Abstract Title

Monitoring rain events in Chaco Xerophytic forest by SMOS and AMSR-E

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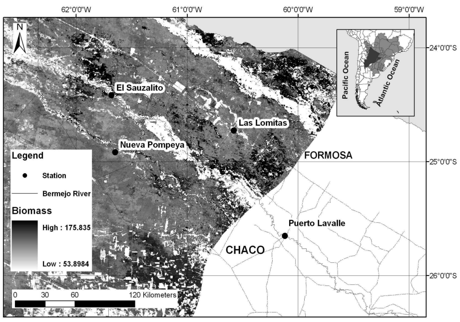
Abstratc Text

The objective of this work is to investigate the capability of SMOS and AMSR-E in monitoring rain events occurred in Chaco forest The particular region selected by us spans the North-East of Argentina In general, it is covered by continuous and deciduous forest, which is xerophytic, that is adapted to leave in an arid environment.

At L band, both emissivity and Polarization Ratio are moderately sensitive to Soil Moisture, although with an appreciable dispersion.

The forward model follows the TB trends, but with a general underestimation, which is particularly evident at H polarization and with dry soil.

Related to this, the retrieved SM generally follows the ECMWF trend and the rainfall patterns, but SM is underestimated in dry conditions.



Selected 0.5°X0.5° areas:

1) Las Lomitas: Forest with ~100 t/ha (some deforestation)
2) Puerto Lavalle: 30% of forest cover
3) Nueva Pompeya: Forest with ~120 t/ha
4) El Sauzalito: Forest with ~120 t/ha

All the 4 sites have the same ECOCLIMAP classification (used by the SMOS algorithm): Forest with a maximum yearly LAI of 3

Figure 1: Map of the study area indicating the main geographical landmarks. Superimposed is a biomass map of the area derived using optical images, ancillary data and in situ measurements.

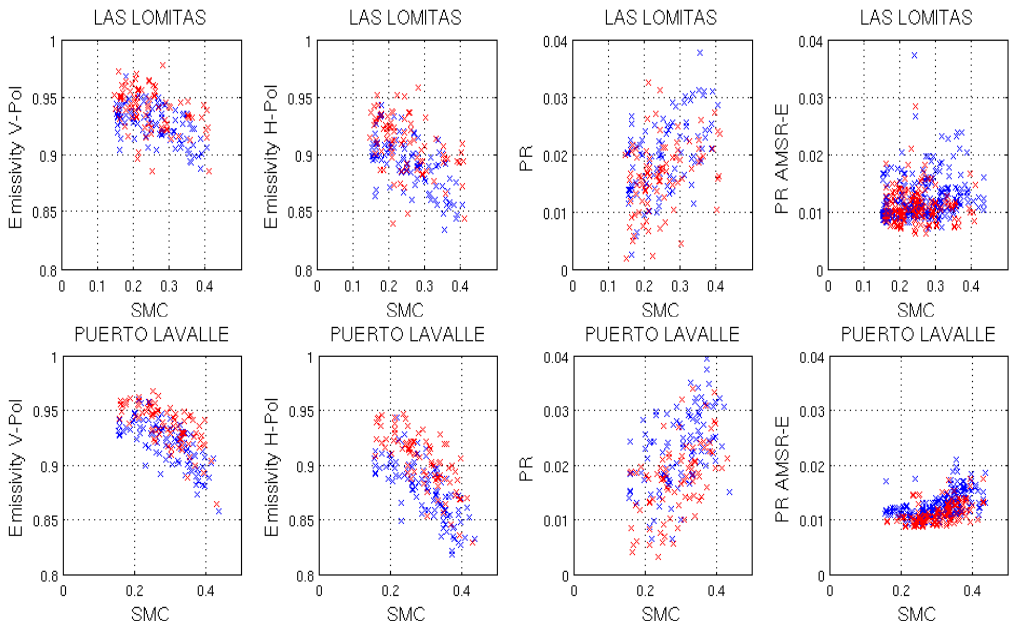


Figure 2: Trends of emissivity and Polarization Ratio (PR) vs. Soil Moisture (ECMWF estimate) **(LAS LOMITAS, PUERTO LAVALLE), * Spring, Summer, * Autumn, Winter,** SMOS signatures averaged in the range 37.5°-47.5

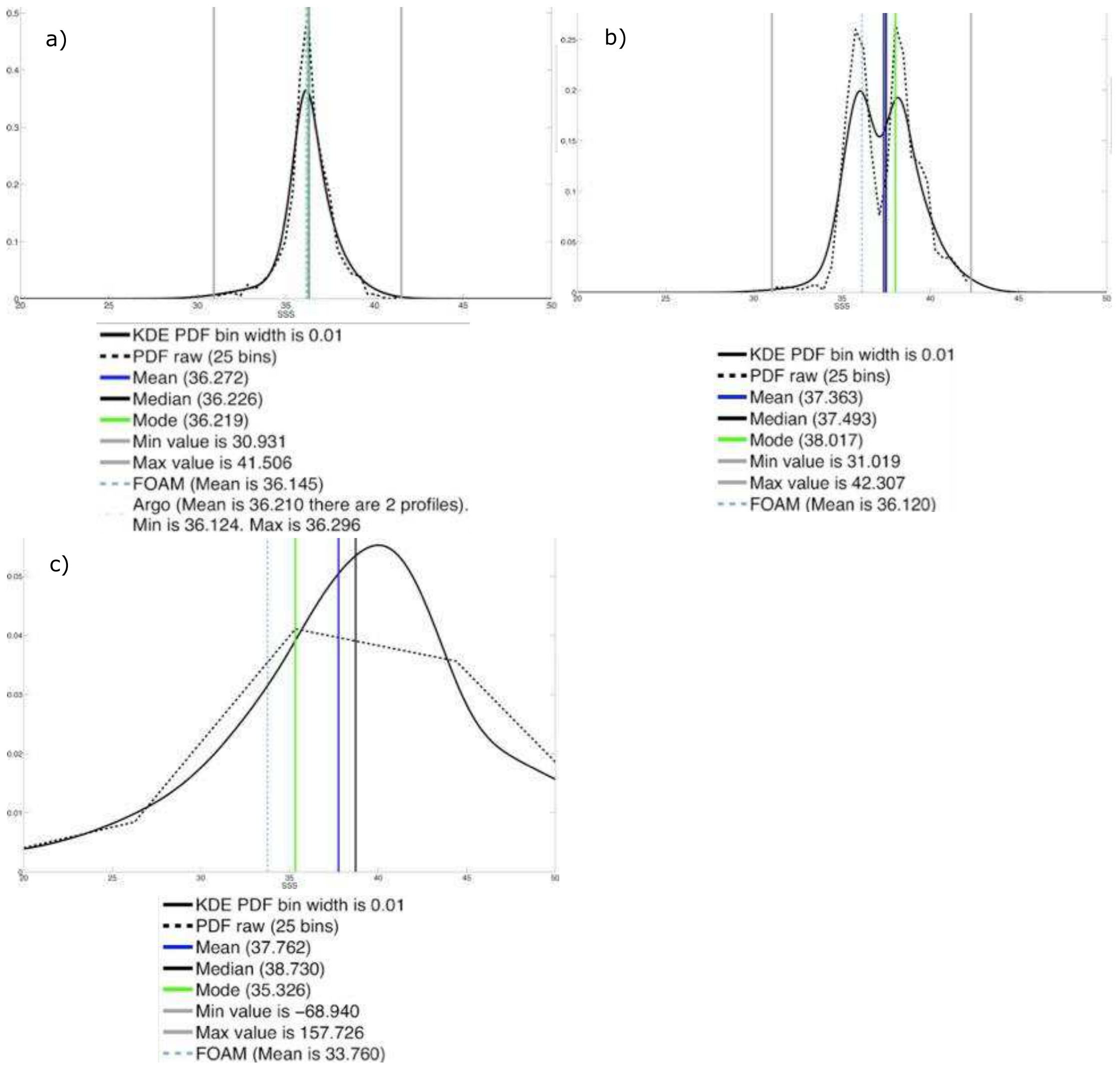


Figure 1 Examples of distributions of SMOS L2 data within a given grid cell for July 2011 ascending passes for 1º x1º cells where the southwestern corner is located at a) -35ºW, 39º N, b) -35ºW, 0ºN, and c) -40ºW, -60ºS. See text for explanation of legend.

Figure 1a shows the case where the data are unimodal and there is good agreement between the various estimates of SSS. Although the range of SSS values is wide, the majority of data fall within a much narrower range of values. Figure 1b is bimodal and the estimate of SSS from FOAM-NEMO coincides with the lower peak of the PDF whereas the estimates for the L3 product are heavily influenced by the more popular, higher peak. We have yet to investigate the cause of this type of bimodality and it is unknown whether such distributions are less variable if shorter timescale (e.g. 10 days) are used rather than a month. Similarly, using a smaller spatial scale may also result in more homogeneous cells and remove, or reduce, the bimodality. Finally, the distribution in Figure 1c does not support any sensible choice of central tendency as the data are incoherent, covering a wide and unrealistic range of SSS values. This example is located in the Southern Ocean, a region that has already been noted to have reduced reliability of SMOS L2 SSS data due to one or more of the following variables: high wind speeds, cooler water or proximity of sea ice [2].

In a similar way to the inclusion of the error in the KDE PDF described above, it is possible to weight the mean according to the error values. However, we found that the differences between these revised values and the unweighted means were small (~0.07) compared to other differences (i.e. ascending and descending differences). For this reason we have not pursued this approach at this stage.

Error Threshold and out of range

This section is concerned with the choice of a suitable threshold in the associated error in L2 SSS to filter data before producing a L3 product. Figure 2 shows examples of the distributions of errors of SMOS data from ascending and descending passes from all three models. The patterns are the same for both directions and all three models although there are significant differences in the detail. All distributions have a main peak at less than an error of 0.6 psu. In Figure 2a, there is a second mode at an error of ~1 and it is assumed that this is a secondary distribution of errors related to, as yet, unidentified artefacts. For other months in the study period and/or for smaller homogeneous regions the second peak may not be as clear (e.g. Figure 2b).

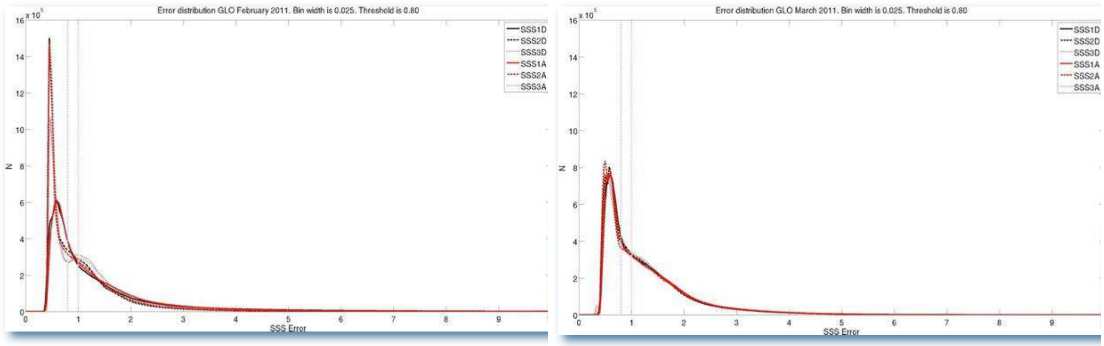


Figure 2 Distributions of error values for a) February and b) March 2011; suggested thresholds are given at SSS errors of 0.8 and 1

Trial L3 Product

The only quality control flag used for the NOC Trial L3 product in this study was to select L2 SSS measurements that are not too close to land (>40 km) [3]. L2 data for the averaging process in this study are filtered as only those SSS measurements where the associated L2 error is less than 1. For each month (February through July 2011), all valid L2 data are gridded onto a 1º by 1º grid over all longitudes and between 60ºS and 60ºN.

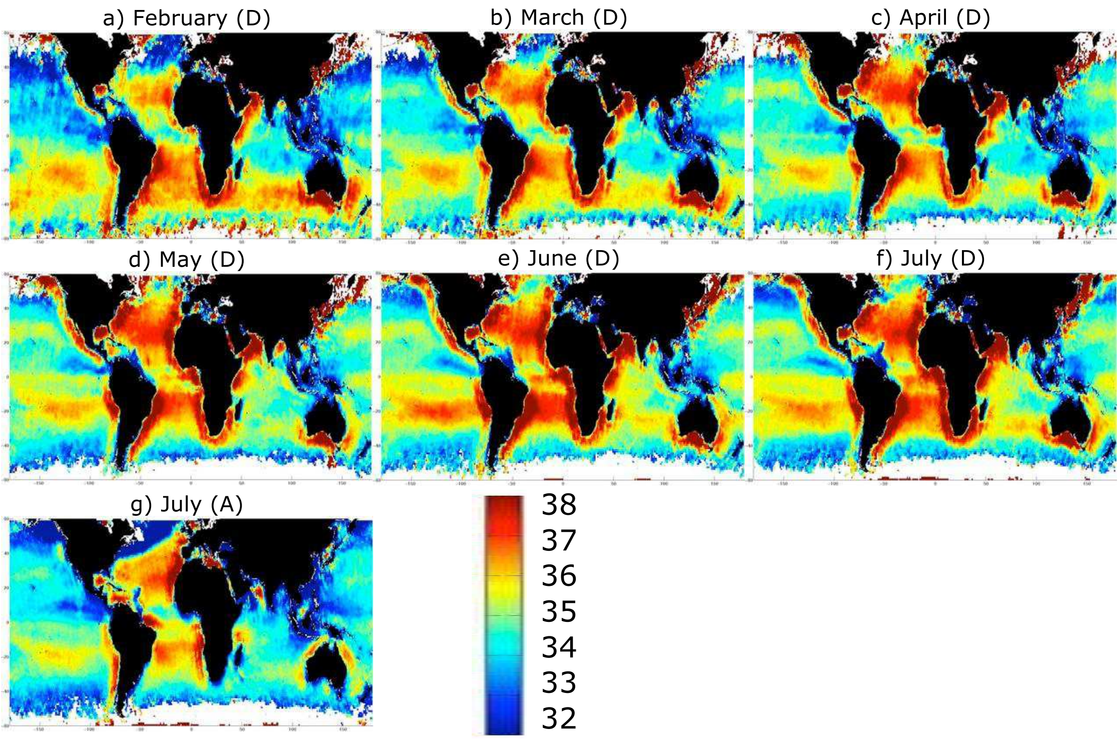


Figure 3 Temporal evolution of NOC Monthly Trial L3 product for a) February 2011 to f) July 2011 for descending passes and g) July 2011 for ascending passes

For this NOC L3 Trial Product the median of all available data is used as this is less sensitive to outliers compared to the mean. All L2 SMOS data in this study were processed using L2 OS Processor Version 03_17 and made available from the ESA ftp server (dpgsftpserver.smos.eo.esa.int).

Data from ascending passes and descending passes are processed separately and examples of the resulting product are given in Figure 3. As detailed in [2] there are temporal variations in ascending and descending passes and this is verified in this study (although not shown here).

Comparison with ocean model forecast output

SSS from FOAM-NEMO has been shown to provide a good representation of *in situ* SSS in the open ocean away from dynamic regions (e.g. Gulf Stream) and as such can be used as a source of validation data for SMOS [2]. Figure 4 shows the differences between the monthly 1º averaged SSS between FOAM-NEMO and the NOC L3 Trial Product. An offset between data from ascending passes and descending passes is clear with SSS from ascending passes being, on average, lower than SSS from FOAM-NEMO (negative values in Figure 4a). SSS from descending passes is marginally higher than SSS from FOAM-NEMO (zero or positive values in Figure 4b). The other obvious features in Figure 4 are the large positive anomalies around coasts: these features result from are a bug in the processing system and are far less clear in the revised processing version (L2 OS Processor Version 05_00).

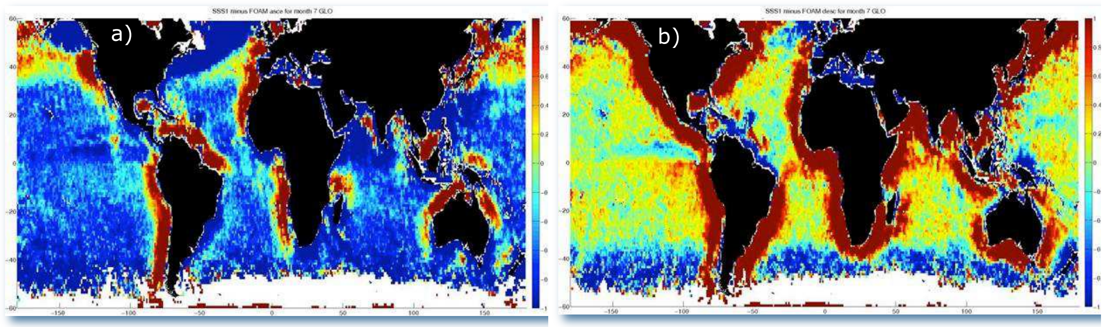


Figure 4 Maps of NOC L3 SSS Trial Product minus SSS from FOAM-NEMO for July 2011 for a) ascending passes, and b) descending passes

Conclusions

We have shown that using the ESA L2 SSS and associated error data provide a simple basis on which to build a reasonable 1º gridded monthly L3 product. The NOC L3 Trial Product works well in the open ocean away from coasts: its use in dynamic regions has yet to be validated. By using the additional information available through quality flags the NOC L3 products will be improved, particularly when the most recent processor version is implemented (Version 05_00).

References:

[1] D. Storkey, E. W. Blockley, R. Furner, C. Guiavarc'h, D. Lea, M. J. Martin, R. M. Barciela, A. Hines, P. Hyder, and J. R. Siddorn, "Forecasting the ocean state using NEMO:The new FOAM system," *Journal of Operational Oceanography,* vol. 3, pp. 3-15, 2010.

[2] C. J. Banks, C. P. Gommenginger, M. A. Srokosz, and H. M. Snaith, "Validating SMOS ocean surface salinity in the Atlantic with Argo and operational ocean model data," *Transactions on Geoscience and Remote Sensing,* In print.

[3] SMOS Team, "SMOS L2 OS Input/Output Data Definition (http://www.argans.co.uk/smos/docs/deliverables/delivered/IODD/SO-TN-ARG-GS-0009_L2OS-IODD_v2.18_101207.pdf)," ICM-CSIC, LOCEAN/SA/CETP, IFREMER18 June 2010 2010.