: telecommunications, electrical power grids, detection systems, tracking, positioning, control of flight vehicles and other systems that use trans-ionospheric signals. The forecast of ionospheric parameters is useful to predict the possible degradation of the performance of these systems for warming purposes. This work presents the simulation of a framework to forecast the Vertical Total Electron Content (vTEC) using GNSS data (Global Navigation Satellite System) and geospheric information. The GNSS observations were processed with the Bernese V5.2 software to obtain a regional vTEC model. The geospheric data such as Solar Flux F10.7, Dst, Kp, among others, were obtained from different repository and processing centers. To perform the vTEC forecast, a Neuro Fuzzy Inference System (NFIS) was implemented, using a 5-layer Neural Network architecture with fuzzy input. The input data in the NFIS model are those that are directly related to the temporal variation of the vTEC and the geospheric information. Different scenarios were proposed. In order to analyze the spatial and temporal performance of the model different scenarios were proposed. Three specific sectors were selected: near the equatorial anomaly, mid-latitude and sub-auroral regions. Finally, different geospheric conditions were analyzed for each sector.

S5P19

An overview of F3 layer occurrence during quiet and disturbed periods

Inez S. Batista (INPE, Brasil), J. R. Souza (INPE, Brasil), M. A. Abdu (INPE, Brasil), A. M. Santos (INPE, Brasil), C. M. N. Candido (INPE, Brasil), L. C. A. Resende (INPE, Brasil), R. de Jesus (INPE, Brasil), R. C. de Araujo (UFRR, Brasil)

Abstract. The F3 layer is a low-latitude phenomenon that occurs under the combined effect of three factors: (1) upward vertical drift (eastward electric field), (2) equatorward meridional wind and (3) the usual photochemical and dynamical processes that form the regular F layer. The F3 layer will be formed at the region where the flux vectors are vertically upward or, in other words, at the region where the combined effect of vertical ExB drift, diffusion along the magnetic field lines and magnetic meridional component of the wind produces a net upward vertical component. Modelling results and satellite observations show that region of occurrence of the layer extends to ±15o dip latitude with the highest occurrences centered at around 7-8 degrees north or south of the magnetic equator, mainly in the summer hemisphere. Ground based measurements using ionosondes have been extensively used to study the occurrence of

the F3 layer and its time evolution in different longitude sectors. Simultaneous measurements at conjugate locations in Brazilian as well as in Asian regions have been used in order to test the various theories about the F3 layer formation. In the present study we review the various theories and measurements and complement them with new observations of the latitudinal variation of the F3 layer in the Brazilian region.

S5P20

A new compact and low cost Langmuir Probe and associated onboard data handling system for CubeSat

P. Muralikrishna, S. Domingos, A.F.P. Horna and Walter A. dos Santos (INPE, Brazil)

Abstract. A new compact and low cost Langmuir Probe and associated onboard data handling system are being developed at Instituto Nacional de Pesquisas Espaciais for launching on board one of the future 2U CubeSat missions. The system is a simplified and compacted version of the Langmuir Probe payloads launched on board several Brazilian SONDA III rockets and also developed for the Brazilian scientific satellites SACI-1 and SACI-2. The onboard data handling system will have the dual functions of preprocessing the data collected by the Langmuir Probe and acting as the interface between the experiment and the on board computer. The Langmuir Probe sensor in the form of two rectangular stainless steel strips of total surface area of approximately 80cm^2 will be deployed soon after the injection of the CubeSat into orbit. A sweep voltage varying linearly from 0V to 3.0V in about 1.5 seconds and then remaining fixed at 3.0V for 1 second will be applied to the LP sensor to obtain both the electron density and electron temperature. A high sensitivity preamplifier will be used to convert the sensor current expected to be in the range of a few nano amperes to a few micro amperes into a varying potential. In order to cover the large dynamic range of the expected sensor current the preamplifier output will be further amplified by a logarithmic amplifier before being sampled and sent to the data handling system. The data handling system is projected to handle 8 analog channels and 4 digital words of 8 bits each. The incoming data will be stored in a RAM and later sent to the on board computer using a serial RS422 communication protocol. The interface unit will process the telecommands received from the on board computer. The interface is also projected to do FFT analysis of the LP sensor data and send the averaged FFT spectral amplitudes in place of the original unprocessed data. The system details are presented here.

S5P21

TEC over a single station studied with PCA

F. Azpilicueta (Facultad de Ciencias Astronómicas y Geofísicas, UNLP-CONICET, La Plata, Argentina). B. Nava (Abdus Salam International Centre del Theoretical Physics, Trieste, Italy)

Abstract. The study long series of the Total Electron Content (TEC) over a single station with the Principal Components Analysis (PCA) technique is relatively new. The usual approach in this studies consists on applying Fourier Transforms, analyzing the dominant frequencies and the subsequent interpretation or association to the physical processes that could be the causes, for example the solar cycle. In this contribution we apply PCA to series of TEC determinations

over a set of GNSS stations. The series consist on daily mean values spanning over more than a 11 year solar cycle and covering all of the periodic geometrical configurations of the Sun - Earth system (annual variation of the distance, annual movement of the sub-solar point, etc.). The results show that the first component alone is enough to explain approximately 90

S5P22

VARIATION OF GEOMAGNETIC FIELD AND TEC AT MID LATITUDES

A. Meza 1,2 and M. P. Natali1,2,3 A. Meza (Laboratorio de Meteorología espacial, Atmósfera terrestre, Geodesia, Geodinámica, diseño de Instrumental y Astrometría (MAGGIA), Facultad de Ciencias Astronómicas y Geofísicas (FCAG), Universidad Nacional de La Plata (UNLP); CONICET, Argentina),M. P. Natali (Laboratorio de Meteorología espacial, Atmósfera terrestre, Geodesia, Geodinámica, diseño de Instrumental y Astrometría (MAGGIA), Facultad de Ciencias Astronómicas y Geofísicas (FCAG), Universidad Nacional de La Plata (UNLP); CONICET, Argentina)

Abstract. Our study is focused on the analysis of the geomagnetic variability of the H and Z components at different local times and at midlatitude during high solar activity. The time geomagnetic field variations can be from scale of seconds to millions of years and they can be periodic or random and its strength can vary from few to thousands of nT. It is divided in two main groups: long and short time variations. The first ones are mainly related with the dynamics of the Earth interior, primarily fluid motion in the core, and are on scale of few years to millions of years. The short time variations come predominantly from an external origin and are produced by currents in ionosphere and magnetosphere and by induced current in Earth's crust and ocean; they are on a scale of seconds up to a year. However these two types of variations could be overlapped particularly on the solar cycle effects and on secular variation impulses, known as jerks. In this work, the data sample were carefully chosen, to isolate certain geomagnetic variabilities characteristic, which are clearly related to primary and secondary current systems of the magnetosphere and the ionospheric region. In this way, the overlap of the events that are not physically orthogonal, is minimized and a numerical technique based on principal component analysis (PCAś technique) will be useful to explain about the causes that produce these variabilities. In order to link these variabilities with the total electron (TEC) content and the thermospheric winds, the same numerical analysis was performed on vTEC obtained from observations of Global Navigation Satellite System network and thermostheric vertical wind from HWM14 model. Some remarkable results are the nighttime variation of the geomagnetic field measure from the ground that show an strong annual variation, with the superposition of a smaller semiannual component, the numerical technique applied over the selected sample, isolate the ring current variability as the main effect. From the Z component, the effect of the F layer currents variabilities could be identify. For midday variations (subtracting the nighttime period) a strong relationship between the TEC variability (spatial and temporal) and the magnetic field was found. The thermospheric wind describe a variability linked to the magnetic field variation . Therefore, In our analysis is clearly observed a remarkable effect of the variability in the conductivity and of the thermospheric wind that causes a current variation that finally induces the variability in the magnetic field.

S5P23

VTEC CLIMATOLOGY AT MIDLATITUDES USING PCA

M.P. NATALI (Laboratorio de Meteorología espacial, Atmósfera terrestre, Geodesia, Geodinámica, diseño de Instrumental y Astrometría (MAGGIA), Facultad de Ciencias Astronómicas y Geofísicas (FCAG), Universidad Nacional de La Plata (UNLP), CONICET) and A.MEZA (Laboratorio de Meteorología espacial, Atmósfera terrestre, Geodesia, Geodinámica, diseño de Instrumental y Astrometría (MAGGIA), Facultad de Ciencias Astronómicas y Geofísicas (FCAG), Universidad Nacional de La Plata (UNLP), CONICET)

Abstract. The effect of the thermospheric vertical neutral wind on vertical total electron content (vTEC) variations including longitudinal anomaly, remaining winter anomaly, mid-latitude summer night anomaly, and semiannual anomaly is studied at mid-latitude regions around zero magnetic declination at midnight during high solar activity. By using the principal component analysis (PCA) numerical technique, this work studies the spatial and temporal variations of the ionosphere at midnight over mid-latitude regions during 2000-2002. PCA is applied to a time series of global vTEC maps produced by: the International Global Navigation Satellite System (GNSS) Service and the International Reference Ionosphere (IRI) 2012. Also, the Horizontal Wind Model 2007 (HWM07) is used to improve our climatology interpretation, by analyzing the relationship between vTEC and thermospheric wind, both quantitatively and qualitatively. At midnight, the behavior of mean vTEC values strongly responds to vertical wind variation the mid-latitude summer night anomaly in South America and Asia regions, and the remnant of the winter anomaly in North America and Oceania regions. Finally, the longitudinal east-west variation is also present. Our results show that at mid-latitudes regions, the IRI model represents midnight ionospheric mean values with a similar spatial distribution, but the values are always lower than those obtained by GNSS. There are also differences between IRI and GNSS in represent the different anomalies.

S5P24

Global Modeling of Ionospheric Outflow

A. Glocer (NASA/GSFC, USA), G. Toth (NASA/GSFC, USA), M.-C. Fok

Abstract. It is well accepted that the ionosphere is a critical source of plasma for the magnetosphere, providing O+, H+, as well as other ions which can have wide ranging consequences for the space environment system. Plasma of ionospheric origin is known to be a dominant contributor to the ring current plasma during storms, and can alter the reconnection. A myriad of mechanisms is frequently invoked to drive ionospheric outflows, including: effects of energetic electron populations, wave particle interactions, and more. This talk will present recent improvements to the Polar Wind Outflow Model (PWOM) to simulate the global outflow solution. The expansion of the model to include kinetic ions based on the hybrid-DSMC approach and hot electron populations will be described along with simulation results examining the competing effects and interplay between different outflow mechanisms in the cusp, aurora, and polar cap. We will also examine the consequences of these processes in terms of supplying plasma to the magnetosphere by coupling the PWOM output to the multifluid MHD variant of the BATS-R-US code.

S5P25

Study of the nighttime lower ionosphere by using VLF signals

J. Samanes (Agencia Espacial del Peru - CONIDA, Peru) J.-P. Raulin (CRAAM, Brazil) J. Cao (Beihang University, China) W. Guevara (Agencia Espacial del Peru - CONIDA, Peru)

Abstract. In this work we study the dynamics of the nighttime lower ionosphere height (hN) by continuously monitoring of VLF signals. We analyze a long-term VLF amplitude narrowband database (almost 8 years) provide by SAVNET. We found that the nighttime lower ionosphere height shows semiannual (SAO) and annual oscillation (AO). Since these large-scale oscillations are also observed in several measurable parameters of the mesosphere-lower thermosphere (MLT) region, our results suggest that the nighttime lower ionosphere can be strongly influenced by the dynamics of the MLT region. We also study the effect of the long-term solar activity on hN, and found that there exists a high negative correlation (R=-0.91). This solar effect was quantified, showing that hN decrease around 1.2 km from low to high solar activity. This result suggests a control of the solar radiation on the nighttime lower ionosphere, and hence, on the electron density at night.

S5P26

Ionospheric response to a recurrent magnetic storm during an event of High Speed Stream in October 2016.

C. Candido (INPE/Brazil) I. Batista (INPE/Brazil) L.Rezende (INPE/Brazil)

Abstract. In this work we investigate the response of the low latitude ionosphere to recurrent geomagnetic activity caused by events of High speed streams (HSSs)/Corotating Interaction Regions (CIRs) during the low descending phase of solar activity in the solar cycle 24. Intense magnetic field regions called Corotating Interaction Regions or CIRs are created by the interaction of fast streams and slow streams ejected by long duration coronal holes in Sun. This interaction leads to an increase in the mean interplanetary magnetic field (IMF) which causes moderate and recurrent geomagnetic activity when interacts with the Earth's magnetosphere. The ionosphere can be affected by these phenomena by several ways, such as an increase (or decrease) of the plasma ionization, intensification of plasma instabilities during post-sunset/post-midnight hours and subsequent development of plasma irregularities/spread-F, as well as occurrence of plasma scintillation. Therefore, we investigate the low latitude ionospheric response during moderate geomagnetic storm associated to an event of High Speed Stream occurred during decreasing phase of solar activity in 2016. An additional ionization increasing is observed in Es layer during the main peak of the geomagnetic storm. We investigate two possible different mechanisms that caused these extras ionization: the role of prompt penetration of interplanetary electric field, IEFEy at equatorial region, and the energetic electrons precipitation on the E and F layers variations. Finally, we used data from Digisondes installed at equatorial region, São Luís, and at conjugate points in Brazilian latitudes, Boa Vista and Cachoeira Paulista. We analyzed the ionospheric parameters such as the critical frequency of F layer, foF2, the F layer peak height, hmF2, the F layer bottomside, h'F, the blanketing

frequency of sporadic layer, fbEs, the virtual height of Es layer h'Es and the top frequency of the Es layer ftEs during this event.

S5P27

Spatial weather and its impact on geophysical studies in the northeast of Mexico

R. López-Montes (CICESE, Mexico) and J. M. Romo-Jones (CICESE, Mexico)

Abstract. The first objective of this work is to present a monitoring dataset of the Total Electron Content (TEC) over the northeast of Mexico, which was computed by using active geodesic networks (CICESE, SSN, INEGI and TLALOCNet). Secondly, this TEC dataset is compared with electromagnetic data registered in continuous in order to (i) gain insights into the mechanisms leading to ionospheric perturbations, and to (ii) understand their impact on geophysical surveys that depend on the electromagnetic field, such as magnetotelluric (MT) and Very Low Frequency (VLF) studies.

S5P28

Global ionospheric and plasmaspheric vTEC maps based on combined GNSS and TOPEX/Jason measurements.

I. Bibbó (FCAG/UNLP, Argentina), C. Brunini (AGGO-CONICET, Argentina)

Abstract. A common distinctive characterization of space weather in the upper terrestrial atmosphere is the Total Electron Content (TEC). GNSS satellites orbiting at altitudes of 20,200 km are widely used to monitor TEC from the ground to the satellite height. They provide slant TEC estimations mainly over the continental region of the planet. In a complementary way, altimetry satellites TOPEX and Jason missions give accurate measurements of the vertical TEC over the oceans in the latitude range $\pm 66^\circ$ from ground up to an altitude of 1,300 km. Combining GNSS and altimetry data provides a unique opportunity to improve the global representation of the electronic content. In this work, an updated version of La Plata Ionospheric Model (LPIM) able to assimilate and combine long GNSS and altimetry data series is presented. For TEC below 1,300 km the model assumes the usual infinitesimal spherical shell at 450 km of height, with a Spherical Harmonic (SH) expansion in the modip-local time system for the global geographic distribution. Spatial and temporal variations in the plasma trapped by closed geomagnetic field lines between 1,300 and 22,000 km are given by Gallagher plasmaspheric model scaled by a constant factor. Also, GNSS satellites and receivers biases and a possible systematic difference between GNSS and altimetry data series are considered. Assuming the invariance of these parameters at n-day intervals, the combined solution is achieved applying a least square fitting algorithm through a stacking of normal equation systems process. SH coefficients, GNSS instrumental biases, plasmaspheric scale factor and the inter-technique bias are estimated. Finally, 2-hourly global ionospheric and plasmapheric vTEC map are obtained. In order to exploit the strength and overcome the weaknesses of each specific data acquisition technique, two different strategies of combination are presented. In the first, altimetry measurements impact exclusively by their contribution over oceanic passes

and accuracy. In the second, different weighting factors are proposed in order to relativize the numerical supremacy and geographic concentration of GNSS data versus altimetry ones. Combining strategies are assessed using an artificial ionosphere simulated with NeQuick model.

S5P29

Stratospheric Temperature Behavior in the Southern Hemisphere

P. Fernández de Campra (FACET-UNT, Argentina), Marta M. Zossi (FACET/UNT-CONICET), Gustavo A. Mansilla (FACET/UNT-CONICET) and Elda M. Zotto (FTyCA-UNCa).

Abstract. Recent research has shown the importance of stratospheric effects over the troposphere. Therefore, the stratosphere could be used as a predictor of climate in the troposphere. Since changes in the stratospheric circulation could be interpreted from the stratospheric temperature trends, the long-term variation of the stratospheric temperature for the period 1979 - 2016 was analyzed in this work. Monthly average temperature of the Southern Hemisphere, between 10hPa and 100 hPa, of the NCEP/NCAR reanalysis data set was used. A similar behavior was observed from 30 hPa and 100 hPa temperatures, showing the influence of El Chichón and Pinatubo eruptions. In all analyzed heights, the temperature decreases during the period studied, with trend values between 0.5 and 1.1 K/decade. If we consider the period from the year 2000, the year in which ozone recovery begins, the negative trend remains at 10 hPa, and a significant positive trend is observed only at 100 hPa, of the order of 0.12 K/decade. When analyzing the seasonal variation (DJF, MAM, JJA and SON) it is observed that SON shows the greatest negative trend for the different heights. The results are compared with others obtained by models and observations

S5P30

Electron density at 600 km of altitude. Measurements and NeQuick2 predictions

J.M.Lopez (CIASUR/UTN,Argentina),G.E.Lescano (CIASUR/UTN,Argentina), R.G.Ezquer (CIASUR/UTN-CONICET-Lab.Ionosfera/UNT,Argentina),M.R.Albornoz (CIASUR/UTN,Argentina),Y.Mig Orue (ICTP, Italy), B.Nava (ICTP, Italy), M.A.Cabrera (CIASUR/UTN - Lab.Teleco./UNT,Argentina)

Abstract. In the present work the performance of the ionospheric model NeQuick2 to predict the values of free electron density (Ne) at 600 km of height, in a period of high solar activity and for the geomagnetic latitudes -15 °, 0 ° and + 15 ° , which correspond to the fringe of the equatorial anomaly, has been analyzed. The predictions of the model were compared with data of measurements of Ne, obtained by the Japanese satellite Hinotori from February of 1981 to June of 1982. The experimental data were downloaded of: `https://cohoweb.gsfc.nasa.gov/ftpbrowser/ae_hinotori.html` Only records with values of F10.7 between 63 and 193 were considered to follow recommendations of the ITU included in the NeQuick2 model, which left a total of more than 450 thousand records to analyze. Then, predictions of Ne with Nequick2 were calculated, under the same conditions in which the data were measured. The measurements and predictions of Ne, were separated into four groups corresponding to the Solstice of June, December Solstice, March Equinox and September Equinox.

In each case, the median of Ne was calculated for each hour in Local Time, for the three latitudes, regardless of its geographical length. In the obtained graphs the presence of peaks in the area of the equatorial anomaly is not observed, which is expected for Ne values at the considered height (600Km). The results obtained show that, in general, for minimum ionization hours, the model gives good predictions, while for the period ranging from 10 LT to 20 LT, it underestimates the value of Ne; except in the case of the Equinox of September in geomagnetic latitude -15 °, when it overestimates from 10 LT to 16 LT. The best performance of the model is observed for the June solstice, and especially at -15 ° of geomagnetic latitude. For daytime values, underestimations of approximately 40% are observed. The results obtained in this work suggest the need of additional studies that lead to a better representation of the Ne topside profile given by the model.

S5P31

An alternative TEC map tool for the ionospheric investigation over the Latin America region.

C.B.A. Oliveira (ITA,Brazil), M.A. Abdu (INPE,Brazil), A.O. Moraes (IAE,Brazil), J. Sousasantos (INPE,Brasil)

Abstract. The Total Electron Content (TEC) of the ionosphere has been widely used by the scientific community to study the phenomenology and the behavior of the ionospheric plasma under different scenarios. In the equatorial and low latitude region, TEC maps have allowed the development techniques to investigate the spatial and temporal distribution of the depleted plasma structures characterized as equatorial plasma bubbles. Majority of the tools currently used to generate TEC maps have been developed for northern hemispheric regions of Asian, European and American sectors, where rather dense spatial coverage of GPS/GNSS receivers are available, and therefore assumption of a uniform distribution of TEC values are justifiable. These tools can present some deficiencies when used for the Latin American region where the spatial coverage of the receivers continues to be considerably more sparse. In this work, an alternative approach for the generation of TEC maps has been developed by the authors. This approach uses the real spatial distribution of the GPS receivers in Latin America and, consequently, the assumption that the TEC values have a uniform spatial distribution is not needed for the purpose of this investigation. Additionally, this alternative tool is used to process the TEC maps information in order to generate keograms which allow a better visualization of the temporal evolution of the dynamic characteristics of the plasma bubble structures. A comparison between the results from this alternative tool and TEC maps generated through other available methodologies is also presented. Furthermore, the keograms are evaluated in association with zonal plasma drift from Digisonde and ionospheric scintillation data. These results reveal some appreciable improvements in the description of TEC map over Latin American region, which is helpful for space weather and telecommunication communities in the understanding of the phenomenology over this region.

S5P32

Searching solar effects on the precipitation over a Northwestern Argentina location

C. A. Padula Villagra (INFINOA/UNT, Argentina) T. Heredia (INFINOA/UNT, Argentina) R. G. Ciocono (CICPBA (prov. de Bs. Aires) y Grupo de Estudios Ambientales UTN, Argentina) F. Bazzano (FACET/UNT-CONICET, Argentina) A. G. Elias (INFINOA/UNT-CONICET, Argentina)

Abstract. The long-term behavior of precipitation over Tucuman (26.8° S; 65.2° W), a location in the Northwestern region of Argentina, is analyzed in the present work in search of a plausible association with solar effects, with the purpose of contributing to the controversial issue on the connection between climate variation and anthropogenic vs. natural forcing. Due to the nature of the processes that lead to precipitation, the discernment between solar and anthropogenic effects, and the link between precipitation and a solar forcing are highly complex and hard to detect. Based on quasi-periodicities detected in climate parameters not linked to evident solar irradiance cycles, we expand our study including another effect which has been considered in the dynamics of large rivers as -the planetary hypothesis of the solar cycles-, which supposes that the barycentric dynamics of the Sun could be involved in modulations of the solar cycles. Thus, we present a preliminary statistical analysis of correlation, cross spectrum, and coherence between a precipitation time series and solar orbital parameters.

S5P33

The effects of geomagnetic storm occurred in April of 2000 on the polar and equatorial ionosphere

Hadassa Raquel Peixoto Jácome (UFRN, Brazil) Elio Pessoa Cazuza (UFRN, Brazil) Manilo Soares Marques (UFRN, Brazil) Gilvan Luiz Borba (UFRN, Brazil)

Abstract. Disturbances in the magnetosphere, caused by intense solar events, can affect the ionosphere, which is an important region of the atmosphere to the propagation and reflexion of electromagnetic waves. In this work, we have identified an extreme geomagnetic storm that occurred on April 6, 2000 using the Dst, Kp, AU, AL and AE indexes and interplanetary plasma parameters. We also have studied its effects on the polar and equatorial ionosphere through the auroral images and digisonde data in the equatorial region. Thus, it was possible to observe an intensification of the auroral eletroject by the injection of particles in the cusps and also an anomalous behaviour of the equatorial ionosphere, that characterized the propagation of a Large-Scale Travelling Ionospheric Disturbances (LSTIDs), probably generated by the propagation of disturbed winds toward the equator.

S5P34

Observation of the lunar tide in the ionosphere over Brazil

Paulino, A. R.[1,2]; Brown,V. T. [1]; Fernades, J. [2]; Lima, L. M.[1]; Batista, P. P.[3]; Batista, I. S. [3] [1] Universidade Estadual da Paraíba, Av. Baraúnas, 351, Bairro Universitário, Campina Grande, PB - CEP: 58429-500; [2] Universidade Federal de Campina Grande, R. Aprígio Veloso,

882, Bairro Universitário, Campina Grande, PB - CEP: 97105-970. [3] Instituto Nacional de Pesquisas Espaciais, Av. dos Astronautas, 1758, Jd. Granja, São José dos Campos, SP - CEP: 12227-010.

Abstract. The atmospheric lunar tide is excited by gravitational action in the lower atmosphere and by the movement of the oceans and Earth's surface. Due to the fact that the source of the lunar tide does not change, the determination of this oscillation in the ionosphere is an excellent tool for understanding the coupling mechanism between the neutral and ionized atmospheres. The lunar tide has been studied in the mesosphere-thermosphere-ionosphere in different longitudinal sectors and using different observational techniques and simulations. However, there are some aspects of lunar tide that still need explanation, for example, the temporal variability of this oscillation. So, in this work, the diurnal and semidiurnal lunar tides are investigated in the ionosphere using ionosonde data over Brazil. The ionosonde measurements were collected at Cachoeira Paulista (22.7° S; 45.0° W) and São Luis (2.6° S; 44° W) from 2001 to 2009 with a temporal resolution of 15 minutes. Using these data, it was possible to extract the characteristics of the lunar tide. Salient features of this oscillation are presented and discussed in this work. For instance, the semidiurnal lunar tide is dominant comparing to the diurnal tide and had amplitude of 0.6 MHz in foF2 and 7 km in hmF2.

S5P35

Ionospheric conductivity height profile and conductance spatial distribution changes due to Earth magnetic field variations

Bruno S. Zossi (1,2) and Ana G. Elias (1,2) (1) Laboratorio de Fisica de la Atmosfera, INFINOA (CONICET-UNT), Facultad de Ciencias Exactas y Tecnologia, Universidad Nacional de Tucuman, Av. Independencia 1800, 4000 Tucuman, Argentina (2) Consejo Nacional de Investigaciones Cientificas y Tecnicas, CONICET, Argentina

Abstract. The ionospheric conductivity is extremely important in geophysical processes and plays a critical role in magnetosphere-ionosphere-thermosphere coupling processes. The upper atmosphere electrodynamics depends on many parameters, including the Earth's magnetic field, which varies greatly with time. The present field can be approximated by a magnetic dipole that accounts for 80% of the magnetic field of the Earth's surface, plus multipolar components making up the remaining 20%. During a polarity transition the field magnitude diminishes to about 10% of its actual value at expense, most likely, of decreasing the dipolar component and becoming mostly multipolar in nature. The effects of geomagnetic field variations on height profile of Hall and Pedersen conductivities and dominant conducting ions are analyzed in the present work, extrapolating the magnetic field to a possible reversal scenario. Significant changes are observed in these profiles with noticeable increasing peak heights under certain conditions. During the actual magnetic field configuration, conductivities' peak height occurs within 100-150 km range, the main conducting ion is NO+. For a decreased field configuration, conductivities maximize at higher levels, reaching 200 km and higher, where 80% of the ions are O+. Hall and Pedersen conductances' spatial structure is also analyzed. Both conductances change significantly with sharp spatial gradients as a consequence of an overall hyperbolic dependence of conductances with magnetic field.

S5P36

STUDY OF THE EFFECTS ON THE GEOMAGNETIC FIELD DURING THE MAULE TSUNAMI USING FOUR SPATIOTEMPORAL METHODS

Klausner, V (UNIVAP, Brazil); Kherani, A. E. (INPE, Brazil); Ojeda-González (UNIVAP, Brazil), A.; Prestes, A. (UNIVAP, Brazil)

Abstract. In this work, we focused on the survey of tsunamigenic variations in the vertical component (Z) and in the horizontal component (H) of the geomagnetic field using four spatiotemporal methods. Magnetic disturbances originated from ionospheric currents contain both horizontal and vertical components, however the vertical component is dominant in tsunamigenic magnetic signals observed on land. In this way, one can distinguish the former from the latter, and vice-verse. Here, we selected nine magnetic observatories that were influenced or more directly affected by the Maule (2010) tsunami event, which occurred during a very geomagnetically quiet period, i.e., without external influences. The continuous and discrete wavelet techniques have been used to identify the tsunamigenic magnetic disturbances, and together with the travel-time diagram (TTD) and mean absolute percentage error (MAPE) maps, these found tsunamigenic disturbances have been validated. These disturbances are found to have contributions from both oceanic and thermospheric currents which are arising from the tsunami forcing. The amplified N-shaped disturbances occurring instantly and with the time delay of 10-50 minutes from the tsunami arrival are attributed to be of the oceanic current and thermospheric current origin, respectively. These results suggest that these both kinds of tsunamigenic magnetic disturbances can be well-identified for the four spatiotemporal methods used here.

S5P37

Araucaria growth response to solar and climate variability in southern Brazil

A. Prestes (UNIVAP, Brazil), I. Rojahn da Silva (UNIVAP, Brazil), C. Lorensi (UNIVAP, Brazil), V. Klausner (UNIVAP, Brazil), and A. Ojeda-Gonzalez (UNIVAP, Brazil)

Abstract. In this work, the Sun-Earth-climate relationship is studiedusing tree growth rings of Araucaria angustifolia (Bertol.) O. Kuntze, which were collected in Passo Fundo, Rio Grandedo Sul (RS) State, Brazil. From these araucarias, it is obtained the chronology average series for 263 years, and the classical method of spectral analysis by iterative regression and cross-wavelet method is applied to find periodicities and trends present in the tree growth, sunspot number, El-Nino Southern Oscillation (ENSO), and annual mean temperature anomaly between the latitude 24°S to 44°S. The time series analysis of the tree growth ring thicknesses indicates periodicities related to the solar activity corresponding to Schwabe(∼11 yr), Hale (∼22 yr),4th de Suess (∼55 yr) and Gleissberg (∼80 yr) cycles. All these periodicities are derived with a significance level up to 95%. The average chronology obtained at Passo Fundo shows that the periods of 6.6 and 35years are the beating results of the periods between 11 and 16.2 years. In

the same way, the periods of 17.5 and 33.5 years may also be a resonance mode result from the beating of 23 and 73.1 years. This fact may show a possible influence of the solar activity in the tree growth in the recent past. Here, we also find periods between 2 and 7 years possibly related to the El-Nino events, and a ∼23 years period related to temperature variation. These results may represent the tree response to local climatic conditions during its respective lifetime, and to non-linear coupling between the Sun and the internal climate variability responsible to the regional climatic variations.

S5P38

COMPARISON BETWEEN DIFFERENT TEC CALCULATION TECHNIQUES TO CHARACTERIZE THE IONOSPHERE IN THE BRAZILIAN SECTOR

C. S. Carmo (INPE, Brazil), F. Becker-Guedes (INPE, Brazil), P. O. Camargo (UNESP-PP, Brazil), J. F. G. Monico (UNESP-PP, Brazil).

Abstract. The Total Electron Content (TEC) of the ionosphere can be calculated by parameters observed by GPS receivers located in the ground. As a result of the differential phase and group calculation, the non-dispersive terms are canceled, leaving terms due to biases of the satellites and the receiver together with the ionospheric error contribution to the signal. The slant TEC (STEC) corresponds to an arc of TEC for each satellite measured by a given receiver. The combination of the various STECs observed by a receiver using selected methods and mapping functions results in a vertical TEC (VTEC) over the ground station. In this work, the performance of three different VTEC calculation techniques, each one using their own methods to eliminate biases and to obtain VTEC from STECs, is evaluated to describe the ionosphere conditions in the equatorial and low latitude regions in the Brazilian sector. I order to do this, data from a station in the equatorial region, Sao Luis, and a station in the southern crest of the Equatorial Ionization Anomaly (EIA), Cachoeira Paulista, were used. The study was made for a period of minimum solar activity (November 2008 to October 2009) and one of maximum solar activity (November 2014 to October 2015) and the seasonality of TEC along the year was also studied. The three techniques used are: (I) the technique developed by the University of Nagoya, Japan, and adjusted at the National Institute of Space Research (INPE), Brazil, to be used by the Brazilian Space Weather Program (EMBRACE), (II) a technique developed at Boston College, USA, and (III) the method proposed by the International Centre for Theoretical Physics (ICTP), Italy. The evaluation of the TEC curves obtained showed that all three techniques present results consistent with each other but with some small divergences in certain periods. The three techniques show the significant reduction of the TEC in the period of minimum solar activity and during the winter in any condition of solar activity. All techniques showed an increase in TEC at the station under the crest of the EIA in the summer and during the equinoxes due to the intensification of the fountain effect during the day and the pre-reversion peak at the sunset. The large discrepancies between the results obtained by the three techniques were observed during the beginning of the night hours due to the presence of ionospheric irregularities. The method used in INPE responds well to the daily, seasonal and solar cycle variations of the TEC, presenting, on several occasions, intermediate results with respect to the other techniques in the Brazilian region, showing to be suitable to be used by

EMBRACE program to monitoring this region.

S5P39

Analysis of the Effect of Electron Density Perturbations Generated by Gravity Waves on HF Communication Links

Mariano Fagre(CONICET-Laboratorio de Telecomunicaciones FACET-UNT, Argentina), Ana G. Elías(Laboratorio de Fisica de la Atmosfera -INFINOA (CONICET-UNT) FACET-UNT, Argentina), Jaroslav Chum(Institute of Atmospheric Physics, Prague, Czech Republic).

Abstract. In the present work, ray tracing of high frequency (HF) signals in ionospheric disturbed conditions is analyzed, particularly in the presence of electron density perturbations generated by gravity waves (GWs). The three-dimensional numerical ray tracing code by Jones and Stephenson, based on Hamilton's equations, which is commonly used to study radio propagation through the ionosphere, is used. An electron density perturbation model is implemented to this code based upon the consideration of atmospheric GWs generated at a height of 150 km in the thermosphere and propagating up into the ionosphere. The motion of the neutral gas at these altitudes induces disturbances in the background plasma which affects HF signals propagation. To obtain a realistic model of GWs in order to analyze the propagation and dispersion characteristics, a GW ray tracing method with kinematic viscosity and thermal diffusivity was applied. The IRI-2012, HMW14 and NRLMSISE-00 models were incorporated to assess electron density, wind velocities, neutral temperature and total mass density needed for the ray tracing codes. Preliminary results of gravity wave effects on ground range and reflection height are presented for low-mid latitude ionosphere.

S5P40

Quiet Day Curve (QDC) analysis using detectability of radar signals applied to Embrace Magnetometer data

D. D. Moraes (CRS/COCRE/INPE & UFSM, Brazil), J. Moro (CRS/ COCRE/INPE & NSSC/CAS, Brazil-China), C. M. Denardini (Embrace/INPE, Brazil), L. C. A. Resende (Embrace /INPE, Brazil), S. S. Chen (DIDAE/INPE, Brazil), A. V. Bilibio (DIDAE/INPE, Brazil), T. O. Bertollotto (DIDAE/INPE & UNITAU, Brazil), G. A. S. Picanço (DIDAE/INPE, Brazil), P. F. Barbosa Neto (Embrace/INPE, Brazil), P. A. B. Nogueira (IFSP, Brazil), N. J. Schuch (CRS/COCRE/INPE, Brazil)

Abstract. For accurate determination of the influence of the Solar quiet (Sq) Earth's magnetic field and its seasonal variation in magnetic measurements, high-quality and reliable Quiet Day Curve (QDC) is essential since it is the baseline from which the magnetic indices obtained from Magnetometer data are derived. In this work, we present a statistical analysis of the QDCs estimated from data acquired by the Embrace Magnetometer installed at the Southern Space Observatory (SSO/CRS/COCRE/INPE-MCTIC, 29° S, 53° W), São Martinho da Serra - Brazil. This region is characterized by the minimum intensity of the geomagnetic field due to the presence of the South American Magnetic Anomaly (SAMA). The analysis is based on algorithms traditionally used to process radar signals, which take in account statistical methods.

Therefore, we present the preliminary results of monthly QDCs for the period of June 2015 to July 2016 regarding the study of its seasonal characteristics.

S5P41

On the effects of the Earth's magnetic field variation over ionospheric Cowling conductivity

Álvaro T. Concha Álvarez Prado (LAFIAT-INFINOA/UNT, Argentina), Bruno Zossi (LAFIAT-INFINOA/UNT-CONICET, Argentina), Mariano Fagre (Laboratorio de Telecomunicaciones/UNT-CONICET), Blas F. de Haro Barbas (LAFIAT-INFINOA/UNT, Argentina), Ana G. Elias (LAFIAT-INFINOA/UNT-CONICET, Argentina)

The equatorial region is characterized by nearly horizontal magnetic field lines and maximum sun's ionizing radiation. In this region, above the dip equator a high current density flows during daytime hours called the equatorial electrojet (EEJ). The effective conductivity of the EEJ is the Cowling conductivity which depends, among other variables, on the Earth's magnetic field intensity. This field presents long-term variations with changes in strength and orientation. Particularly, changes in strength should affect the conductivity values and height profile, and orientation changes may affect the EEJ location. The effects of the geomagnetic field secular variations on the intensity and height profile of the Cowling conductivity are analyzed in the present work. In general, the conductivity of the ionosphere is extremely important in geophysical processes and understanding its nature is essential to understand the physics of ionospheric electrodynamics.

S5P42

Medium-Scale Gravity Waves observed in the airglow over Cachoeira Paulista.

A. V. Bilibio (DIDAE/INPE, Brazil); C. M. Wrasse (Embrace/INPE, Brazil); C. A. Figueiredo (DIDAE/INPE, Brazil); N. J. Schuch (CRS/INPE, Brazil); I. Paulino (UFCG, Brazil); H. K. Takahashi (DIDAE /INPE, Brazil).

Abstract. Medium-scale gravity waves were observed in the mesosphere and lower thermosphere region between 1998 and 2013 at the Observatory of Cachoeira Paulista, SP, (22.4ºS; 45.0ºO). Images obtained from OH and OI (557.7 nm) airglow emissions were used to investigate the wave characteristics, using the keograma technique. The results showed that 142 gravity wave events observed in the airglow emission have the following characteristics: horizontal wavelength between 50 and 500 km, observed period between 20 and 80 minutes, phase velocity between 40 and 100 m/s. Medium-scale gravity wave propagation directions were analyzed for each season of the year and presented the following propagation characteristics: summer propagation to Northeast and Southeast, autumn mainly propagation to Northwest, winter showed a quasi-isotropic propagation and during spring the waves propagated to Northeast and Southeast. A comparison of the propagation directions between small and medium scale gravity wave was also performed. The mainly propagation directions of small and medium-scale gravity waves are similar for each season of the year. This may indicate that the possible wave

sources of medium-scale gravity wave may be related to the same meteorological phenomena that generate small-scale gravity waves over Cachoeira Paulista, such as frontal systems and convective systems.

S5P43

Occurrence and Simulation of Sporadic E Layers near the Equatorial Ionization and South Atlantic Magnetic Anomalies

F.C. Santos (UNIVAP, Brazil), M.T.A.H. Muella (UNIVAP, Brazil), L.C.A. Resende (INPE, Brazil), P.R. Fagundes (UNIVAP, Brazil), V.F. Andrioli (INPE, Brazil), P.P. Batista (INPE, Brazil), V.G. Pillat (UNIVAP, Brazil), A.A. Carrasco (ULA, Venezuela)

Abstract. An analysis of the sporadic E layers (Es) in the Brazilian sector has been carried out using data recorded by digital ionosondes installed at São José dos Campos (23.21S, 45.86W, dip angle: -37.07, dip latitude: 20.69S), and Jataí (17.9S, 51.7W, dip angle: -25.16, dip latitude: 13.21S). In this study, statistical survey of the types of Es layers at latitudes of the Equatorial Ionization (EIA) and South Atlantic Magnetic (SAMA) anomalies were obtained during the months that represent different seasonal periods (April, June, September and December of 2016). The results revealed the manifestation of four different types of Es layers (flat/low, cusp, high and slant), in which the flat/low type was the most frequent over both stations. In order to investigate the main mechanisms acting to the generation of the Es layers, we used the Ionospheric Model of the E Region (MIRE). Tidal winds parameters estimated from Meteor Radar observations at Cachoeira Paulista (22.42S, 45.0W, dip angle: -36.98, dip latitude: 20.63S) are used as input to the MIRE model aiming to investigate tidal waves influence in the formation of these Es layers. The vertical profiles of ionospheric plasma density estimated by the MIRE are compared with the electron density obtained using the blanketing frequency parameter (fbEs) deduced from ionograms registered in the analyzed regions. In general, the results show that the values computed by the MIRE are in good agreement with the observational data for the Es layers, in which it is confirmed that the Es layers formed near both anomalies have a strong influence of the wind shear mechanism.

S5P44

Study about the Downward Movement of Sporadic E Layers using a Theoretical Model around the Equatorial Ionization Anomaly

F.C. Santos (UNIVAP, Brazil), L.C.A. Resende (INPE, Brazil), M.T.A.H. Muella (UNIVAP, Brazil), P.R. Fagundes (UNIVAP, Brazil), A.A. Carrasco (ULA, Venezuela)

Abstract. Sporadic E layer (Es) refers to narrow ionization enhancements of the ionospheric plasma with thickness less than 5 km occurring in heights from 90 to 150 km. At equatorial and low latitude regions, Es layers cause a scattering of radio waves at HF frequencies. Thus, their detection and occurrence characteristics can be analyzed from ionosonde observations. The Es layers are classified in several types in relation to the formation mechanism according to the region of the globe where they are detected. At low and middle latitudes, the Es layer formation depends essentially on the vertical wind shear associated with the tidal winds. In

several data for Brazilian region, it was observed the h type Es with downward movement until lower altitudes. This behavior for the low latitude is still not everything known. Therefore, in this work, we used the Ionospheric Model of the E Region (MIRE) with the purpose to identify the atmospheric physic dynamics of the Es layer movement at latitudes around the Equatorial Ionization Anomaly in the Brazilian sector. The new results about the simulations and data will allow explaining the semidiurnal and diurnal periodicity that characterizes the Es layer downward motion.

S5P45

Possible limits on detectable ionospheric disturbances induced by seismic activities in South America

S. A. Sánchez (INPE, Brazil), E. Alam Kherani (INPE, Brazil), F. C. De Meneses (INPE, Brazil), E. R. de Paula (INPE, Brazil), and V. Klausner (UNIVAP, Brazil)

Abstract. Space weather and meteorological events, besides anthropogenic sources, remain as the main causes of ionospheric perturbations. Following large displacements of Earthś surface caused by Earthquakes, the ionosphere can also be disturbed in face of Lithosphere-Atmosphere-Ionosphere (LAI) Coupling. Using spectral analysis techniques applied to ground-based aeronomic measurements, we particularly investigate possible responses of the ionosphere to recent seismic events occurred in the Pacific coast of South America, seeking correlations between the range of detectable disturbances from the epicenter, classes of magnitudes, and even depths of focus. The results found here can be potentially adopted for improving knowledge of the LAI coupling mechanisms using simulation.

S5P46

Long-term temperature trends in the 35-65 km range by Rayleigh Lidar measurements at 23 S from 1993 to 2016 and comparison with SABER from 2004 to 2016

Paulo Prado Batista (Instituto Nacional de Pesquisas Espaciais(INPE)/Brazil), Ana Roberta Silva Paulino (Universidade Estadual da Paraíba(UEPB)/Brazil), Barclay Robert Clemesha (INPE/Brazil (Retired)), Dale Martin Simonich (INPE/Brazil (Retired)) Instituto Nacional de Pesquisas Espaciais (Retired)

Abstract. A Lidar tuned to sodium resonance line at 589 nm has been operated at São José dos Campos, Brazil (23°S, 46° W) since 1993 processing the Rayleigh signal from which the temperatures from 35 to 65 km are retrieved in a nightly mean basis. In order to remove tidal effects only profiles obtained from 18:30 LT to 23:30 LT were considered in this analysis. We used these nightly profiles to determine the monthly temperature profiles from April 1993 to September 2016. A model including solar cycle, southern oscillation index, QBO, Annual and Semiannual oscillations and Linear trends has been fitted to the monthly temperatures every 3 km from 36 to 63 km. Variable linear trends with altitudes are determined with a maximum negative trends at 54-55 km attaining 3.15 K/decade. We also have separated data from 1993-to 2003 and 2004-to 2016 and compared the last with SABER temperature data for

the same altitude range and for the same place.

S5P47

Phase and amplitude GPS/GLONASS scintillation in Siberia region

Yu. Yasyukevich (ISTP SB RAS, Russia; ISU, Russia) , S. Syrovatski (ISU, Russia), A. Vesnin (ISTP SB RAS, Russia; ISU, Russia), D. Zatolokin (ISTP SB RAS, Russia), V. Demyanov (ISTP SB RAS, Russia; ISTU, Russia), M. Sergeeva (SCiESMEX/IGUM-UNAM, Mexico)

Abstract. In the Earthś ionosphere there are always highly dynamic, non-stationary electron density structures of various scales. The ionospheric irregularities with order size of the first Fresnel zone cause rapid random changes in the amplitude and phase of the signal passing through them. Such an effect is called ionospheric scintillation (amplitude and phase). In the present work, examples of observation of amplitude ionospheric scintillations at mid-latitude station are presented. We used NOVATEL GPSTation-6 receiver. The measurements were carried out during 2006 for GPS systems (at frequencies L1, L2, L5) and GLONASS (at frequencies L1, L2). We found that at mid-latitudes there are almost no intense amplitude scintillations even for strong magnetic storms. At the same time, a number of cases of strong scintillations (S4 1) were recorded during quiet geomagnetic conditions. We found unexpected significant differences in the occurrence of intense amplitude L1 scintillation of GLONASS and GPS. In GPS data, several hundred events with S4¿ 0.7 values were detected, while only about 10 for GLONASS. The study was supported by the Russian Foundation for Basic Research (project N 15-05-03946).

S5P48

Start-up and calibration of atmospheric electric field monitoring equipment and first data analysis

F. Monterde(IGeof/UNAM,México)

Abstract. The objective of this work was the reinstallation of the Boltek EFM-100 equipment, a device capable of monitoring and detecting variations in the intensity of atmospheric electric fields. This detector was succesfully rebooted through a calibration process, so that a new stable and reliable database is available for scientific research. The first usage of this data will be aimed towards the development of studies related to the atmospheric variations of the cosmic rays secondary component that reach the detectors at ground level. In addition, the records can also be used in atmospheric sciences and statistics analysis.

S5P49

Geospheric pulsations during moderate Seismic activities

E.A. Kherani (Instituto Nacional de Pesquisas Espaciais (INPE), Brasil) V. Klausner, (Universidade do Vale do Paraiba (UNIVAP), Brasil)

Abstract. Geosphere, that consists of Earthś interior and exterior namely Lithosphere, Biosphere, Atmosphere and Ionosphere, is most closely connected environment to the human life. Lithosphere hosts seismic hazards such as Earthquakes/Tsunamis that have devastating influences on life on the planet. Interestingly, their effects are not just limited to the biosphere but extended beyond into the atmosphere upto the 300 km heights, the region where ionosphere is located. In fact, in this region, the effects are amplified by 3-4 order owing to the Atmospheric waves excited by seismic activities. This whole phenomenon is called as Seismic weather, drawing analogy from the convective weather or space weather. In the present work, few seismic weather studies related to moderate Earthquakes (with magnitudes between 4.5-5.5) over South America are performed. The seismogenic ionospheric pulsations are searched in the ionospheric density and currents, from the electron density and magnetic field measurements, using GPS receivers and magnetometers. Objective is to develop the data analysis tools to forecast the strong earthquakes that come after the series of moderate earthquakes.

S5P50

Multi-scale ionospheric irregularities occurrence over South America during the St. PatrickŽs Storm on March 17, 2015

Fagundes PR(UNIVAP, BraziL), Barbosa FRE(IFTO and UNIVAP, Brazil), Venkatesh K(UNIVAP, BraziL), Pillat VG(UNIVAP, BraziL), Denardini CM (INPE, Brazil) and Muella MTAH(UNIVAP, BraziL)

Abstract. During the solar cycle 24 there was a very intense geomagnetic storm called the St. PatrickŽs Day storm and the effects of this storm on ionosphere has become a topic of extensive space weather investigation. Up to now several aspects of the St. PatrickŽs ionospheric storm have been study such as the prompt penetration electric fields (PPEFs), GPS-TEC changes, electron density disturbances, plasma drift, O+ concentration modification, hemispherical asymmetry developments, equatorial ionization anomaly (EIA) modification, and ionospheric irregularities. Besides all these important studies, there are some essential aspects, which have not been addressed yet, related to the occurrence of multi-scale ionospheric irregularities. In this paper, we present and discuss the generation and suppression of multi-scale ionospheric irregularities, using the observations conducted in the Latin American Sector from 4 ionosondes (ESF) and 20 GPS-TEC stations (ROT phase fluctuation) observations during the month of March 2015, which includes the St. PatrickŽs Day geomagnetic storm period. Suppression of large-small scales ionospheric irregularities has occurred during the main and second night of the recovery phases. However, during the first night of recovery phase there was post-midnight ionospheric irregularities.

S5P51

Variability of foF2 in Tucumán for high and low solar activity and comparison with the IRI-2016 model

G. González (UNT-CONICET, Argentina) J. López (FRT-UTN, Argentina)

Abstract. In this work, the variability of foF2 in Tucumán (26.9 ° S, 294.6 ° E, lat Geomagnetic 15.5 ° S) is study for a year of low solar activity (2009) and one of high solar activity (2016). The data was measured with the ionosonde AIS-INGV and the parameters used in the analysis are median, upper and lower quartiles. In addition, the foF2 values are compared with those estimated by the International Reference Ionosphere (IRI) - 2016 model. It is found that: a) the average value of foF2 is higher for high solar activity, b) the variability is greater during low solar activity than during high solar activity and c) the variability is greater during the night than during the day. d) In general, between 5 LT and 16 LT, IRI-2016 overestimates foF2 for both high and low solar activity.

S5P52

Ionospheric TECclimatology over the Latin America

E. Romero-Hernandez(FCFM/UANL, Mexico), C.M. Denardini (EMBRACE/INPE, Brazil), H.Takahashi (INPE, Brazil), J.A. Gonzalez-Esparza (IGF/UNAM, Mexico),P.A.B. Nogueira (IFECTSP, Brazil), M.B. de Padua (EMBRACE/INPE,Brazil), R. Lotte (INPE, Brazil), P.M.S. Negreti (INPE, Brazil),M.A. Sergeeva (CONACyT, IGF/UNAM, Mexico),L.C.A. Resende (INPE,Brazil), M. Rodriguez-Martinez (ENES/UNAM, Mexico), O.F. Jonah (MITHaystack Observatory, USA), V. de la Luz (CONACyT, IGF/UNAM,Mexico), P.F. Barbosa Neto (INPE, Brazil), J.M.G. Monico (UNESP,Brazil), F.C. de Meneses (INPE, Brazil), E. Perez-Tijerina(FCFM/UANL, Mexico), E. Aguilar-Rodriguez (IGF/UNAM, Mexico)

Abstract. We present acomprehensive study of the ionospheric Total Electron Content (TEC)climatology, based on data collected by four network of ground-basedGlobal Navigation Satellite System (GNSS) sensor networks thatcovered Latin America. This work provides a qualitative andquantitative daytime and nighttime analysis of the ionospheric TECclimatology, which encompasses: (a) the response of TEC to the solarflux; (b) the seasonal variation of TEC in different latitudinal andlongitudinal ranges; and (c) the North-South electron densityasymmetry of TEC over Latin America. The response to the solar fluxis based on day-to-day TEC variations during two periods of differentsolar activity conditions: 2011 (ascending phase) and 2014 (maximum).

S5P53

Influence of the Temporal Resolution of averaged TEC values on the accuracy of the Disturbance Ionosphere Index

G. A. S. Picanço (DIDAE/INPE, Brazil), C. M. Denardini (Embrace/INPE, Brazil), P. F. Barbosa Neto (Embrace/INPE & UNISAL, Brazil).

Abstract. In the present work, we show the preliminary results of effects in the accuracy of the Disturbance Ionosphere Index (DIX) when using different temporal resolutions of the Total Electron Content (TEC) averaged during magnetically quiet-time conditions (meaning quiet ionosphere) as a baseline for deriving it. DIX is an index primarily dedicated to express the response of the ionosphere to magnetic disturbances. Thus, we assume that different temporal resolutions of averaged TEC express different degrees of the background quiet-ionosphere variation that are considered in the DIX calculation. Therefore, we calculated the averaged TEC values

from the quiet-ionosphere for several different selected groups of quiet time (e.g. hours, days, weeks, months, and seasons). The results are presented and discussed in terms of the scalogram analysis that becomes usual with the advent of the wavelets analysis. Complete list of G. A. S. Picanço (DIDAE/INPE, Brazil), C. M. Denardini (Embrace/INPE, Brazil), P. F. Barbosa Neto (Embrace/INPE & UNISAL, Brazil), P. A. B. Nogueira (IFSP, Brazil), E. Romero-Hernandez (FCFM/UANL, Mexico & Embrace/INPE, Brazil), S. S. Chen (DIDAE/INPE, Brazil), A. V. Bilibio (DIDAE/INPE, Brazil), L. C. A. Resende (Embrace /INPE, Brazil), T. O. Bertollotto (DIDAE/INPE & UNITAU, Brazil), J. Moro (CRS/INPE & NSSC/CAS, Brazil-China).

S5P54

Response of the Equatorial and Low-latitude Ionosphere to Solar Flare Events during the Descending Phase of Solar Cycle 24

T. O. Bertollotto (DIDAE/INPE & UNITAU, Brazil), L. C. A. Resende (Embrace /INPE, Brazil), C. M. Denardini (Embrace/INPE, Brazil), S. S. Chen (DIDAE/INPE, Brazil), G. A. S. Picanço (DIDAE/INPE, Brazil), P. F. Barbosa Neto (Embrace/INPE, Brazil), J. Moro (CRS/INPE & NSSC/CAS, Brazil-China), A. V. Bilibio (DIDAE/INPE, Brazil), P. A. B. Nogueira (IFSP, Brazil).

Abstract. In the present paper, we present the response of the equatorial and low-latitude ionosphere to M and X class solar flares events that were registered in the descending phase of the solar cycle 24. It is well established that extreme solar flares may cause sudden changes in the ionospheric ionization density, including the equatorial and low latitudes regions. Therefore, we investigated the influence of the solar flares in the ionospheric regions. It is based on a quantitative analysis of the time delay between the ionospheric response of the M and X class solar flare events, as well as the intensity of such response. To perform this, we analyzed data from ionosondes installed in São Luís - MA (2º 31' S, 44º 16' W), Cachoeira Paulista - SP (22º 39' S, 45º 00' W) and Boa Vista - RR (02º 49' N, 60º 40' W) during records of X-Ray flow changes associated with solar flares covering the period from 2014 to 2015 . Our results show the disappearance of echoes in the ionogram (knwon as HF radio blackouts) during the flare event indicating absorption of radio signals in the D region, in which the response time depended of the solar flare intensity.

S5P55

Upper atmospheric tides from airglow observations at El Leoncito, Argentina

Esteban R. Reisin and Jürgen Scheer, IAFE (CONICET/UBA), Buenos Aires, Argentina

Abstract. We extract information on the upper atmospheric tide from our long dataset of airglow-derived temperatures and band intensities. This is based on spectroscopic observations of the OH(6-2) and O2b(0-1) bands corresponding to two different altitudes (87 and 95 km) in the mesopause region. For this study, about 2900 nights of data acquired at El Leoncito (CASLEO; 31.8ºS, 69.3ºW) between 1998 and 2014 are used. Spectral analysis of the nocturnal

time series of temperatures and intensities results in the characterization of the dominant spectral components in the tidal period range. We find strong tides mainly from April to October, but often subject to considerable night-to-night variations. We focus on the 169 cases most clearly identified at similar periods for both airglow emissions, which is more than an order of magnitude above our result from the 1980s/early 1990s. These cases are particularly suitable for determining vertical wavelengths independently, and consistently, for both emissions. The technique uses the phase difference between the intensity and temperature oscillations and Krassovskyś ratio, according to the Hines and Tarasick theory. All theses cases correspond to upward energy propagation, as expected for low-altitude tidal excitation. The mean vertical wavelength is 31.1(±1.5)km for OH and 46.5(±2.4)km for O2.

S5P56

MLT winds estimations obtained from specular and non-specular meteor trails at Jicamarca

Danny Scipión (Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, Perú), Julio Oscanoa (Fakultät für Informatik, Technische Universität Münche, Germany), and Marco Milla (Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, Perú)

Abstract. Many non-specular meteors studies have been conducted with the high-power large-aperture (HPLA) radar at the Jicamarca Radio Observatory (JRO). Studies of interest are the ones that use the high-power meteor trails to estimate Mesosphere and Lower Thermosphere (MLT) winds (85-105 km) by combining 3 or more received signals using interferometry. The main limitation for obtaining the winds with this technique is the presence of the Equatorial ElectroJet (EEJ) particularly strong between 90-110 km. Here, the authors present the preliminary results of a comparative study of MLT winds obtained from non-specular and specular meteor trails on a coordinated campaign conducted on the night of June 2nd - 3rd, 2016. MLT winds using non-specular meteor trails were obtained by a combination of two modes for better comparison. The first method used the conventional interferometric approach, while the second method used 3 or 4 non-collinear beams to resolve the MLT winds by implementing the Doppler Beam Swinging (DBS) technique. These two approaches are susceptible by EEJ contamination in the meteor detection, so an additional time was devoted to the detection of the trails in the presence of EEJ. MLT winds using specular meteor trails were obtained by the Jicamarca All-Sky METeor system that operates at 30 MHz (JASMET 30) routinely since 2015. The specular condition of the received echoes makes the system not susceptible to EEJ contamination. Estimates from the specular meteors are obtained every hour with 2 km meter resolution, while estimates from the non-specular meteors were obtained with high time (15 minutes) and spatial (300 m) resolution.

S5P57

Study on Planetary Wave Propagation in the Lower Thermosphere and its response to ionospheric layer in the Brazilain Equatorial Region.

Lomotey,O.S(INPE,Brazil),Buriti,R.A(UFCG,Brazil),Paulino,I.(UFCG,Brazil), Medeiros,A.F.(UFCG,Brazil) of Illinois at Urbana-Champaign,U.S.A),Meriwhether, J.W(Clemson University,U.S.A), Barros,D(INPE,Brazil).

Abstract. This research is focused on the study on planetary wave oscillations (PW) propagation in the lower thermosphere, using Fabry-Perot Interferometer (FPI). The FPI is a passive optical sensing instrument used to estimate thermospheric winds and temperature. The data used in this paper were captured by the FPIs which are located at São João do Cariri (7.4°S, 36.5°W). A comparison to the ionospheric F-layer maximum critical frequency (foF2) and virtual height (hŽF) located at Fortaleza (3.8°S, 38.6°W) was done. This research aims at looking for periodicities in the wind measurements with periods longer than few days in both components of wind. This was done by using airglow emission of Atomic Oxygen OI630.0 nm the red line during the nighttime, i.e., from 20:00 to 03:00 local time (LT). Lomb-Scargle analysis was used to process the thermospheric winds and temperature. Phases (time of maximum) and amplitudes of these oscillations were estimated by using Least Square fitting method (LSF). Almost all of periodicities of propagation of planetary waves were above 2 days. Strong oscillations of 6-8 days were observed from September to December 2013.

S5P58

Analysis of the positive and negative ionospheric response to an intense geomagnetic storm over Brazilian sector using total electron content data

A.J. de Abreu, M. Roberto, J.R. Abalde, M.A. Alves, I.M. Martin (Instituto Tecnológico de Aeronáutica (ITA), Brazil), R. de Jesus, C.M. Denardini (Instituto Nacional de Pesquisas Espaciais (INPE), Brazil), K. Venkatesh, P.R. Fagundes (Universidade do Vale do Paraíba (UNIVAP), Brazil), M. Gende (Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata (UNLP), Argentina).

Abstract. Interaction between magnetosphere and ionosphere during intense geomagnetic storms continue as an important issue nowadays related to the space weather studies. In this investigation, we present and discuss the ionospheric F-region disturbances over Brazilian sector during an intense geomagnetic storm occurred between 27 and 29 May 2017. This geomagnetic storm reached a minimum Dst of -125 nT at 0700 UT on 28 May. For this investigation, we present vertical total electron content (VTEC) observations from a chain of 124 GPS stations, covering from equatorial to low-latitudes regions over Brazilian sector. Also, the magnetometer measurements obtained at two stations in the low-latitude regions are presented. The results obtained are relevant to enlarge our understanding on the electrodynamics and the physical processes which involved with positive and negative ionospheric storm phases due to the prompt penetration of electric fields/disturbance of electric fields, thermospheric wind circulation changes and traveling ionospheric disturbances. The influence of these phenomena on the characteristics of ionospheric F-region over Brazilian sector during geomagnetic disturbance will be presented and discussed

S5P59

Estado actual de la relación entre eventos sísmicos y la Resonancia Schumann. Exploración en México.

P. Sierra (IGA, Cuba), B. Mendoza(IG, UNAM, México), E. Andrade(IG, UNAM, Mexico), D. Rodríguez(IG, UNAM, México),

Abstract. Se presenta el estado actual de las investigaciones a nivel mundial en cuanto a la posible asociación entre los eventos sísmicos de gran magnitud y su predicción de varios días mediante el análisis espectral de la señal electromagnética natural de extremadamente baja frecuencia (ELF). Para la exploración de este complejo y controvertido fenómeno, se ha investigado la respuesta de la Resonancia Schumann registrada en la Estación instalada en el observatorio MEXART del Instituto de Geofísica de la UNAM, en Michoacán. Se muestran los resultados del análisis de amplitud y frecuencia de una muestra de más de 10 terremotos ocurridos en territorio mexicano y sus cercanías.

S5P60

Characterization of the ionospheric scintillation from high to low latitude in the South American sector - DemoGRAPE

E. Correia (INPE-CRAAM, Brazil), L. Alfonsi (INGV, Italy), L. Spogli (INGV, Italy), G. De Franceschi (INGV, Italy), V. Romano (INGV, Italy), N. Linty (Politecnico di Torino, Italy), I. Hunstad (INGV, Italy), O. Terzo (ISMB, Italy), F. Dovis (Politecnico di Torino, Italy), G. Alves (UPM, Brazil) and R. Câmara (UFRR, Brazil)

Abstract. Demonstrator for Global Navigation Satellite System (GNSS) Research and Application for Polar Environment (DemoGRAPE) is an international project leaded by the Istituto Nazionale di Geofisica e Vulcanologia (INGV), in partnership with Politecnico di Torino, Istituto Superiore Mario Boella, and South African National Space Agency (SANSA) and the Brazilian National Institute of Space Physics (INPE) as collaborators. The aim of project is to improve satellite navigation particularly in Antarctica, where the accuracy is of paramount importance for the surface displacements, and it is strongly affected by atmospheric disturbances. The DemoGRAPE activities started on November 2015 with the system installed at Brazilian Antarctic Station Comandante Ferraz (EACF, 62o 05$\acute{0}$7'S, 58o23$\acute{2}$9' W) located in the King George Island. To investigate the ionospheric disturbances from high to low latitudes in the South American sector we present the GNSS scintillations observed during 2016 at EACF inside DemoGRAPE activities, which are combined with GNSS observations done at Universidade Mackenzie in São Paulo (23°32'56"S, 46°38'20"W, inside the South American Magnetic Anomaly - SAMA) and at Cauamê Campus of Universidade Federal de Roraima (02°49$\acute{1}$2'N, 60°40$\acute{2}$3' W). The goal is to characterize the occurrence of scintillations in association with the equatorial fountain effect and inside the SAMA region.

S5P61

Multi-instrument observations of the ionospheric response to the 7 September 2017 geomagnetic storm in the South American Sector

Gabriel Campos Damasceno(CRAAM-MACKENZIE, Brazil) Emília Correia (INPE-CRAAM, Brazil) Eduardo Perez Macho(CRAAM-MACKENZIE, Brazil)

Abstract. The South American ionospheric behavior during the period from 05 to 10 September 2017 is investigated using data from GNSS network from Continuous Monitoring Brazilian Network (RBMC) and ionosondes available in the Space Weather Brazilian Studying and Monitoring (Embrace) site. The geomagnetic activity was produced by the impact of two Coronal Mass Ejections (CMEs) on the Earth magnetosphere . The first one caused a geomagnetic storm that started at 19:00 UT on 07 September and reached the maximum at 02:00 UT on 08 September with DST Index of -142 nT (Intense Storm), KP index 8 and Auroral index 1500 nT. During the recovering phase of this storm another CME arrived at 11:00 UT on 08 September increasing the geomagnetic activity, with Dst reaching -122 nT at 15:00 UT. The Vertical Total Electron Content (VTEC) measured at different latitudes shows a distinct ionospheric response to each storm phase. During the onset main phase of the geomagnetic storm on 7 September VTEC increased at equatorial latitudes during afternoon, and after sunset shows another increase as consequence of electric field associated with the evening Pre-reversal Enhancement (PRE). In association with the intensification of magnetic storm on 8 September, the VTEC shows an increase during sunrise and the fountain effect was intensified. The results shows that during the first hours of the main phase geomagnetic storm the ionospheric response was mainly affected by the prompt penetration electric fields (PPEFs), being a combination of PPEF and dynamo effects afterwards.

Plasma Physics and Nonlinear Processes in Space Geophysic

S6P01

On the spatio-temporal behavior of magnetohydrodynamic turbulence in a magnetized plasma II

R. Lugones (DF/FCEN/UBA, Argentina, and IFIBA/CONICET, Argentina), P. Dmitruk (DF/FCEN/UBA, Argentina, and IFIBA/CONICET, Argentina) and P.D. Mininni (DF/FCEN/UBA, Argentina, and IFIBA/CONICET, Argentina)

Abstract. Using direct numerical simulations of three-dimensional magnetohydrodynamic (MHD) turbulence the spatio-temporal behavior of magnetic field fluctuations is analyzed. Cases with relatively small, medium and large values of a mean background magnetic field are considered. The (wavenumber) scale dependent time correlation function is directly computed for different simulations, varying the mean magnetic field value. From this correlation function the time decorrelation is computed and compared with different theoretical times, namely, the local non-linear time, the random sweeping time, and the Alfvénic time, the latter being a wave effect. It is observed that time decorrelations are dominated by sweeping effects, and only at large values of the mean magnetic field and for wave vectors mainly aligned with this field time decorrelations are controlled by Alfvénic effects.

S6P02

Beta dependence of kinetic plasma turbulence

Tulasi Parashar (University of Delaware), William H Matthaeus (University of Delaware)

Abstract. Turbulence in kinetic plasmas is a key player in the dynamics of many astrophysical and terrestrial systems, e.g. the Solar Wind. Understanding the dynamics of solar wind requires an understanding of not only the turbulent cascade in an almost collisionless plasma but also how the turbulent fluctuation energy is deposited into random degrees of freedom. Here we discuss how the properties of kinetic plasma turbulence vary based on plasma beta. Fully kinetic particle-in-cell simulations of reasonably large systems (149.6 di) are used to investigate the nature of intermittency, heating and cascade in kinetic plasmas.

S6P03

Particle-in-cell simulations of satellite surface charging in the solar wind

J. M. N. de J. Luz, (UnB, Brazil), R. A. Miranda (UnB, Brazil)

Abstract. In this paper we present results from numerical simulations of a particle-in-cell model of the solar wind to study the effect of surface charging in satellites. We set the model parameters to represent two solar wind regimes, namely, a slow, quiet solar wind, and a fast, shocked solar wind in the presence of a interplanetary coronal mass ejection. We investigate the resulting accumulation of charged particles, charge density and electrostatic potential in

the surface of several models of satellites from Brazilian space missions. Our results indicate that the collected charge from the solar wind on the surface of satellites may lead to localized arcing and discharges and can be useful for future missions.

S6P04

THE ROLE OF CURRENT SHEETS ON THE STATISCAL MODELLNG OF EXTREME EVENTS FOR SPATIAL-TIME SERIES IN THE SOLAR WIND

Tiago Francisco Pinheiro Gomes (National Institute for Space Research-INPE, Brazil); Abraham Chian Long Chian (University of Adelaide, Australia) - *Advisor*; Erico Luiz Rempel (Technological Institute of Aeronautics-ITA, Brazil) - *Advisor*; Fernando Manuel Ramos (National Institute for Space Research-INPE, Brazil) - *Advisor*; Suzana de Souza e Almeida Silva (Technological Institute of Aeronautics-ITA, Brazil)

Abstract. The solar wind constitutes a nonlinear dynamical system, presenting intermittent turbulence, multifractality and chaotic dynamics. One characteristic shared by many such complex systems is the presence of extreme events, that play an important role in several Geophysical phenomena and their statistical characterization is a problem of great practical relevance. This work investigates the presence of extreme events in time series of the modulus of the interplanetary magnetic field measured by Cluster 1 spacecraft. One of the main results is that the solar wind near the Earthś bow shock can be modeled by the Generalized Pareto (GP) and Generalized Extreme Values (GEV) distributions. Both models present a statistically significant positive shape parameter, implying a heavy tail in the probability distribution functions and an unbounded growth in return values as return periods become very long. There is evidence that current sheets are the main responsible for positive values of the shape parameter. In addition, we will perform the same statistical analysis on simulated data for current sheets in the solar wind environment using spatio-time series. It is also shown that magnetic reconnection at the interface between two interplanetary magnetic flux ropes in the solar wind can be considered as Dragon Kings (DK), which are a class of extreme events whose formation mechanisms are fundamentaly different from others, thus opening the possibility of their identification, prediction and even suppression. Dragon kings had previously been identified in time series of financial crashes, nuclear power generation accidents, stock market and so on, and it is believed that they are associated with the occurrence of extreme events in dynamical systems at phase transition, bifurcation, crises or tipping points.

S6P05

Four new analytical solutions of the Equilibrium AmpereŽs law using the WalkerŽs Method

A. N. Laurindo Sousa (UNIVAP, Brazil), A. Ojeda-González (UNIVAP, Brazil), V. Klausner (UNIVAP, Brazil), A. Prestes (UNIVAP, Brazil), L.A. Caritá (UNIVAP, Brazil).

Abstract. The Equilibrium AmpereŽs law has an analytical solution proposed by Walker (1915). He obtained a formula which is dependent of the analytic function g(X+iY), where

X and Y are two dimensionless spatial coordinates. In this article, four function are choice as g(X+iY) to obtain new analytical solutions that presents isolated magnetic islands for the current sheet configuration.

S6P06

The Role of Current Sheets on Statistical Modeling of Extreme Values and Evidence of Presence of Dragon King (DK) in Solar Wind

Tiago Gomes (National Institute of Space Research-INPE, Brasil) Erico Luiz Rempel (Aeronautics Institute of Technology-ITA, Brasil) Fernando Ramos (National Institute of Space Research-INPE, Brasil) Abraham C.-L.Chian (University of Adelaide, Australia)

Abstract. The solar wind constitutes a nonlinear dynamical system, presenting intermittent turbulence, multifractality and chaotic dynamics. One characteristic shared by many such complex systems is the presence of extreme events, that play an important role in several Geophysical phenomena and their statistical characterization is a problem of great practical relevance. This work investigates the presence of extreme events in time series of the modulus of the interplanetary magnetic field measured by Cluster spacecraft. One of the main results is that the solar wind can be modeled by the Generalized Pareto (GP) and Generalized Extreme Values (GEV) distributions. Both models present a statistically significant positive shape parameter, implying a heavy tail in the probability distribution functions and an unbounded growth in return values as return periods become very long. There is evidence that current sheets are the main responsible for positive values of the shape parameter. It is also shown that magnetic reconnection at the interface between two interplanetary magnetic flux ropes in the solar wind can be considered as Dragon Kings (DK), which are a class of extreme events whose formation mechanisms are fundamentaly different from others, thus opening the possibility of their identification, prediction and even suppression. Dragon kings had previously been identified in time series of financial crashes, nuclear power generation accidents, stock market and so on, and it is believed that they are associated with the occurrence of extreme events in dynamical systems at phase transition, bifurcation, crises or tipping points.

S6P07

Multifractal Analysis of Ionospheric Transition Region

Neelakshee I. Joshi, Reinaldo R. Rosa, Siomel S. Odriozola, Stephan Stephany, Francisoco C. R. de Meneses Jr., Esfhan A. Kherani, Polinaya Muralikrishna.

Abstract. Ionospheric irregularities are nonlinear phenomena and its key source are the plasma instabilities and the signature of an underlying turbulent process has long been investigated using Power Spectral Density methods. However, it is evident that ionospheric data exhibits a complex nonlinear spatiotemporal behavior and has richness of scaling but its underlying process is very hard to characterize (Fornari et al., 2016). Beyond the traditional PSD analysis, the multifractal structure function is able to characterize much more complex process such as nonhomogenous energy cascade. In this work, we applied both the multifractal detrended fluctuation analysis (MFDFA) algorithm (Kantelhardt et al., 2002) and p-model (Meneveau and

Sreenivasan,1987) in order to refine the interpretation of ionospheric data from E-F transition region obtained from a rocket experiment. This procedure is relatively unprecedented since the study of equatorial E-region and the intermediate region between the E and F layers at night time are sparse (Sinhaet al., 2011) and not much references are available. Earlier results (Odriozola et al., 2017) from this data using PSD method has shown the presence of a dual slope under the presence of complex small and medium scale plasma irregularities. Singularity spectra obtained from MFDFA analysis can be fitted using the p-model input parameters. The preliminary results we have obtained are 1.66 ¡ PSD ¡ 2.00 and 0.35 ¡ p ¡ 0.6 suggesting that the main underlying physical process is the nonhomogenous multiplative cascade. The results on scaling pattern obtained from singularity spectra and fitted p-value helps in understanding the nature of ionospheric turbulence in the EF transition region.

S6P08

1/f noise in spherical dynamo simulations

Mauro Fontana (DF/FCEN/UBA-CONICET), Pablo Dmitruk(DF/FCEN/UBA-CONICET), Pablo D. Mininni (DF/FCEN/UBA-CONICET)

Abstract. For the last 70 years, it has been commonly accepted that Earth's magnetic field suffers non-periodic reversals (sudden polarity changes in the component of the dipole moment parallel to Earth's rotation axis), as it represents the simpler mechanism to explain features observed in paleomagnetic studies . The most salient ingredients of the geomagnetic field, including reversals, have been successfully reproduced in simulations by solving the equations of the magnetohy drodynamic (MHD) framework inside a spherical shell with appropriate boundary conditions. Aditionally, frequency domain analysis of dipole moment paleomagnetic records shows a region with a distinct 1/ f trend . This spectral functional form is associated with scale invariance and long-term memory in the system, and has been reported to emerge in ideal magnetohydrodynamics as a consequence of the nonlocal interactions between length scales. Employing direct numerical simulations, we show here that the aforementioned 1/ f behavior in the dipole moment can be reproduced in non-ideal MHD for almost the entire region of parameter space explored. Moreover, by testing two different, but steady, forcing geometries, we were able to simulate both small scale and mostly dipolar dynamos.

S6P09

Development of a Magnetohydrodynamic (MHD) model in Non-Local Thermodynamic Equilibrium (NLTE) to study the upper solar atmosphere

J. J. González-Avilés (IGUM/UNAM, Mexico) and V. De la Luz (CONACYT-SCiESMEX/LANCE/IGUM/U
Mexico)

Abstract. In this paper, we develop a MHD model in the NLTE approximation by coupling the Newtonian CAFE MHD code (González-Avilés et al. 2015) with PakalMPI (De la Luz et al. 2010). Newtonian CAFE solves the ideal and resistive MHD equations considering a fully ionized plasma. On the other hand, PakalMPI solves the ionization states using the NLTE

approximation for Hydrogen, electronic densities and H-. The resulting code solves the MHD equations and calculates the densities of the different species using the NLTE approximation in each time-step. As a first application of the code, we study the contribution of the different ionization states in the case of an equilibrium solar chromosphere described by the C7 model (Avrett & Loeser 2008).

Space Weather

S7P01

Assessing the Geomagnetic Field contribution during three Forbush Decreases: May 2005, December 2006 and September 2017 at the Pierre Auger Observatory

M. Suárez-Durán (Escuela de Física, Universidad Industrial de Santander, Bucaramanga-Colombia / Instituto de Tecnologías en Detección y Astropartículas (CNEA, CONICET, UNSAM), San Martín-Argentina) for the Pierre Auger Collaboration (Observatorio Pierre Auger, Malargüe-Argentina)

Abstract. The flux of galactic cosmic rays (GCR) in the near-Earth environment is affected during the occurrence of transient solar phenomena, such as the arrival of an interplanetary Coronal Mass Ejections (iCME) producing a Forbush Decrease (FD). Several causes are associated with the observed changes in the flux during these phenomena, including the induced disturbances in the Geomagnetic Field (GF). While some of these causes are well understood, some others need additional efforts, such as the relationship between GF perturbations and the observed flux variations at ground level. To estimate how much the GF can contribute to the variation of particles at the ground, we simulated the evolution of the local GF configuration at Malargüe, Argentina, during three FDs registered on May 15th, 2005; March 09th, 2012 and September 8th, 2017. For each GF configuration, we calculated how the flux of GCR is affected and evaluate the corresponding modulation of secondary particles at the ground. After that, we quantitatively compared our findings with the flux measured by the low energy modes of the Pierre Auger Observatory. Evidence of GF effects on the GCRs modulation is clearly visible when the measured rates are compared with the simulated fluxes. Our analyses show that GF variations significantly affect the flux observed at the ground, even at low geomagnetic latitudes. This affectation could be dominant for some components of the flux, such as secondary neutrons. This analysis shows that by combining our method with the extended capabilities of Cherenkov detectors measured from ground level it is possible to discriminate the heliospheric disturbances occurred during the passage of the ICMEs from those originated on the GF perturbations.

S7P02

Towards forecasting of GIC in power grid

L. Trichtchenko and L.Nikitina (Canadian Space Weather Forecast Centre, Natural Resources Canada)

Abstract. Geomagnetic disturbances can affect power systems producing transformer heating, relay misoperation, voltage sag and, in extreme cases, system collapse. Concern that an extreme geomagnetic storm could seriously affect power systems across North America has prompted the development of new standards that require power utilities to conduct a geomagnetic hazard assessment and take appropriate mitigation measures if necessary. The best way to be prepared for the GMD event is to have a real-time forecasting system, which will give the predictions of

the GIC level in the system. In order to do it, first the forecasting of the geoelectric field needs to be done. However, Canadian Space Weather Forecast Centre/Geomagnetic Observatory operated by Natural Resources Canada provides forecast of the ground geomagnetic activity on regional scale in the form of local hourly range indices. Building on this existing forecast, the investigations are underway towards the possibilities for the GIC forecasting for a particular regional power grid. The presentation will discuss two approaches under investigation: The first is based on existence of a possible correlation between the local geomagnetic index and variations of the local (modelled) geoelectric field (hourly maximum index); The second is based on the identification of a possible statistical pattern of geoelectric variations for different levels of the space weather activity (quiet, stormy etc.) which could then be used for the forecasting of the geoelectric field variations for a specific area. This talk will describe the methodologies being used and present the up-to-date progress and findings.

S7P03

The Embrace Magnetometer Network for South America: Network Description and Firsts Results

C. M. Denardini (Embrace/INPE, Brazil) et al. (16 more authors from several institution in Brazil and Argentina)

Abstract. We present the new Embrace Magnetometer Network (Embrace MagNet) in South America, which so far is planned to cover most of the Easter Southern American longitudinal sector displacing magnetometer in several locations in South American. We discuss the purpose and scientific goals of the network, associated with the Aeronomy and Space Weather. We provide details on instrumentation, location of the sensors, sensibility matching process, gain matching process, and installations of the magnetometers. In addition, we present and discuss details on the data storage, near-real time display and availability. Finally, we provide some of the first scientific findings that we have already achieved with this network, which involve: (a) the identification of the diurnal and the seasonal natural variations of the H component; (b) the precise determination of SSC and SI; (c) the pretty good agreement with respect to the ΔH amplitudes derived from the Embrace MagNet during the intense magnetic storm and the Dst index; and (d) the investigation of the effects of the Sq systems response to the X-class solar flares occurring during daytime under magnetically quiet conditions.

S7P04

Effects of magnetic fields produced by simulated and real geomagnetic storms on rats

Blanca Mendoza (1) and Julia Lenica Martinez-Breton (2) 1 Instituto de Geofisica, Universidad Nacional Autonoma de Mexico, Ciudad Universitaria, 04510 CDMX, Mexico. 2 Universidad La Salle, CDMX, Mexico.

Abstract. We report experiments of arterial pressure (AP) measurements of ten Wistar rats subjected to geomagnetic field changes and to artificially stimulated magnetic field variations. Environmental electromagnetic effects were screened using a semianechoic chamber, allowing

us to discern the effects associated with geomagnetic storms. We stimulated the subjects with a linear magnetic profile constructed from the average changes of sudden storm commencement (SSC) and principal phases of geomagnetic storms measured between 1996 and 2008 with Dst between 6 and 100 nT. Statistically significant AP changes were found when a geomagnetic storm occurred during the experimental period. Using the observed geomagnetic storm variations to construct a geomagnetic profile to stimulate the rats, we found that the geomagnetic field variations associated to the SSC day were capable of increasing the subjects AP between 7% and 9% from the reference value. Under this magnetic variation, the subjects presented a notably restless behavior not seen under other conditions. We conclude that even very small changes in the geomagnetic field associated with a geomagnetic storm can produce a measurable and reproducible physiological response.

S7P05

Space Weather on Mexico: the geomagnetic Kmex index

P. Corona-Romero (LANCE/IGEOF-UNAM, Mexico), M. Sergeeva (LANCE/IGEOF-UNAM, Mexico), J.A. Gonzalez-Esparza (LANCE/IGEOF-UNAM, Mexico), G. Cifuentes-Nava (SM/IGEOF-UNAM, Mexico), E. Hernandez-Quintero (SM/IGEOF-UNAM, Mexico), A. Caccavari (SM/IGEOF-UNAM, Mexico), E. Sanchez-Garcia (PCT/IGEOF-UNAM, Mexico), E. Aguilar-Rodriguez (LANCE/IGEOF-UNAM, Mexico), J.C. Mejia-Ambriz (LANCE/IGEOF-UNAM, Mexico), V. de la Luz (LANCE/IGEOF-UNAM, Mexico), L. X. Gonzalez (LANCE/IGEOF-UNAM, Mexico)

Abstract. Space weather affects the Earthś magnetic field in multiple ways. A geomagnetic storm is probably the most intense effect of space weather over Earth's magnetosphere. Geomagnetic storm effects threaten the distribution of energy (electricity, oil and gas) as well as systems of geopositioning and telecommunication, and compromise technology and facilities related with security of nations. For this reason, the magnetosphere of Earth is continuously monitored in order to detect the occurrence of geomagnetic storms. One of the main tools to detect a geomagnetic perturbations is the geomagnetic K index. The K index is a scale for assessing the effects associated with the (3-hourly) variations of the geomagnetic field. In this work we present the procedures to calibrate, calculate, and validate the geomagnetic K index for the central region of Mexico (Kmex). Additionally, we present a geomagnetic storm recorded by the Kmex index. Kmex index is a collaboration between the National Space Weather Laboratory (LANCE) and the Magnetic Service (MS) of the Geophysics Institute (UNAM).

S7P06

Effects of solar flares and solar energetic particle events on the atmospheric electric field.

J.-P. Raulin (CRAAM/EE/UPM), J. Tacza (CRAAM/EE/UPM)

Abstract. The AFINSA network (Atmospheric Electric Field Network in South America) is composed of eight sensors installed in Brazil, Argentina and Peru, and three new stations are planned for beginning of operation in 2018. AFINSA provides continuous measurements of the

fair weather atmospheric electric field. In this paper, we present and discuss the comparison of the records obtained with AFINSA sensors in fair weather conditions with the 'universal' Carnegie curves. Once obtained these template curves of the daily atmospheric electric field variations, we concentrate on their deviations obtained during solar and geomagnetic disturbed conditions. Namely, we study the effects of hundreds of solar flares as well of tens of Solar Energetic Particle (SEP) events on the atmospheric electric field. To increase the possible effects, a superimposed method was used in both cases. We find that no significant effects are observed during solar flares. On the other hand, during SEP events, a clear increase in the atmospheric electric field is detected of about 10 V/m in average. We discuss these results in terms of the electrical conductivity of the Earth 's atmosphere and its time variability.

S7P07

The Space Weather Supercomputing Center in Mexico (CESCOM)

Victor De la Luz (Conacyt/LANCE/UNAM, México), Américo González Esparza (LANCE/UNAM, México), José Juan González Aviles (LANCE/UNAM, México), Francisco Tapia Vázquez (LANCE/UNAM, México), Elizandro Huipe Domratcheva (ENES/UNAM, México), Carlos Humberto Miranda Salcido (UAS, México), Fernando Rodrigo Aguilar Javier (ENES/UNAM, México), Gilberto Dominguez (ENES/UNAM, México)

Abstract. Fundamental duties in the National Space Weather Laboratory (LANCE) includes i) Storage, processing and visualization of data from the instrumentation network; ii) Development of software tools for the operation of the Mexican Space Weather Service (SCiESMEX) and iii) Basic science research in Space Weather. These functions are being concentrated in the Space Weatjer Supercomputing Center (CESCOM). In this paper we present the improves in the development of the infrastructure of CESCOM that include: The Institutional Repository of Space Weather (RICE), the data center of the Michoacán Unit of the Institute of Geophysics of the UNAM (IGUM), the showroom and the software repository.

S7P08

Analysis of systematic ionosphere variations over Mexico based on GPS data.

V. Gatica-Acevedo (IPN, Mexico), M. Sergeeva (SCiESMEX/IGUM-UNAM, Mexico), O. Maltseva (IP-SFU, Russia), J.-A. Gonzalez-Esparza (SCiESMEX/IGUM-UNAM, Mexico), M. Sánchez-Meraz (IPN, Mexico)

Abstract. The ionosphere state over the Mexican region was estimated based on data of Total Electron Content (TEC) that is one of the main parameters of the Earth's ionosphere. Data from global ionospheric maps, local networks of GPS stations and GPS receiver installed in the National Polytechnic Institute in Mexico were used for the analysis. Geomagnetic field data (global indices and local magnetometer data) and data from the low-orbit satellites were also used. Diurnal, day-to-day, seasonal and annual systematic TEC variations were revealed as well as TEC dependence on solar activity (represented by F10.7-index) and TEC anomalies. Local TEC variations were compared to TEC obtained from IRI-2012 and NeQuick models.

GPS positioning errors were estimated during quiet and disturbed geomagnetic periods. The spatial correlation between TEC values from different local receivers was studied. The cases of low correlation were revealed that proves the diversity of ionospheric effects in the considered region.

S7P09

Detection of solar radio bursts in Mexico with Callisto and the IPS antena MEXART

E. Huipe-Domratcheva (UNAM, Mexico) V. de la Luz Rodriguez (UNAM, Mexico) A. Gonzales-Esparza (UNAM, Mexico) E. Andrade (UNAM, Mexico) P. Villanueva (UNAM, Mexico) J. C. Mejía-Ambriz (UNAM, Mexico) E. Aguilar-Rodriguez (UNAM, Mexico) C. Monstein (ETH Zurich) C. Miranda (Autonomous University of Sinaloa, Mexico)

Abstract. The Callisto stations are radiospectrographs made for the detection of solar radioburst, theyŕe part of a global network e-callisto constituted by more than 136 stations, thus, altogether the network monitors the Sun the 24h globally from different latitudes. The Callisto-MEXART station located in LANCE uses an Yagui Log-periodic dipole array, it has a 0.25 seconds frequency sweep and operates in a bandwidth of 45-225 MHz since 2015. MEXART in the other hand is an 4096 dipoles array, it spans 9500 meters square, it operates in a central frequency of 146.9 MHz with a 2 MHz bandwidth since 2008. The original purpose of MEXART is making a scanning of radiosources to do IPS tomographies, however new applications are found, for example, the detection of solar radiobursts, these correlated with the Callisto-MEXART station. This opens a new opportunity to analyze the MEXART data for the study the radiation/energy transference during the flares which causes this solar radioburst due to the higher sensitivity and a sma ller frequency sweep (20 milliseconds). In this study is analized the capability of the two instruments to detect solar radioburts compared with the databases of SOHO/LASCO and WIND/WAVES, this to demonstrate the importance of earth-based instruments for space weather monitoring. The local radio interference generated by these radioburts are studied, finally the MEXART data is reviewed as a way to analyze the flare phenomena.

S7P10

Geomagnetic storms effects over O3 and NOx in South Atlantic Magnetic Anomaly Zone

Marta M. Zossi (INFINOA (CONICET-UNT)/ CONICET, Argentina), Elda M Zotto (TECNO-UNCa, Argentina), Patricia Fernández de Campra (FACET-UNT/ Argentina) and Gustavo A. Mansilla (INFINOA (CONICET-UNT)/ CONICET, Argentina)

Abstract. The low magnetic field in the South Atlantic Magnetic Anomaly (SAMA) zone facilitates the entrance of high-energy particles from the magnetosphere. The presence of SAMA leads to the fact that particles drifting around the Earth in closed orbits can be quasi-trapped instead of being stably trapped or precipitating. The effects over total ozone and NOx and ozone profiles, from 20 to 60 km, in four different stations located in SAMA zone, during and

after intense geomagnetic storms, have been analyzed in this work. Data of UARS-HALOE and TOMs are used. The results show that the effects depend on the intensity of the storms. In some cases, the total ozone shows a statically significant decrease, but in others, the depletion is not significant. In the case of the ozone profile from TOMs data, there are increments followed by significant decreases sweeping from high to low altitude. The profiles of NOx from UARS-HALOE data show significant increases from 45 to 25 km, but in the case of O3, no statistically significant variations are observed

S7P11

Extreme electron fluxes during Space Weather events in the radiation belts and South Atlantic Anomaly: Extreme value analysis using data from the Argentinean SAC-D spacecraft

Vanina Lanabere [1] and Sergio Dasso [1,2,3] [1] UBA-FCEyN-DCAO, [2] CONICET-UBA, IAFE, [3] UBA-FCEyN-DF

Abstract. The van Allen radiation belts are regions in the terrestrial space environment that present ions and energetic electrons trapped by the geomagnetic field. Since the geomagnetic field in the South Atlantic Anomaly (SAA) region is relatively weakest over the western South Atlantic Ocean, trapped energetic particles of the radiation belts can reach closer distances to the Earth than energetic particles in other regions. The electron population in the outer radiation belt can reach energies mainly in a range from some keV to tens of MeV. During a geomagnetic storm, the population of energetic particles in the radiation belts can significantly increase. The increase of fluxes of these energetic particles has a major interest for Space Weather, mainly because of the impact on satellites and human activities in space. The specific effects and impacts will depend upon satellite orbit and the energy of the energetic particles. A detailed knowledge of the highest energies reached as well as the extreme fluxes and frequencies, is essential for the specific design of satellites and for the development of satellite technologies. The main purpose of the present work is to study the extreme electron fluxes in the terrestrial outer radiation belt (L 3-6) and in the SAA,for an energy range between 0.249 MeV and 1.192 MeV at 660 km of altitude above the Earth surface, using measurements made by the detector ICARE-NG/Carmen-1 on board the polar Argentinean satellite SAC-D. A statistical analysis based on the peaks over threshold approach was implemented for the daily average electron fluxes, and we present results of its cumulative probability distribution function, showing that it likely has a finite upper limit for a wide range of energies and in different regions.

S7P12

Study of small-scale solar wind irregularities in the inner heliosphere from interplanetary scintillation

J. Mejia-Ambriz (Cátedras CONACyT, LANCE, UNAM, México), J. González-Esparza (LANCE, UNAM, México), P. Villanueva-Hernández (LANCE, UNAM, México), E. Andrade-Mascote (LANCE, UNAM, México), E. Aguilar-Rodriguez (LANCE, UNAM, México), P. Corona-Romero (Cátedras CONACyT, LANCE, UNAM, México), V. de la Luz (Cátedras CONACyT,

LANCE, UNAM, México), P. Reyes-Marín (Universidad Michoacana de San Nicolás de Hidalgo , México), O. Chang (LANCE, UNAM, México), G. Casillas-Pérez (LANCE, UNAM, México).

Abstract. The interplanetary scintillation (IPS) is the observed flux fluctuation of astronomical radio sources when their signals cross through density irregularities in the solar wind. By IPS analyses it is possible to explore solar wind characteristics as speed, density, turbulence level, and the evolution of small-scale solar wind irregularities whose scales range from tens to hundreds of kilometers. The understanding of these irregularities can improve models of the inner heliosphere for space weather purposes. In this work we show the evolution of the small-scale solar wind irregularities from 0.1 to 0.6 AU by using IPS at different frequencies and assuming isotropic and quiet solar wind. We also give an introduction to the Mexican Array Radio Telescope (MEXART), a dedicated instrument of the Mexican Space Weather Laboratory (Laboratorio Nacional de Clima Espacial - LANCE) to IPS observations.

S7P13

The Multi-viewpoint CME Catalog: properties of CMEs from different perspectives

Balmaceda, Laura (GMU and NASA/GSFC, USA) Vourlidas, Angelos (JHU/APL, USA) Stenborg, Guillermo (NRL, USA) Dal Lago, Alisson (INPE, Brazil)

Abstract. Taking advantage of the new Multi-Viewpoint CME (MVC) Catalog (Vourlidas et al. ApJ 2017), we present the results based on the comparison of the properties of CMEs from simultaneous observations of the twin COR2 coronagraphs on board STEREO for the period 2007-2014 from two different vantage points. We focus on the analysis of angular widths, and radial and expansion speeds obtained using a supervised image segmentation algorithm, CORSET. The sample of 460 events detected simultaneously with both spacecraft at varying separation angles allow us to investigate the accuracy and constraints of single viewpoint properties that underlie the bulk of CME research to date and examine the dependence of the properties on the morphology of the events. Here we discuss some of the main results: 1) in average, we find a good agreement between the radial speeds derived from different perspectives throughout the period under analysis. 2) Projection effects seem to affect more the CME width determination rather than speeds. 3) In agreement with early predictions, the expansion speeds are less affected by projection effects than the radial speeds.

S7P14

SPACE WEATHER OBSERVATORY IN PERU: PORTAL WEB

F. Flórez (Agencia Espacial del Peru-CONIDA, Peru) J. Samanes (Agencia Espacial del Peru-CONIDA, Peru) W. Guevara (Agencia Espacial del Peru-CONIDA, Peru)J.P. Raulin (CRAAM, Brazil) C. A. Monstein (Institute of Astronomy, Switzerland)

Abstract. In this work we present results obtained by two stations SAVNET and CALLISTO-BPL, part of a space weather observatory located in Punta Lobos Scientific Base (Peru) and developing in CONIDA. SAVNET purpose is to monitor ionospheric parameters during quiet

and active solar phenomena and CALLISTO uses a radio telescope to monitoring and observing radio solar emissions from the solar corona in the frequency band of 45 to 870 MHz. From both stations, we developed a web data to show and to monitor the obtained results from 2008 to 2015. We also show and report some results of the CRIRP (China Research Institute of Radiowave Propagation) cooperation for the Ionospheric modeling and the APOSOS/APSCO (Asia-Pacific Ground-Based Optical Satellite Observation System/Asia Pacific Space Cooperation Organization) project for monitoring DEBRIS phenomena, satellites orbits and asteroids warning alerts from the Space Observation Center (COE) located in Huancayo, Peru.

S7P15

Analisis of Schumann resonance station data in Mexico during geomagnetic events.

M. Pazos (UNAM, Mexico), B. Mendoza (UNAM, Mexico), P. Sierra (AMA-CITMA, Cuba), E. Endrade (UNAM, Mexico), D. Rodriguez (UNAM, Mexico).

Abstract. We analyzed the first four modes of the Schumann resonance frequencies f1 (7.8 Hz), f2 (14.3 Hz), f3 (19.6 Hz), f4 (25.9 Hz) and their respective amplitudes during strong geomagnetic storm events in 2015 and 2017, using data of the Schumann Resonance Station in Coeneo, Mexico. The amplitudes of these frequencies show a decrease during the days of the geomagnetic storm. These results might indicate that Schuman resonances could be affected by space weather.

S7P16

Ionospheric response to the geomagnetic storm on 2nd October 2013:Longitudinal chain analisys over the American sector

M.G. Molina 1,2,3, N. Ellahony 4, U. Apponi 5, O. Ming 6, Y. Xiao 6, C. Amory-Mazaudier 7 1 Laboratorio de Telecomunicaciones, Dpto. de Electricidad, Electrónica y Computación, Facultad de Ciencias Exactas y Tecnología (FACET), Universidad Nacional de Tucumán (UNT). gmolina@herrera.unt.edu.ar 2 Dpto. de Ciencias de la Computación, FACET-UNT 3 Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) 4 Space Weather Monitoring Center (SWMC), Helwan University, Ain Helwan 11795, Egypt. 5 SpaceEarth Technology S.R.L., Istituto Nazionale di Geofisica e Vulcanologia spin-off, Via di Vigna Murata605,00143,Rome, Italy. 6 China Research Institute of Radiowave Propagation, N36 XianShan Dong road, ChengYang district, Qundao, People's Republica of China. 7 University Paris VI, LPP, Paris, France, 3 Lab-STICC/UMR CNRS, Brest, France

Abstract. The ionosphere is part of the upper atmosphere of the earth that has a direct in pact on telecommunications and modern human activities. Thus, the knowledge of the ionosphere conditions and variations is very important. Ionosphere conditions have to be considered in order to perform corrections or other forms of mitigation strategies over degradation in telecommunications, both sub-ionospheric and trans-ionospheric , when severe disturbances occur. . In this work we study the impact of a space weather event forcing to response in the ionosphere. Using several data sources we study the development of a magnetic storm on 2nd

October 2013 with a sudden commencement storm arond 02 UT. The minimun dst reached -72 nT at 07 UT after that, a long recovery face is observed. We selected the longitudinal chain over the American sector to analyze the impact of the storm over the ionosphere. We primaly used vertical electron content (vTEC) from GNSS data to observe the storm consequences over the ionosphere. The preliminary results showed an ionospheric storm moving from south to north with a significant enhancement on vTEC. We analyzed several stations covering from high to equatorial latitudes on both hemispheres. We also observed the horizontal component H of the Earthś magnetic field exhibiting a behavior that is opposed to the regular one.

S7P17

Space Weather Monitoring: challenges in data managment

Namour, Jorge; Torres Peralta, Ticiano; Ruiz, Myriam Noemí del Valle; Molina, María Graciela; Fagre, Mariano; Miranda Bonomi, Fernando

Abstract. Modern society relies heavily on electronic and telecommunications devices that are critically vulnerable to Space Weather effects. Space Weather events are originated in the Sun-Earth system and may have the ability to distort high frequency radio signals, satellite based communications, precise positioning based on satellite constellations, and in some latitudes, can affect power grid distribution systems and even human health in space. So that, a Space Weather monitoring system can benefit different scientific and socio-productive sectors that are affected by adverse Space Weather effects. Currently, there are numerous world wide databases about solar observations, solar wind, magnetic and atmospheric data. Data sources vary from raw data resulting of in situ and remote measurements, preprocessed data and also as a result of simulations. Another important feature about space weather data is time and space scales. A CME can take three days to travel 1 AU from the sun to the earth, but its effects in the upper atmosphere can occur in a scale of hours and kilometers. The coupling and analyzing this data can be very challenging. In addition, in Argentina and in particular at the Tucumán Low Latitude Observatory for Upper Atmosphere there are numerous ionospheric monitoring instruments deployed to study the upper atmosphere. These instruments provide the system with raw data and in some cases with not structured data. All these data sources involve a great amount of data to process with different resolution and diverse data format. Dataset management has special role in any monitoring systems. Obtaining data systematically and with high reliability is a main issue, so it is important to be able to acquire, store and process heterogeneous data efficiently. In this work we propose the development of a space weather monitoring system using the tools of big data, data mining, artificial intelligence and time series processing with the quality to efficiently process multiple heterogeneous data sources in an asynchronous manner using multiple data sources.

S7P18

On a possible geomagnetic signature over extreme precipitation in Tucuman.

Franco Medina (Laboratorio de Física de la Atmosfera INFINOA/CONICET-UNT, Argentina), Teresita Heredia (Laboratorio de Física de la Atmosfera INFINOA/CONICET-UNT, Argentina), Flavia Bazzano (Laboratorio de Construcciones Hidráulicas FACET-UNT, Argentina), Ana G. Elias (Laboratorio de Física de la Atmósfera INFINOA/CONICET-UNT, Argentina) (1) Laboratorio de Física de la Atmosfera, INFINOA (CONICET-UNT), Facultad de Ciencias Exactas y Tecnología, Universidad Nacional de Tucumán (2) Laboratorio de Construcciones Hidráulicas, Dpto. de Construcciones y Obras Civiles, Facultad de Ciencias Exactas y Tecnología, Universidad Nacional de Tucumán (3) Consejo Nacional de Investigaciones Científicas y Técnicas, CONICET

Abstract. The annual maximum daily precipitation over Tucuman (26.8°S, 65.2°W), Argentina, presents long term variations of quasi-periodicities with characteristic timescales greater than a decade. Its possible link to geomagnetic activity measured through the aa index that is directly linked to solar activity variations, is analyzed. A similar behavior is observed with an overall increasing trend in both time series. This trend in the case of precipitation may be due also to the increasing greenhouse gases concentration which is expected to induce an increase in this climate parameter in the studied region. Due to the nature of processes that lead to precipitation, it is hard to distinguish between solar and anthropogenic effects. In consequence the link between precipitation and a solar forcing is highly complex and hard to detect. However, there is some evidence that increased geomagnetic activity intensifies precipitation regimes in tropical zones. In our case, a possible explanation would be the intensification of the zonal flow in the Southern Hemisphere induced by geomagnetic storms and increased solar activity, which would favor the pressure gradient also inducing more precipitation.

S7P19

Criteria for Identifying High-Intensity, Long-Duration, Continuous AE Activity Events Modifying Some Parameters Based On Geomagnetic Indices: A Computational Algorithm

I.C.P. Lamin(FEAU/IPD-UNIVAP,Brazil), V. Klausner(FEAU/IPD-UNIVAP,Brazil), A. Ojeda-González(FEAU/IPD-UNIVAP,Brazil), A. Prestes (FEAU/IPD-UNIVAP,Brazil), V.G. Pillat(FEAU/IPD-UNIVAP,Brazil).

Abstract. The project aims at the study of High Intensity and Long Duration, Continuous AE (Geomagnetic Auroral Eletroject) Activity events (HILDCAAs) and HILDCAAs* (in which * corresponds to the phenomenon HILDCAA more flexible) through the development of the algorithm using the Python software, based on code previously developed by Prestes et al (2017) in MATLAB. The purpose of the new program proposed here is to make the code accessible, because Python is a free tool, and to validate the existing MATLAB program. In addition, the events found in 1998 using Python, according to the new flexibilization adopted, are compared with those obtained by Prestes et al (2017) and Guarnieri et al (2006). Also, this events are associated with the HSS/CIRs (High Speed Streams/ Corotating Interaction Regions).

S7P20

COMPOSITION CHANGES DURING GEOMAGNETIC DISTURBANCES

Gustavo A. Mansilla and Marta M. Zossi 1-Departamento de Física, Facultad de Ciencias Exactas y Tecnología, Universidad Nacional de Tucumán. Av. Independencia 1800, (4000) San Miguel de Tucumán, Argentina. 2-Consejo Nacional de Investigaciones Científicas y Técnicas. Godoy Cruz 2290, CABA, Argentina.

Abstract. Studies of ionospheric disturbances caused by geomagnetic storms are studied since several decades ago. They constitute an important subject of the space weather because cause significant disturbances in technological systems which depend on transionospheric communications, in the static or dynamical positioning with satellites, among others. Increases or decreases of the Total Electron Content TEC and/or peak electron density of the F2 layer NmF2 with respect to quiet magnetic conditions can be observed during geomagnetic storms. It is well known that decreases in TEC or NmF2 (called negative disturbances) are correlated with an increase in the N2/O ratio, which is attributed to an increase in the molecular nitrogen N2 and practically no change in the atomic oxygen O. Using the DE-2 satellite data at F2 region heights, we analyze the changes observed in the molecular nitrogen and atomic oxygen densities during storms occurred in 1982. The results show that both N2 and O increase during storm periods but N2 increase more than O. An order of magnitude of the relative deviations has been calculated. Although data used are rather old, they are useful because they are one of the few in situ measurements that have been made. That permits to study with precision the ionospheric and thermospheric responses to geomagnetic storms.

S7P21

Evidences of GLE Occurrence by some Planetary Magnetospheric Connections through IMF

Eduardo del Pozo García and Francisco González Vertía. Institute of Geophysics and Astronomy

Abstract. The distribution of GLE occurrence around each nearly planetary alignment with Mercury,Jupiter and Saturn are presented, and some effects are analyzed: The GLE frequency around Sun-Mercury-Earth alignment shows an increase from 40 to 30 days before the alignment time, and a high increase to 20 to 30 days after the alignment time. The GLE frequency around Sun-Earth-Jupiter alignment shows a large increase from 150 to 120 days before Sun-Earth-Jupiter alignment time, which is time coincident with [Timofeev, V. E.: 2003] magnetic line connections results between Jupiter and Earth magnetospheres of about 156 days before alignment. Also, a large increase takes place from 120 to 160 days after the alignment time. The GLE frequency around Sun-Earth-Saturn alignment shows a large increase from 80 to 40 days before the alignment (fig.4) and a low GLE occurrence around alignment, and a cyclical behavior around 80-120 days interval. Additionally, was determined: The distribution of GLE occurrence around each nearly Earth perihelion shows increments about 50 days before perihelion and 50 days before aphelion To each planet: Mercury, Jupiter and Saturn the declination values in equatorial geocentric coordinates at GLE time indicates the major GLE occurrence

when one of the Earth poles is inclined toward these planets. The Mercury, Jupiter and Saturn declination values in equatorial geocentric coordinates are approximately values at GLE time and at alignment time to each planet. These effects put in evidence the magnetosphere connections over active regions at Sun, according to current interplanetary magnetic field sectors. Thus, particles from their magnetospheres and possible deflected cosmic rays, increase theenergetic particle flux over current Sun active regions, and gradually enhance theirmagnetic complexity, and a time after intensificate a solar proton event in progress ortrigger a GLE.

S7P22

Comparing Distribution Functions for Approximating Dst Variations during Geomagnetic Storms

M. C. Damas (CUNY/Queensborough Community College, USA)

Abstract. In this study, the Disturbance Storm Time (Dst) profile of geomagnetic storms is approximated using two probability distribution functions (PDFs): gamma and lognormal. Profiles of several storms are fitted and although both PDFs tend to approximate the main phase of storms reasonably well, the gamma distribution function tend to approximate the recovery phase much better. Further analysis also shows that the gamma distribution function is also a much better fit than the lognormal distribution for storms caused by ICMEs as opposed to CIR storms. This may due to CIR storms long duration recovery phases that can sometimes last days to weeks. More storms are being added to this study to further support our analysis and conclusion. Methods used and results will be discussed, including space weather predictions.

S7P23

Study for the qualification of the magnetic data used form deriving index K South American

A. V. Bilibio (DIDAE/INPE, Brazil), C. M. Denardini (Embrace/INPE, Brazil), S. S. Chen (DIDAE/INPE, Brazil), J. Moro (CRS/INPE & NSSC/CAS, Brazil-China), L. C. A. Resende (Embrace /INPE, Brazil), P. F. Barbosa Neto (Embrace/INPE, Brazil), G. A. S. Picanço (DIDAE/INPE, Brazil), T. O. Bertollotto (DIDAE/INPE & UNITAU, Brazil), P. A. B. Nogueira (IFSP, Brazil), N. J. Schuch (CRS/INPE, Brazil).

Abstract. In the present work, we summarize the results obtained for the study for the qualification of the magnetic data used form deriving the South American K (Ksa) index, based on mathematical and statistical techniques. The Ksa index was developed by the Brazilian Studies and Monitoring of Space Weather (Embrace) Program of the National Institute for Space Research (INPE). It uses magnetometer data collected by the Embrace Magnetometer Network (Embrace MagNet), which includes a magnetic station installed at the Vassouras Magnetic Observatory, Brazil (VSS, 22.4° S, 43.6° W). Therefore, we compared the magnetic data collected by the Embrace MagNet station with the same data collected by a magnetometer of the International Real-time Magnetic Observatory Network (Intermagnet) chain, installed at the same site. The results are presented and discussed in terms of an analysis of the quality

and precision of the magnetic data of the Embrace MagNet and of used methodology.

S7P24

Mexican Observations of the Low Latitude Red Aurora During the 1859 Carrington Geomagnetic Storm

A. Gonzalez-Esparza (LANCE/IGF-UNAM, Mexico), M.C. Cuevas-Cardona (Universidad Autonoma del Estado de Hidalgo, Mexico)

Abstract. On the first of September of 1859 occurred the most intense solar storm that has been documented in the recent history. This storm is known as the Carrington event. On the previous days (28th of August) there were reports in Europe and North Amer- ica of extended auroras and magnetic perturbations, pointing an interval of a few days of very high solar activity affecting the Earth's environment. That morning (1st of September) Richard Carrington and Richard Hodgson observed in England, independently, for the first time, an intense white light solar flare at around 11:15 UT. About 17 hours af- ter this solar event there were stronger geomagnetic field perturbations and a very ex- tended aurora which covered unusual low latitudes. The red auroral display on the second of September was reported in regions where this kind of phenomena are very rare, like in Cuba and Hawaii. However, until now, it was not known that it was also registered in Mexico too. At that time Mexico was in civil war and there were very difficult conditions to establish astronomical and magnetic observatories. Although there were already well established educational institutions funded in the XVIII century, the polit- ical conditions prevented the funding of the observatories. Nevertheless, the natural phenomenon was observed between 7:00-8:00 UT and reported to a local newspaper from five different locations.

S7P25

Geomagnetically induced currents measured at low latitude during the space disturbances on 07-08 September, 2017

L. R. Alves (Instituto Nacional de Pesquisas Espaciais (INPE/MCTI), Sao Paulo, Brazil) R. Caraballo (Facultad de Ingenieria (Udelar), Montevideo, Uruguay) G. A. Hartmann (Instituto de Geociencias, Universidade Estadual de Campinas, Campinas, Brazil) C. S. Barbosa (Observatorio Nacional (ON/MCTI), Rio de Janeiro, Brazil)

Abstract. Geomagnetically induced currents (GICs) were first described by W. H. Barlow in 1849 as anomalous currents in telegraphic wires. These phenomena are currently understood as a ground effect arising from a chain of events in the Sun-Earth system. They are mainly observed at power networks and their amplitudes are controlled by a combination of geophysical conditions and network parameters. The magnetic disturbances detected on the ground came from the coupling of highly disturbed solar wind plasma propagating through the interplanetary medium which eventually impinges on the Earth's magnetosphere. The perturbed magnetosphere-ionosphere coupling can produce intense currents systems that can induce strong geoelectric fields at the Earth's surface, which in turn generate currents that can flow through grounded technological infrastructure as it offers low-resistance pathways. The available GIC datasets show that at high latitudes GIC records can reach hundreds of

Amperes, leading to failure at transformers, such as reported at Hydro-Quebec, in Canada in 1989 and at Malmo, in Sweden in 2011. Due to the higher GIC intensities recorded at auroral regions, the GIC data at mid-to-low latitudes had been scarce. However, more recent works have shown that GIC can reach tenths of Amperes during intense sudden commencement and at the peak of geomagnetic storms. Despite intense geomagnetic storms are rare during the solar cycle declining phase, on the period of 04-06 September 2017 solar activity was increased due to the evolution of the active region 2673, thus it was observed two CME propagating Earthwards. The geomagnetic storm initiated at the beginning of 07 September evolving to one day long main phase as high as -140 nT. Besides the geomagnetic disturbances due to the ICME shock, also at least two intense solar flares (at 06 and 10 September 2017) causing spike disturbances in the geomagnetic field measured at the ground. Considering the relevance of the intense space disturbance during the solar cycle declining phase, in this work, we use de Lethinen-Pirjola model to calculated GIC at low latitude power network located at Brazil and Uruguay during the period of the disturbance. The GIC results obtained during the solar cycle declining phase, compared to the long-term survey available at literature, are used to verify the significance of GIC intensity observed at low latitude measured after the ICME disturbance and also with the flare geomagnetic disturbance registered after a long-term of solar cycle condition.

S7P26

SPARTOS: a forecasting tool for extreme space weather events

P. Corona-Romero (LANCE/IGEOF-UNAM, Mexico), A. Perez-Alanis (PCT/IGEOF-UNAM, Mexico), E. Aguilar-Rodriguez (LANCE/IGEOF-UNAM, Mexico), J.A. Gonzalez-Esparza (LANCE/IGEOF-UNAM, Mexico), J.C. Mejia-Ambriz (LANCE/IGEOF-UNAM, Mexico), V. de la Luz (LANCE/IGEOF-UNAM, Mexico), M. Sergeeva (LANCE/IGEOF-UNAM, Mexico), L. X. Gonzalez (LANCE/IGEOF-UNAM, Mexico)

Abstract. SPArToS (Spanish acronim for Solar Storms Arrival Prediction System) is an early-alert system to predict the arrival of coronal mass ejections and associated shock waves to Earthś neighborhood. Our system provides to the coustumer the time and date at which a potentially dangerous solar storm (CME and shock) would arrive to the Earthś neighborhood. The core of SPArToS is is built on two pillars: (1) An analytic physics-based model called P̈iston-Shock;̈ which simultaneously approximates the trajectoryes of CMEs and associated shocks as well. (2) And an empirical tendency that relates the initial inertial of solar stomrs with the conditions in which solar storms evolve. Although the development of SPArToS formaly began by 2016; since the middle of 2015 the Piston-Shock model is used as an experimental tool for arrival-forecasting of CME/shocks. Since then up to now, the modelś predictions have been regularly used in SCiESMEXś spaceweather reports (weekly and special issues).

S7P27

Reconstruction of ICMEs/Shocks trajectories using Type-II Radio Bursts

P. Corona-Romero (LANCE/IGEOF-UNAM, Mexico), A. Perez-Alanis (PCT/IGEOF-UNAM, Mexico), E. Aguilar-Rodriguez (LANCE/IGEOF-UNAM, Mexico), J.A. Gonzalez-Esparza (LANCE/IGEOF-UNAM, V. de la Luz (LANCE/IGEOF-UNAM, Mexico), Mexico), J.C. Mejia-Ambriz (LANCE/IGEOF-UNAM, Mexico), M. Sergeeva (LANCE/IGEOF-UNAM, Mexico), L. X. Gonzalez (LANCE/IGEOF-UNAM, Mexico)

Abstract. We present a physical methodology for reconstructing the trajectory of interplanetary shocks using Type-II radio bursts. This technique calculates the shock trajectory assuming that the disturbance propagates as a blast wave in the interplanetary medium. We applied this blast-wave reconstruction (BWR) technique to analyze eight fast Earth-directed ICMEs/shocks associated with Type-II emissions. The technique deduces a shock trajectory that reproduces the Type-II frequency drifts and calculates shock onset speed, shock travel time, and shock speed at 1 AU. The BWR results agreed well with the Type-II spectra, with data from coronagraph images, in-situ measurements, and interplanetary scintillation observations. Perturbations in the Type-II data affect the accuracy of the BWR technique. This methodology could be applied to track interplanetary shocks causing Type-II emissions in real-time and to predict the shock arrival time and shock speed at 1 AU.

S7P28

Study of disturbances in the interplanetary medium and its geoefectivity using local data.

Maria Elena Muñiz Sanchez (IGA, Cuba), Ismael González Metauten(IGA, Cuba), Lyhen Sanchez Suárez (IGA,Cuba)

Abstract. The spatial climate deals with the study of the conditions in the Sun-Earth complex as a consequence of solar activity and the risks derived for people, electrical and electronic systems, satellites and telecommunications. Therefore one of the needs resulting from these situations is the forecast of some geophysical parameters for different time scales. This scientific aspect is approached in this paper using the generalized least squares method for the forecast of the Dst geomagnetic index, and the parameter f0F2, very dependent on the geomagnetic activity. In this work, three methods for the variations assessment that occur in the geomagnetic field components are analyzed during the occurrence of geomagnetic disturbances recorded locally. Analyzing here the Dst index variations, the Sq (solar quiet variations) and the solar daily variations SD in the local components of the geomagnetic field. Comparing the measurements made for 3 geographic zones with approximately similar geomagnetic latitude as is the case of the geomagnetic station of San Juan, Puerto Rico; Havana Cuba; and El Ebro, Spain and as control one of geomagnetic latitude different as to station of Rome, Italy.

S7P29

ESTIMATE OF THE AMPLITUDE OF GEOMAGNETICALLY INDUCED CURRENTS (GIC) AT DIFFERENT PLACES IN BRAZIL DURING MAGNETIC STORMS OCCURRED IN THE YEAR 2015

K. Espinosa (INPE-Brazil), A. Padilha (INPE-Brazil), L. Alves (INPE-Brazil).

Abstract. Geomagnetic induced currents (GIC) detected on the Earthś surface are related to extreme solar events and may represent a significant danger to technological systems installed both in space and in the ground. Its effects are relatively well studied in auroral and mid-latitude regions, but there are still few studies in low latitudes and near the magnetic equator. To evaluate its effects in the low latitude region of South America and thus contribute to the development of new mechanisms that may help to minimize its possible impact, the intensity of the GIC in four locations in the Brazilian territory is here evaluated during four geomagnetic storms that occurred during the year 2015. Geomagnetic field variation data recorded by fluxgate magnetometers of the Brazilian Space Weather program at INPE (EMBRACE) are available during these storms. Using information from the electrical conductivity distribution below each magnetic station, geoelectric field variations were derived for the period of the magnetic storms. Subsequently, GIC values were estimated using the Lehtinen-Pirjola (LP) engineering model and available information from a 500 kV transmission grid located in Central Brazil (around the Furnas substation node in Itumbiara, State of Goiás). After validating the numerical calculations comparing with the GIC data measured at this substation, the electric power transmission grid at Itumbiara was hypothetically shifted to the stations where measurements of the geomagnetic field are available. The maximum GIC amplitude estimated by the LP model was about 8A during the main phase of a magnetic storm on June 21 (Dst = -204 nT) at a station in the center-west Brazil. Although this station is affected by the diurnal currents of the equatorial electrojet, the comparison with the other storms showed that, besides the large dH/dt of this storm, the main responsible for the GIC is the high resistivity of the rocks below this station.

S7P30

Analysis of possible perturbations of the height temperature profile at tropospheric and stratospheric levels at the Antarctic Peninsula during intense and long-lasting geomagnetic storms

V.E. López (SMN / UBA-FCEN-DCAO, Argentina) A.M.Gulisano (IAA-DNA / CONICET-UBA-IAFE / UBA-FCEN-DF, Argentina) S.Dasso (CONICET-UBA-IAFE / UBA-FCEN-DF / UBA-FCEN-DCAO, Argentina)

Abstract. The climatology of the height temperature profile at tropospheric and stratospheric levels at the Argentinean Marambio station in the Antarctic Peninsula has been assessed. It is planned the installation of a Water Cherenkov particle Detector (WCD) in this site. This detector will be part, as an Antarctic node, of the LAGO network (Latin American Giant Observatory). This node site location assures a low rigidity cut-off and will allow the study of the cosmic rays flux at ground level and the monitor of space weather conditions through its solar modulation. In this work, we analyze the temperature altitude profile in a range covering the upper troposphere, and the low-mid stratosphere, for quiet conditions and during five major geomagnetic storms. We analyze the seasonal climatology of temperatures and investigated possible variations during these events, analyzing the possibility of physical and chemical effects. In order to make a detailed description of the mentioned atmospheric levels, we analyze data obtained from balloon surveys measured at Marambio by the National Meteorological Service (Servicio Meteorológico Nacional, SMN) of Argentina from 1998 to 2016. We present the

seasonal behavior, of the temperature variable environment from 8 to 40 km throughout the studied period, and analyze the median and quartile statistics during five geomagnetic storms: one in summer and the others in winter, with radiosonde available on the date of the event, extending the analysis period to seven days prior to the occurrence of the storms and to the fourteen subsequent days. On the other hand, for the geomagnetic storms with soundings not available at the date of occurrence of the event, we quantified the heating or cooling, comparing the previous days with the days after the storms considering 31 cases: Summer (2), Autumn (10), Winter (8) and Spring (11). The results of this study will be useful to better understand the possible events of Space Weather and, on the other hand, will also be very useful to make atmospheric corrections to the extended shower to determine the flow of cosmic rays from ground level observations, with particle the particle detector of LAGO at Antarctic, and thus to study the solar modulation of the cosmic ray flux and solar GLE (Ground Level Enhancements) events, in the site with the lowest rigidity cut off of this observatory.

S7P31

Analysis of Pc3 and Pc4 magnetic pulsations in the South Atlantic Magnetic Anomaly region

A.Piassi(INPE, Brazil), L.Alves(INPE, Brazil), A.Padilha(INPE,Brazil)

Abstract. Much of South America is affected by the South Atlantic Magnetic Anomaly (SAMA), characterized by the minimum intensity of the geomagnetic field on the Earthś surface. Due to the presence of this anomaly, there is an increase in particle precipitation from the internal radiation belt that surrounds the planet, generating different aeronomic effects. In this study, we investigated the effect of this process on the amplitude of Pc3-Pc4 magnetic pulsations as a function of the distance from the center of the anomaly. Data from highly sensitive fluxgate magnetometers (1 Hz acquisition rate) operated by the Brazilian Space Weather Program (EMBRACE) and INTERMAGNET in several locations in South America are used in the analyzes. Four magnetic storms were selected during the year 2015 and data from 7 days before (quiet period) and 7 days after each storm (most disturbed period, including the recovery phase) were filtered in the Pc3-Pc4 intervals. The results show a permanent amplification in the pulsation amplitude at the station closest to the center of the anomaly. It is proposed that this amplification is linked to the increase of the ionospheric conductivity in SAMA, caused by the enhanced particle precipitation from the radiation belt. Also, this effect is continuous in the anomaly region, being valid for both low level geomagnetic activity (quiet days) and high level geomagnetic activity (disturbed days).