Kipling was not completely wrong

Esteban R. Reisin and Jürgen Scheer

Instituto de Astronomía y Física del Espacio (IAFE)

CONICET-UBA

Buenos Aires, Argentina

Rudyard Kipling is known to have written:

"OH, East is East, and West is West, and never the twain shall meet"

(although he did not really believe it)

We will show that SABER temperatures over El Leoncito do somewhat depend on observing perspective, but not sooo much...

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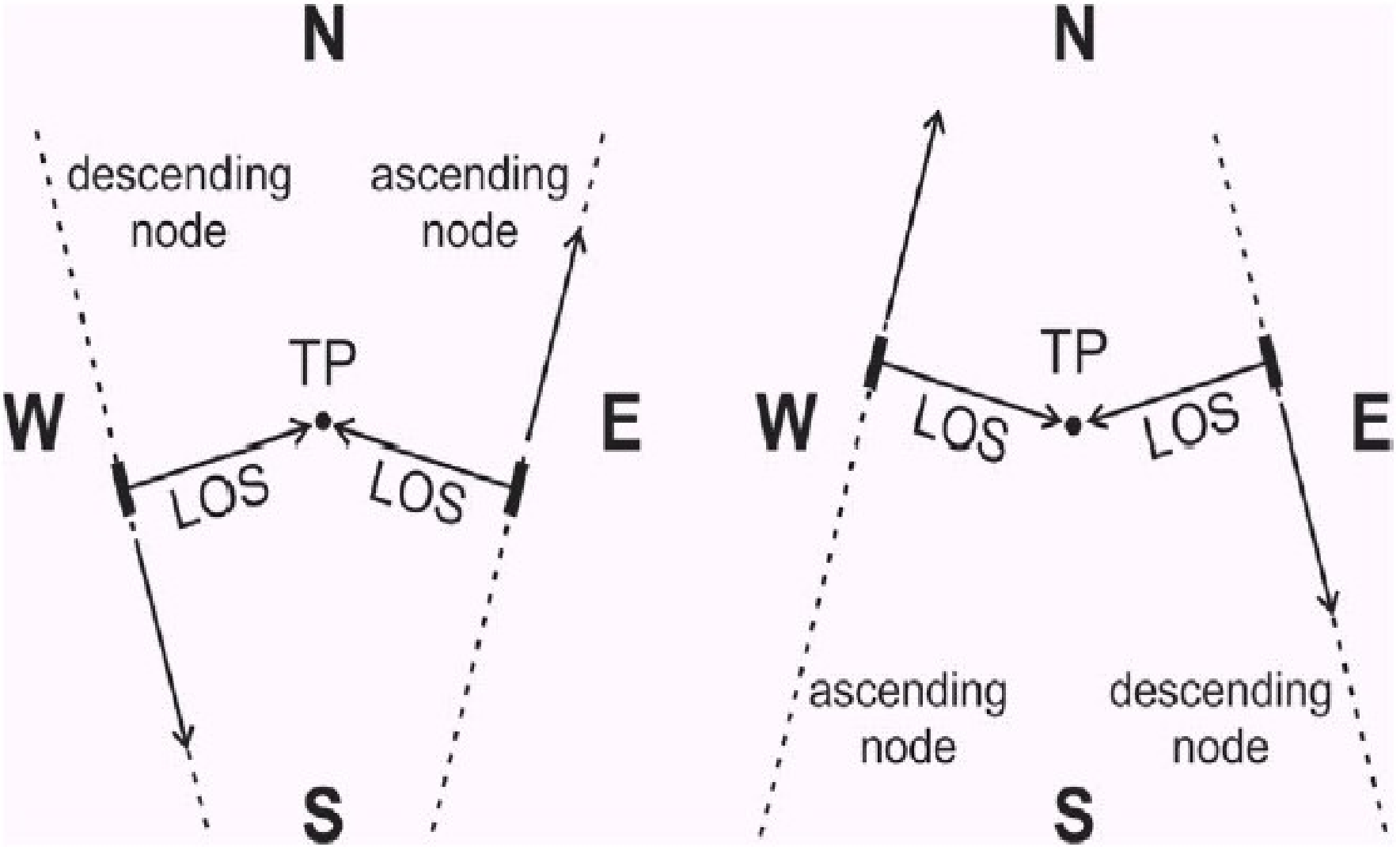
Unexpected East-West effect in mesopause region SABER temperatures over El Leoncito

Esteban R. Reisin*, Jürgen Scheer

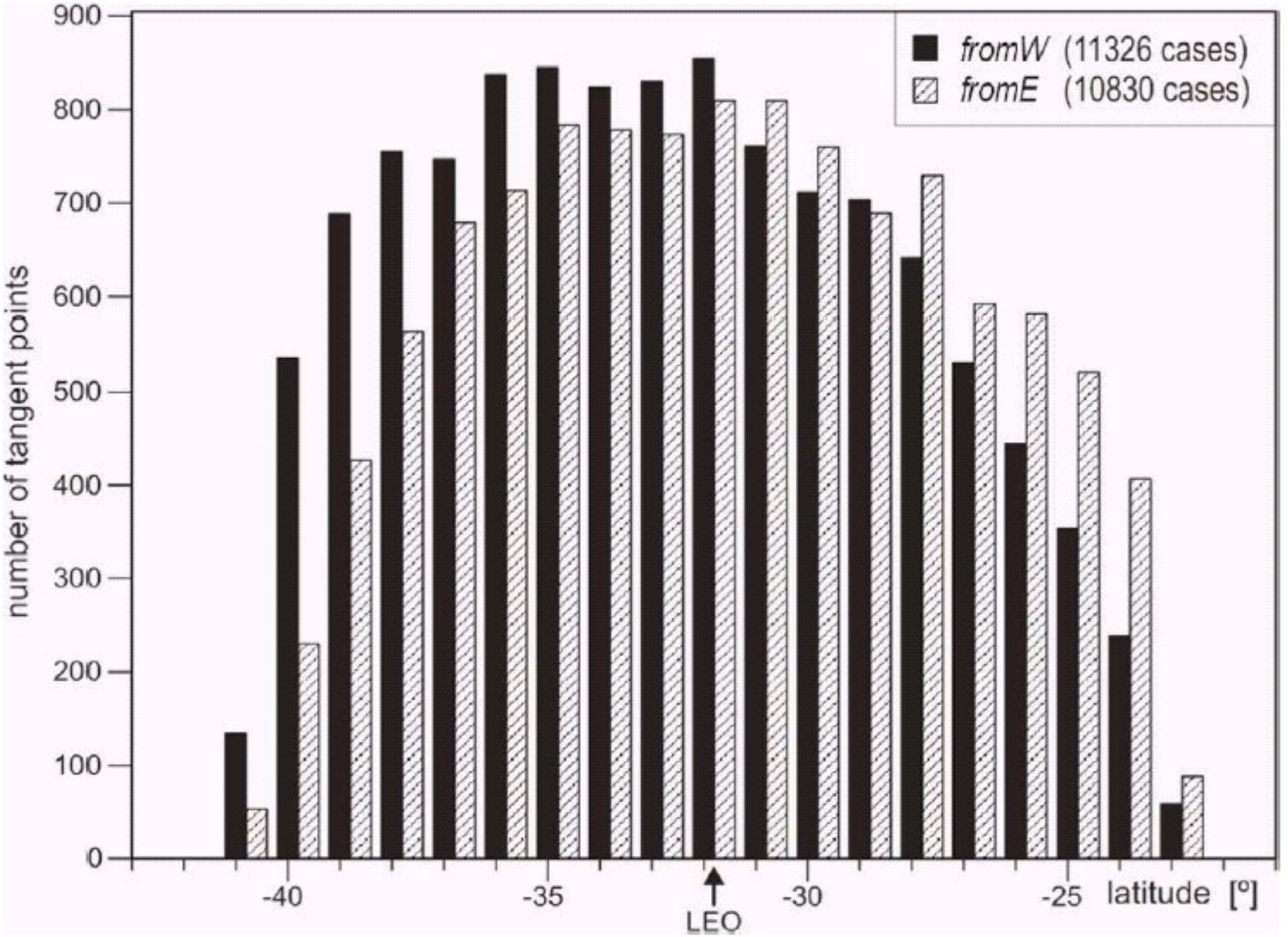
Instituto de Astronomía y Física del Espacio, CONICET - Universidad de Buenos Aires, Buenos Aires, Argentina

SABER overpasses at LEO happen with the TIMED satellite at 2600 km either westwards or eastwards of the tangent point. Since we are only interested in nocturnal data, this depends on the yaw cycle TIMED is in. So, we have...

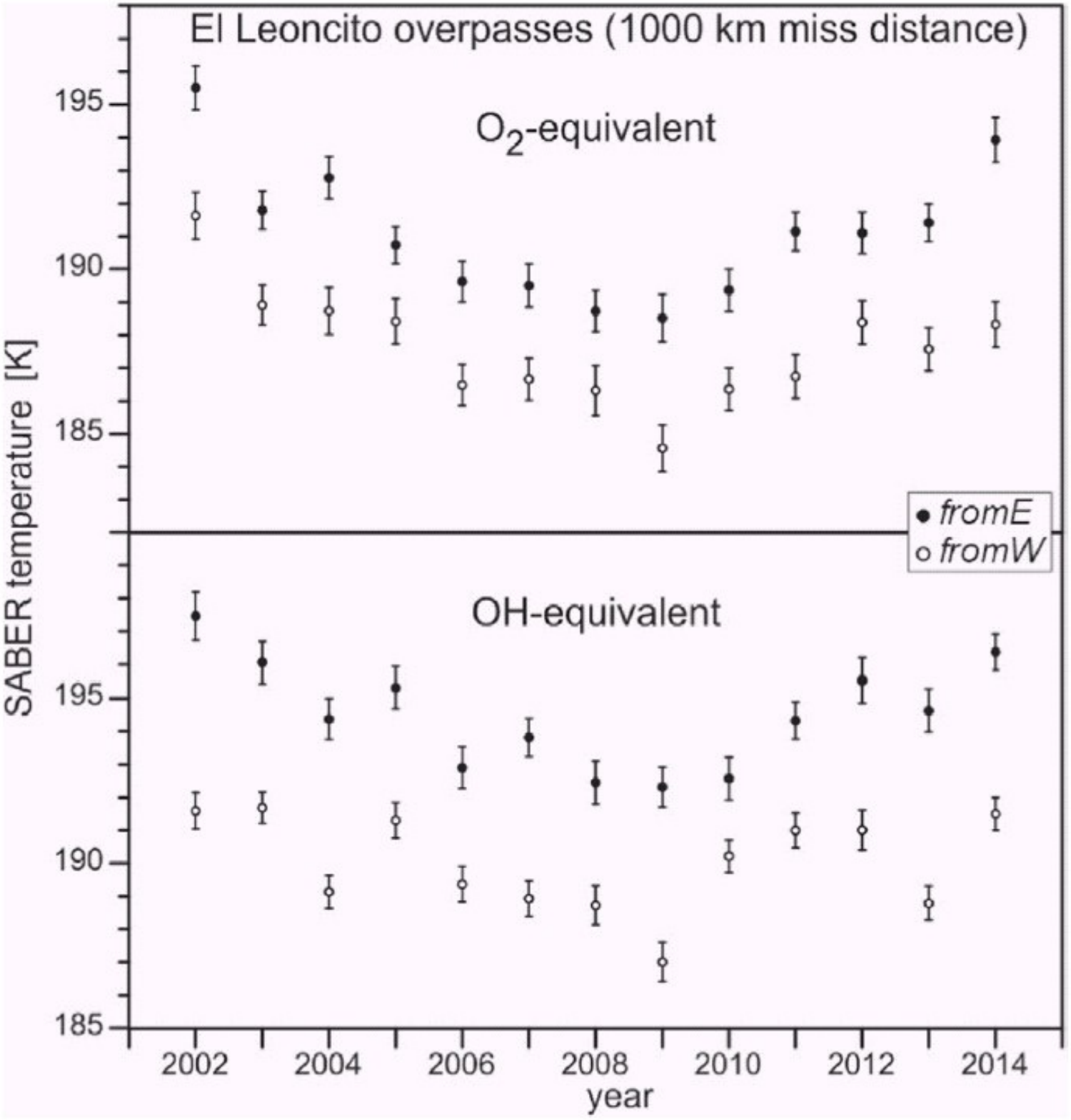


… which leads to these four possible view configurations, according to north- or south-looking yaw phase, and ascending or descending node

Latitudinal distribution of tangent points is rather uniform (though not exactly, but we don't know why)



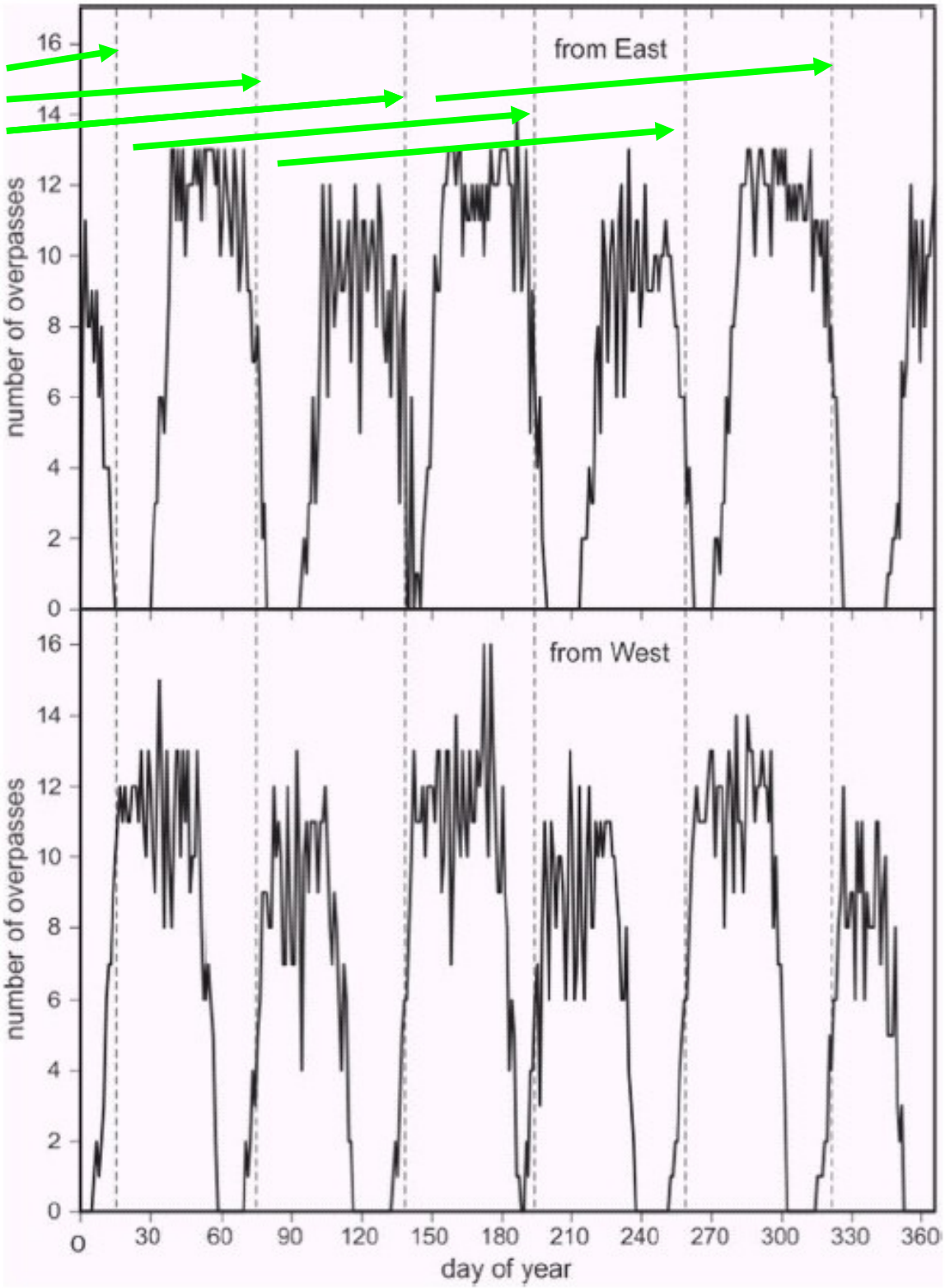
these are the yearly mean temperatures which we get, if we separate views from the East and those from the West



all available SABER overpasses at LEO:

	# fromE	*# fromW*	ΔT (OH) [K]	ΔT (O_2) [K]
2002	181	185	5.86 ± 0.92	3.88 ± 0.97
2003	200	189	4.37 ± 0.79	2.88 ± 0.83
2004	194	193	5.24 ± 0.79	4.04 ± 0.95
2005	194	198	4.01 ± 0.82	2.31 ± 0.89
2006	192	197	3.53 ± 0.83	3.14 ± 0.87
2007	194	190	4.89 ± 0.79	2.85 ± 0.91
2008	195	189	3.73 ± 0.88	2.42 ± 0.99
2009	183	179	5.31 ± 0.85	3.94 ± 1.01
2010	194	188	2.36 ± 0.81	3.01 ± 0.90
2011	197	194	3.33 ± 0.78	4.40 ± 0.88
2012	198	193	4.52 ± 0.90	2.72 ± 0.92
2013	210	194	5.84 ± 0.83	3.84 ± 0.87
2014	198	193	4.86 ± 0.74	5.61 ± 0.97
total	**2530**	**2482**	**4.45 ± 0.23**	**3.46 ± 0.26**

Nominal yaw maneuver dates



These yaw maneuvers imply a 180° turn of the satellite about the local vertical direction. Over the years, this results in these seasonal irregularities in the number of eastward- and westward-looking overpasses

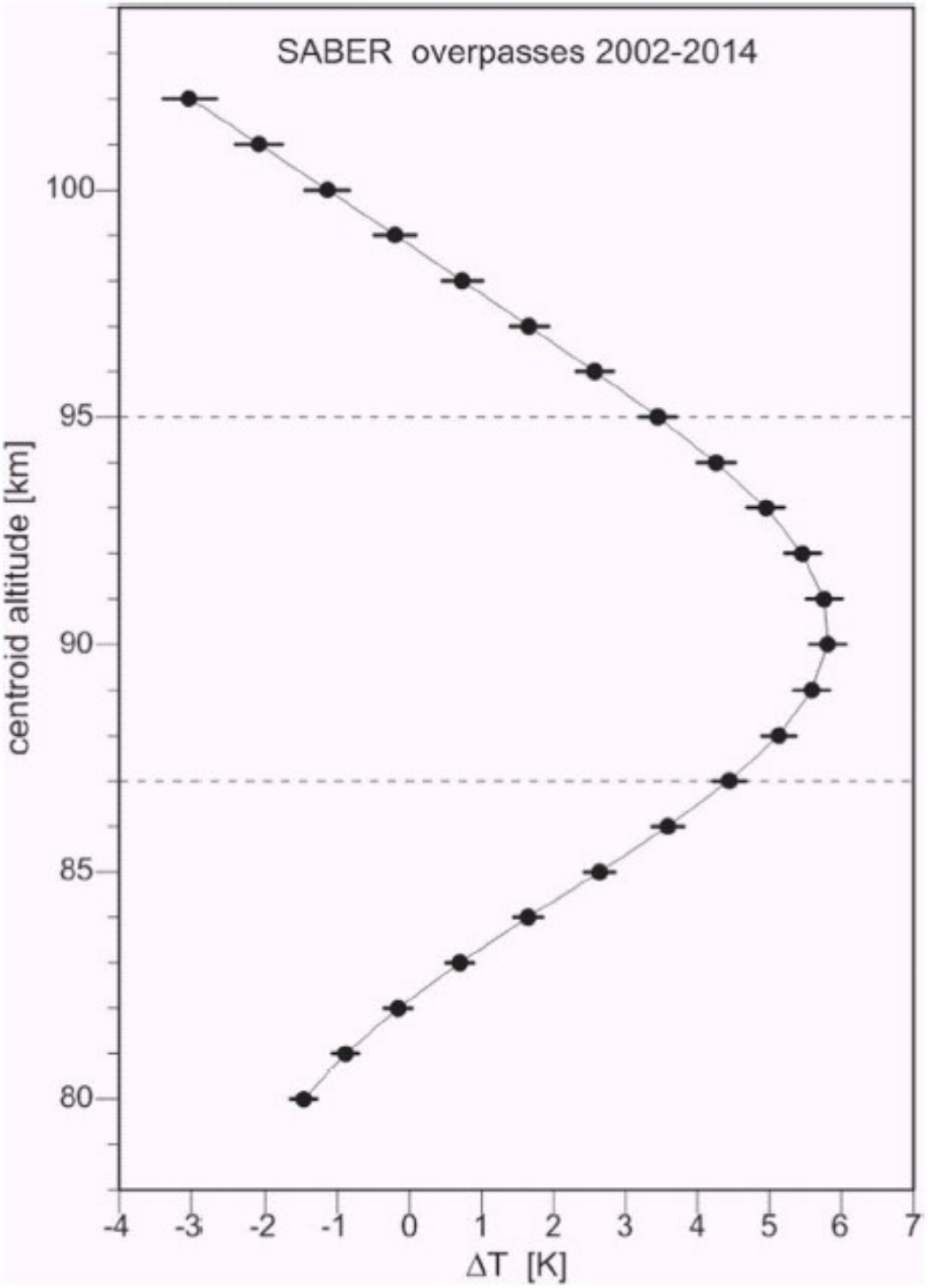


Fig. 5. Changes of ΔT under hypothetical variation of centroid emission altitude. Nominal OH and O_2 emission altitudes are marked by dashed lines.

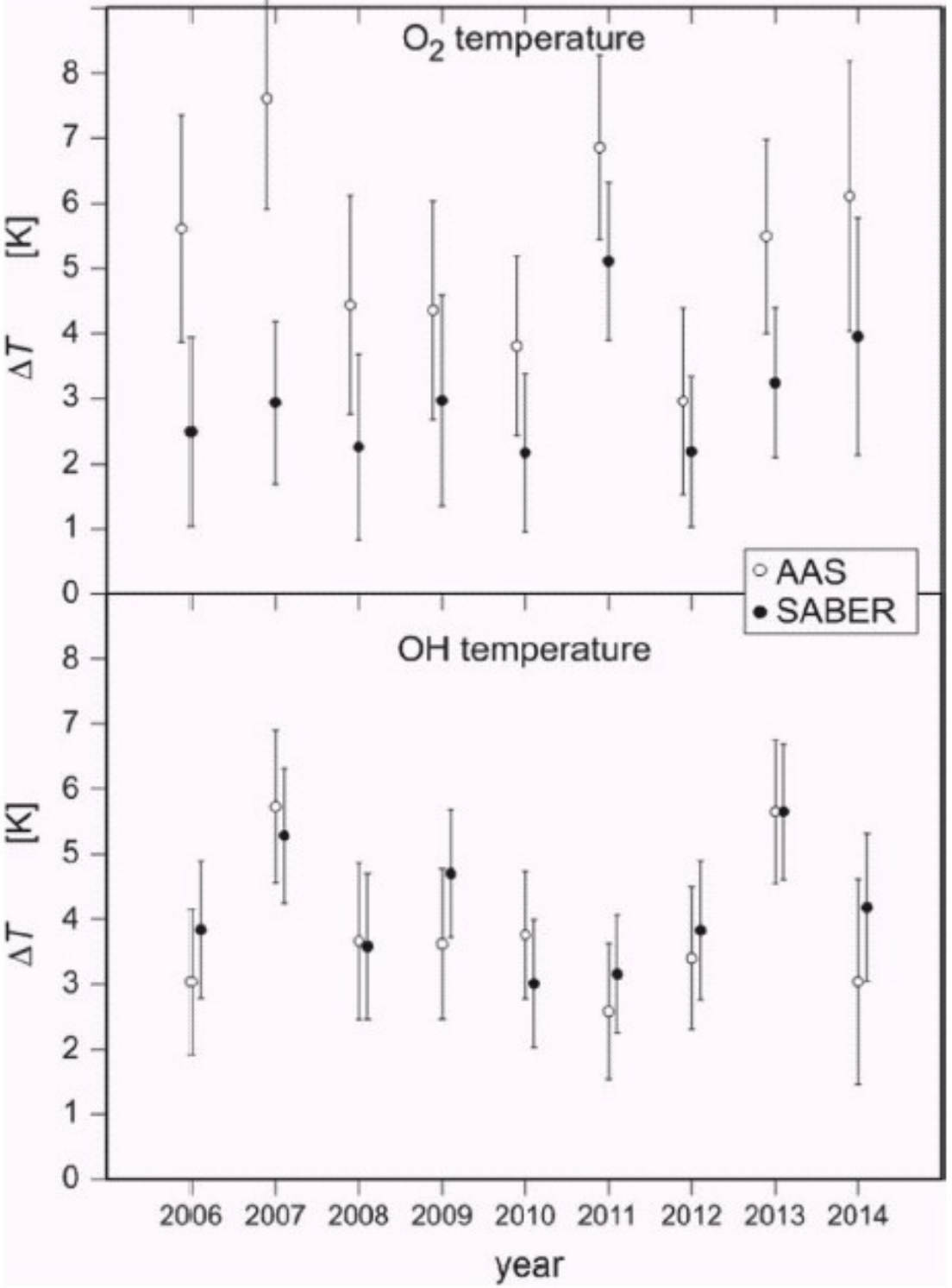
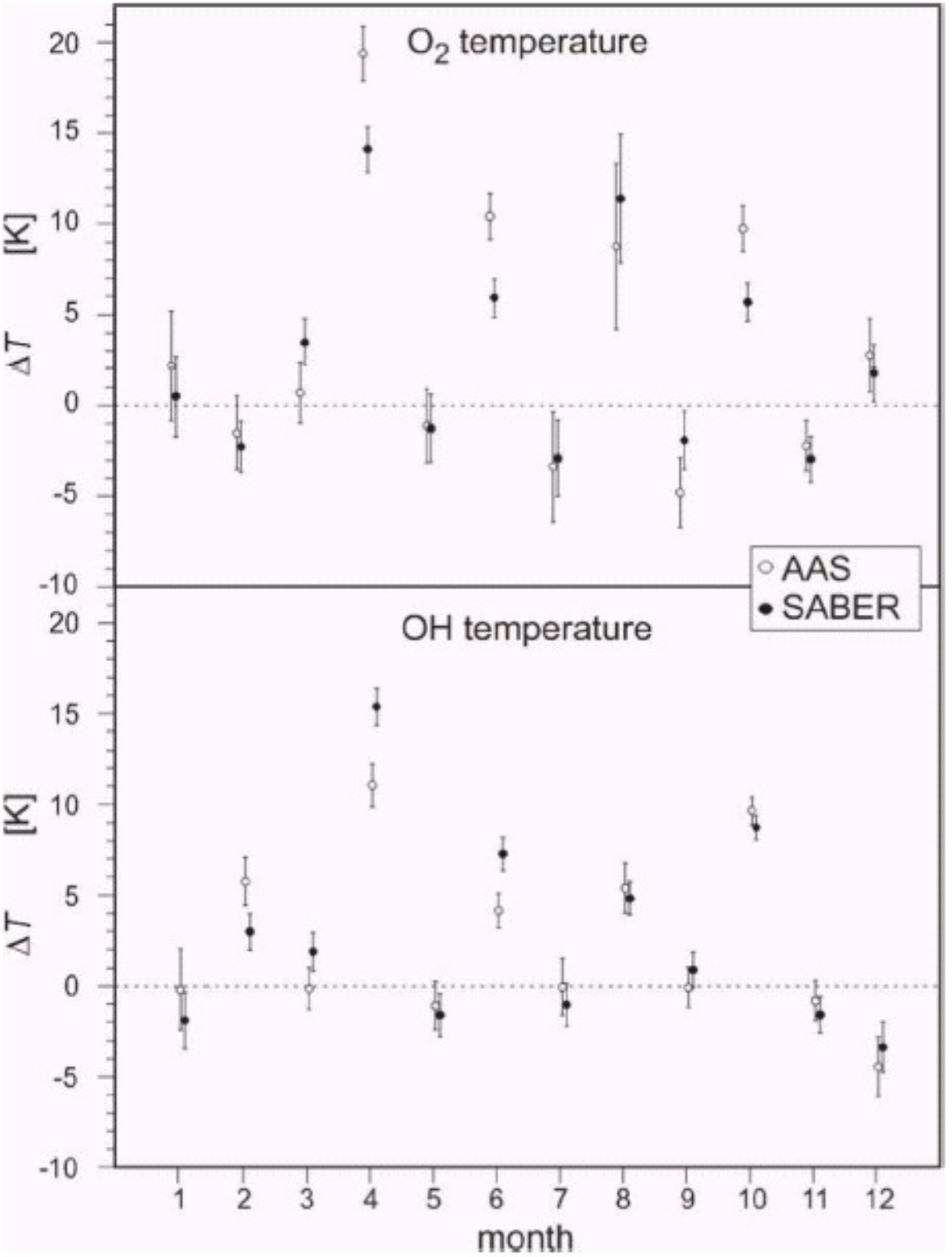
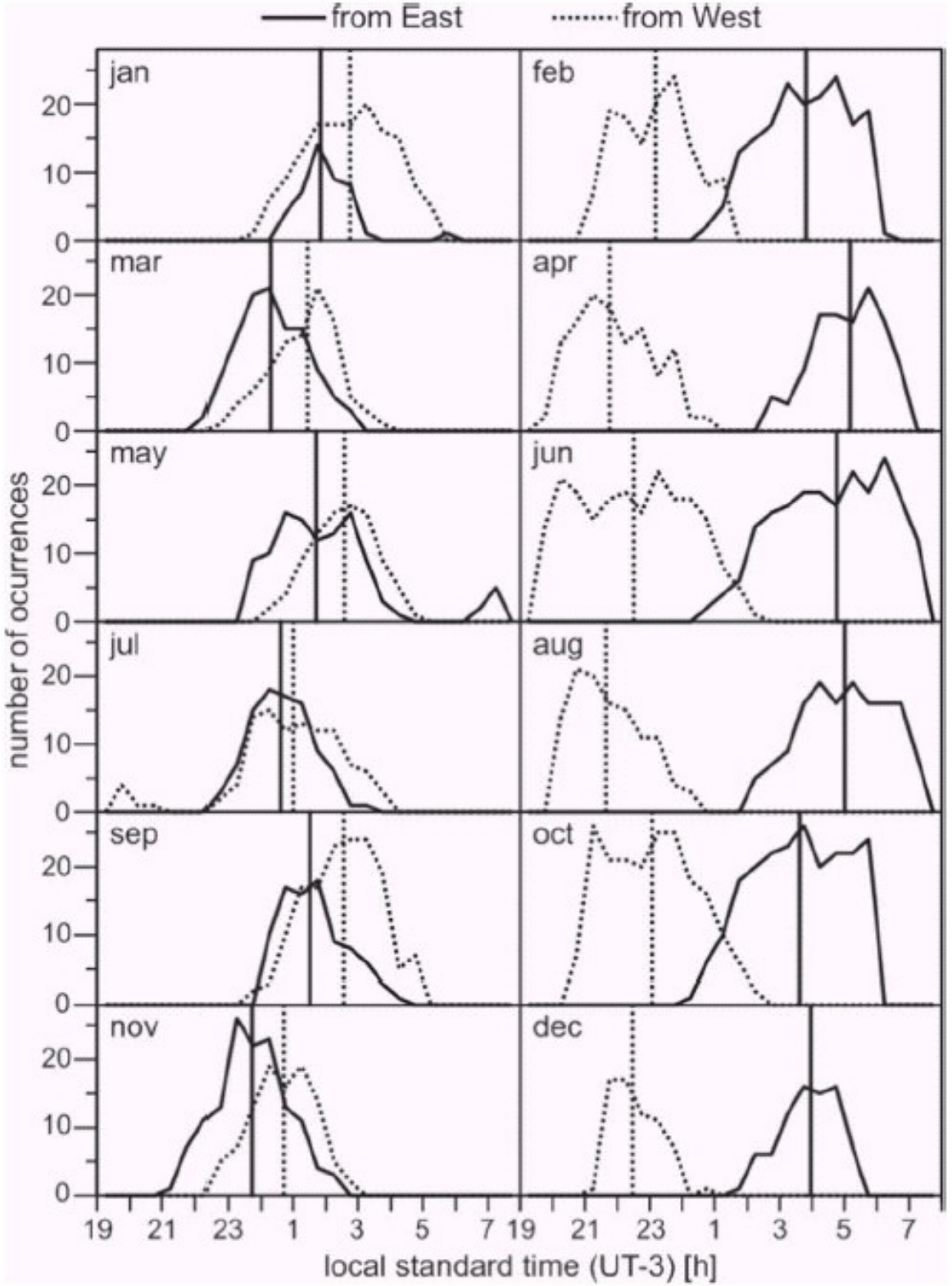


Fig. 6. Annual ΔT values (from SABER and AAS) for SABER overpasses at LEO (see text

Total averages of ΔT for SABER overpasses at LEO simultaneous with AAS measurements, ΔT for AAS data, and differences between SABER and AAS.

	ΔT (OH) [K]	ΔT (O_2) [K]
SABER	4.10 ± 0.35	3.00 ± 0.45
AAS	3.83 ± 0.38	5.13 ± 0.55
SABER-AAS	0.27 ± 0.52	−2.13 ± 0.71


O2 temperature
OH temperature
ΔT [K]
AAS
SABER
20
15
10
5
0
-5
-10
1
2
3
4
5
6
7
8
9
10
11
12
month


from East
from West
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec
number of ocurrences
0
10
20
19
21
23
1
3
5
7
local standard time (UT-3) [h]

Climatology of monthly mean nocturnal O2 (left) and OH temperature (right) variations from our ground-based observations at LEO.

Medians of hourly overpasses from East (dotted lines) and from West (solid lines) suggest when these temperature variations are typically sampled

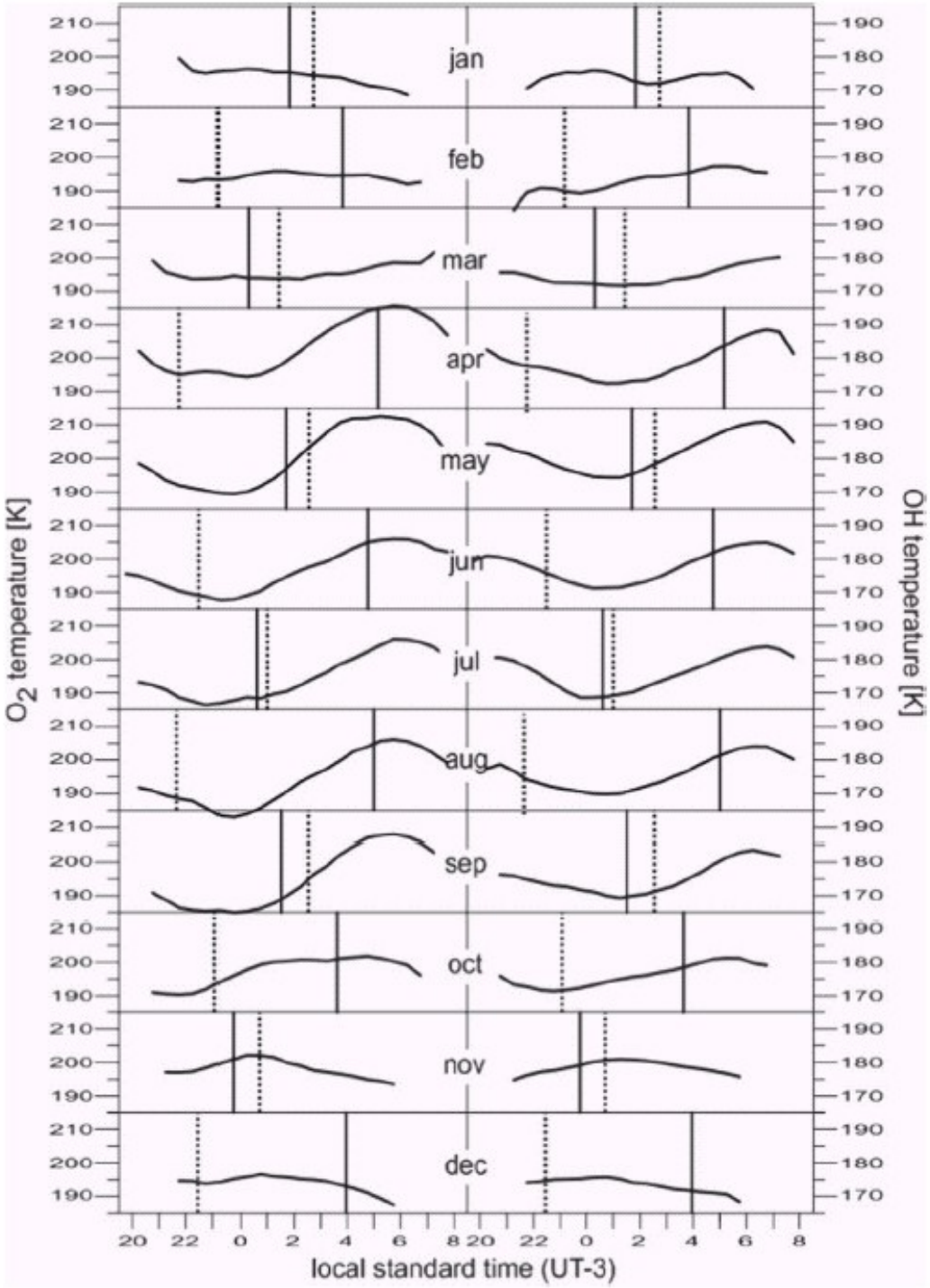


Fig. 9. Monthly mean nocturnal variations of O_2 temperature (left) and OH temperature (right), from AAS data for 2006–2014, and medians of the hourly overpasses (vertical lines from Fig. 8; solid: *fromE*, dotted: *fromW*).

Period (P), amplitude (A), and phase (ϕ = time of maximum) of the main spectral component of monthly mean nocturnal variation for OH and O_2 temperature, and phase difference between OH and O_2 ($\Delta\phi$; see text for how this is defined).

month	P (OH) [h]	A (OH) [K]	ϕ (OH) [h]	P (O_2) [h]	A (O_2) [K]	ϕ (O_2) [h]	$\Delta\phi$ [h]
APR	12.7	6.8	7.0	12.9	10.6	5.6	1.4
MAY	11.8	7.5	6.4	12.1	12.1	5.2	1.2
JUN	11.7	6.3	6.4	13.4	8.7	5.8	0.9
JUL	11.4	7.2	6.5	13.9	9.1	6.3	0.5
AUG	12.3	6.7	6.5	12.7	10.6	5.7	0.9
SEP	13.5	6.7	7.4	12.9	11.6	5.8	1.6
OCT	12.4	4.3	5.3	14.9	6.1	3.6	2.0

By convolving the monthly mean temperature variations with the hourly overpass distributions, we show that the results are reasonably consistent with observations in most months.

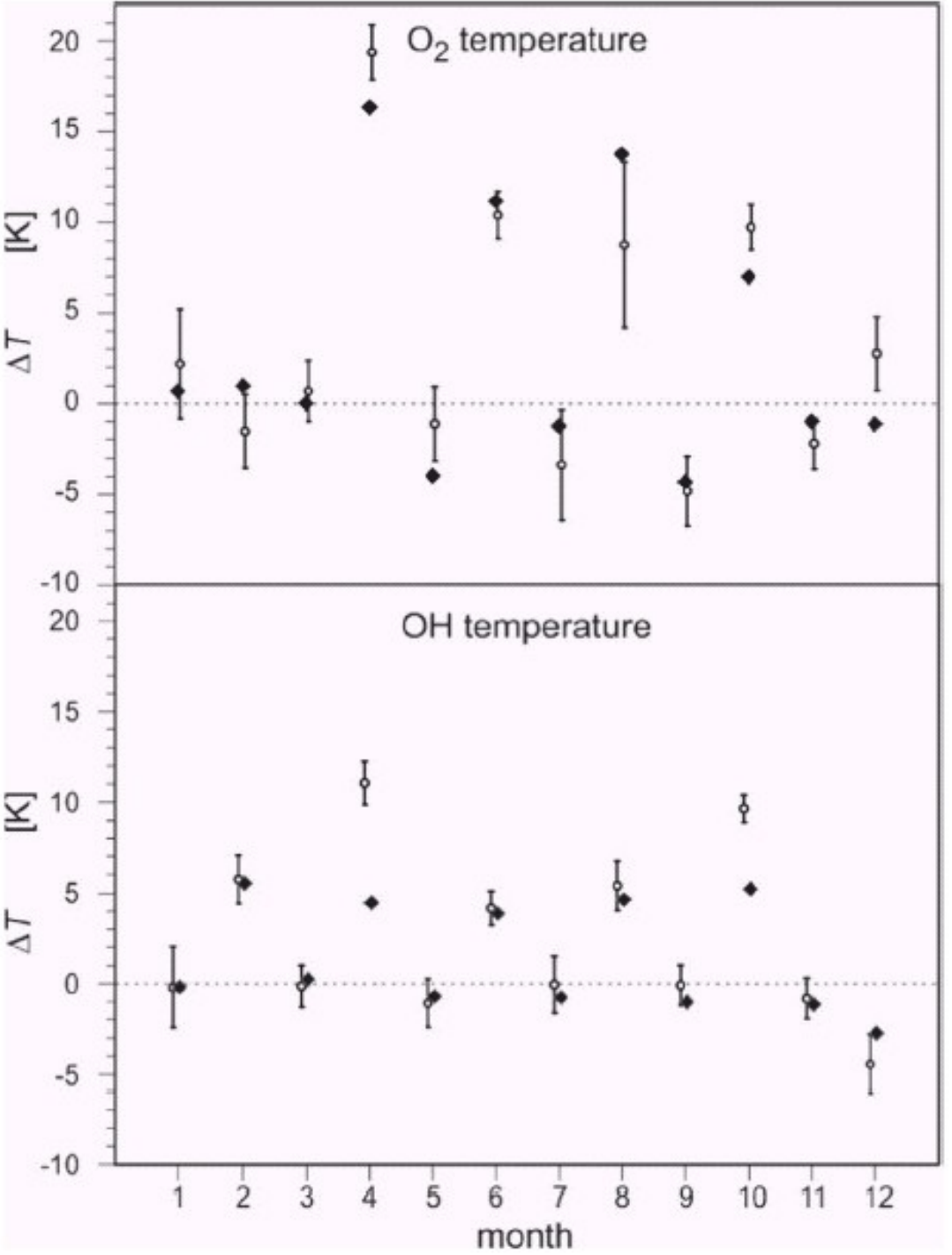


Fig. 10. Monthly ΔT values derived from the convolution between hourly overpass distribution and averaged nocturnal variation (black squares) in comparison with original AAS results (circles with error bars; same as in Fig. 7).

Conclusion

The observed systematic differences between SABER temperatures seen from the East and those seen from the West are due to the details of the sampling in local time of the nocturnal variations as observed from the ground.

The satellite yaw maneuvers executed approximately each two months are part of the reason for the different behavior seen in even- and odd-numbered months, but another important contribution comes from nocturnal variability, mostly due to the semidiurnal tide (which at the LEO site is strong from April to October).

At other sites, “your mileage may vary”, so beware!

Thank you for your attention!

For more details, see

Reisin, E.R., and Scheer, J., Unexpected East-West effect in mesopause region SABER temperatures, J. Atmos. Solar-Terr. Phys. 157-158, 35-41, 2017.

We also invite you to visit our hopefully quite informative web site

http://www.iafe.uba.ar/aeronomia/index_e.html