



AMPLITUDE AND ORIGIN OF DIFFERENCE BETWEEN SATELLITES AND SAOZ TOTAL OZONE IN THE SOUTHERN TROPICS

J.-P. Pommereau⁽¹⁾, F. Goutail⁽¹⁾, C. Clerbaux⁽¹⁾, A. Pazmino⁽¹⁾,
A. Frihi⁽¹⁾, C. Lerot⁽²⁾, M. Van Rozendael⁽²⁾

(1) LATMOS, CNRS and University of Versailles
Saint Quentin, Guyancourt, France

(2) BIRA-IASB, Brussels, Belgium

OZONE MEASUREMENTS

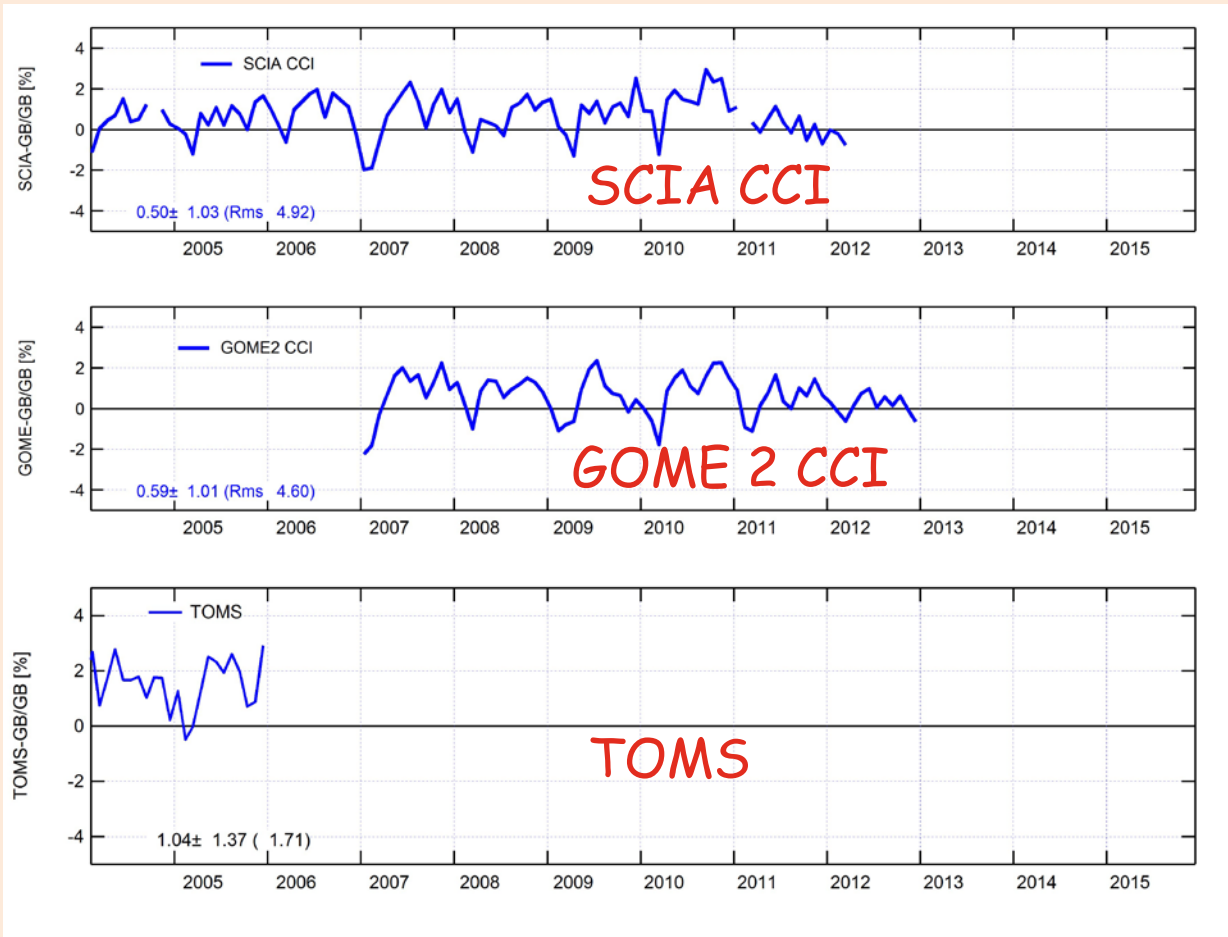
SATELLITES overpasses above SAOZ stations

GOME2 CCI (2007-12), SCIAMACHY (2002-11), TOMS 1995-2005, NPP (2012-15), SBUV (1995-14), OMI-TOMS (2005-15), OMI-DOAS (2005-15)

SAOZ

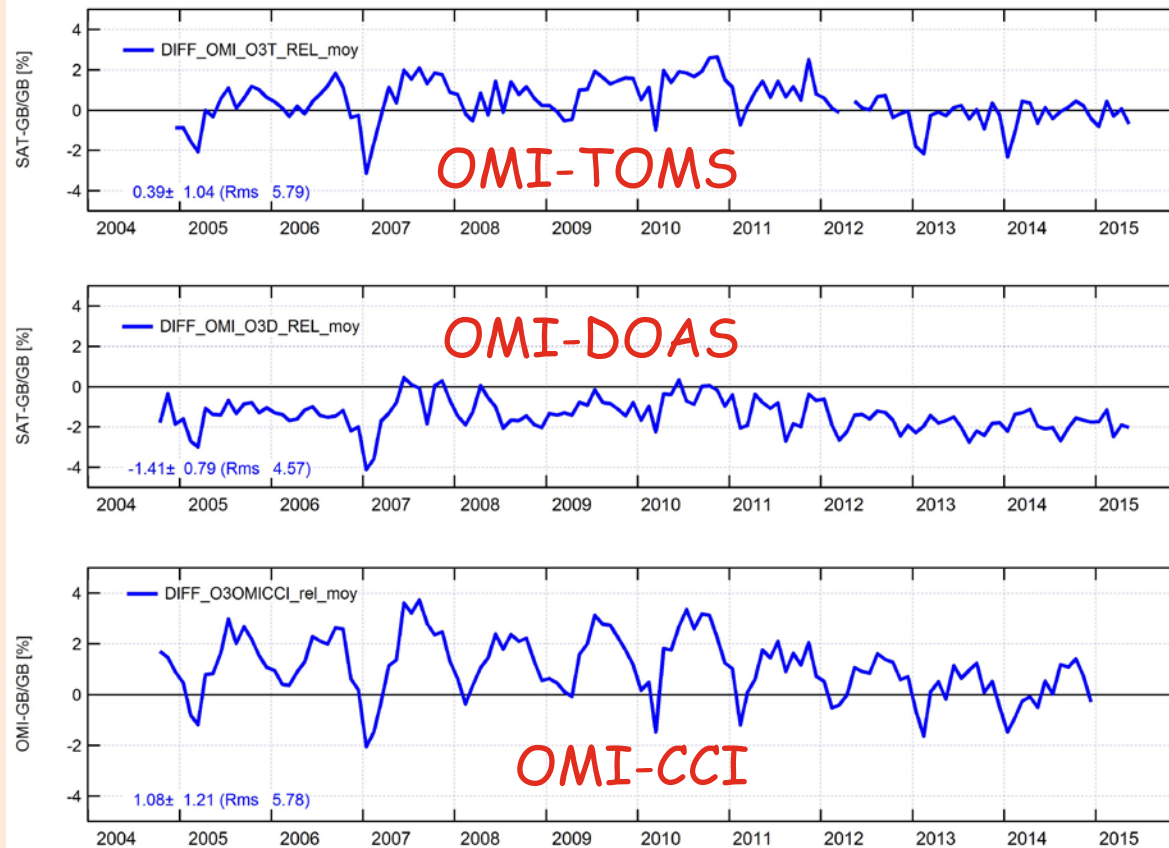
- Zenith sky at twilight 86-91° SZA, Visible Chappuis bands
- Version 2 retrieval following NDACC working group recommendations (daily Air Mass Factors from TOMS V8 ozone profiles climatology)
- Data cleaned for thick clouds and rainfall from SAOZ O4 and H2O.

Satellite-SAOZ monthly mean (1)



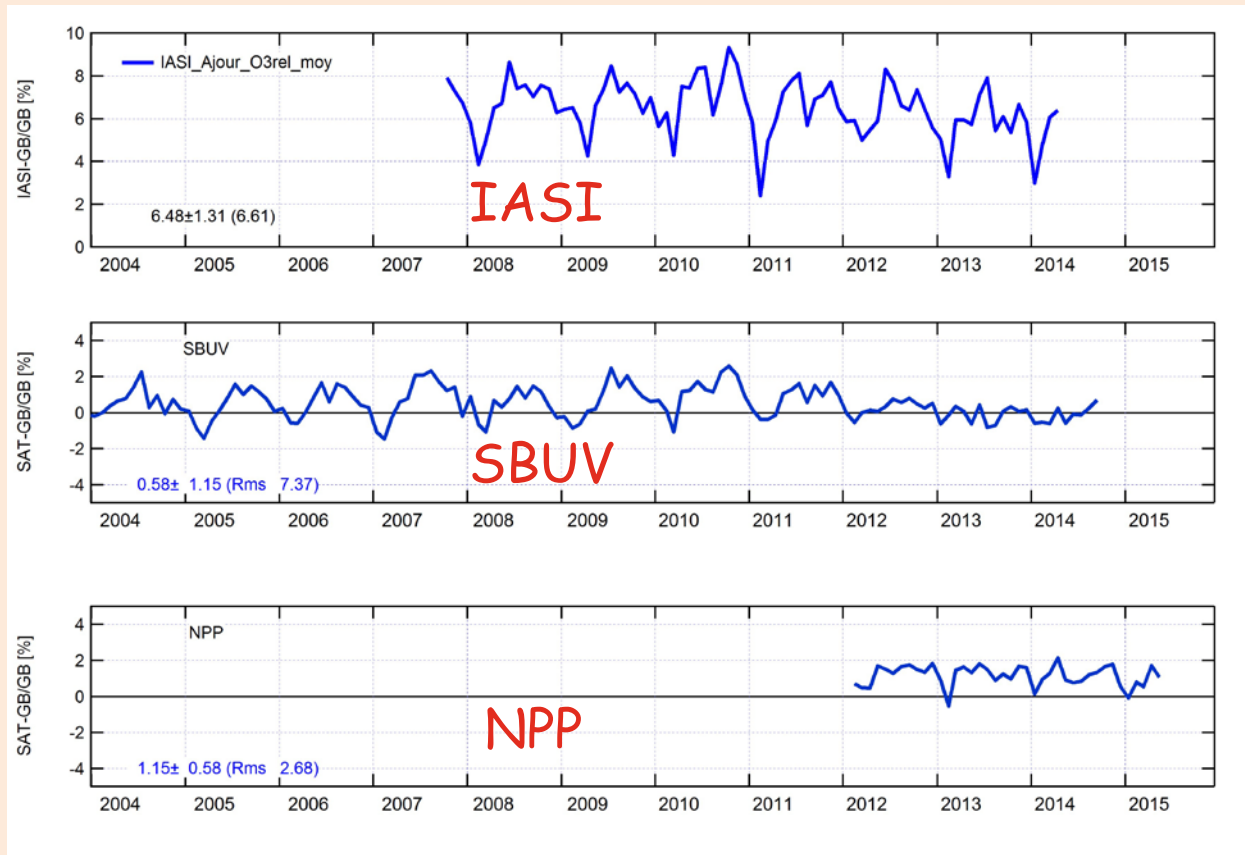
- GOME2, TOMS, SCIA : 2% seasonality <2012
 - Seasonality decrease after 2012
 - Negative peaks in the SH summer

Satellite-SAOZ monthly mean (2)



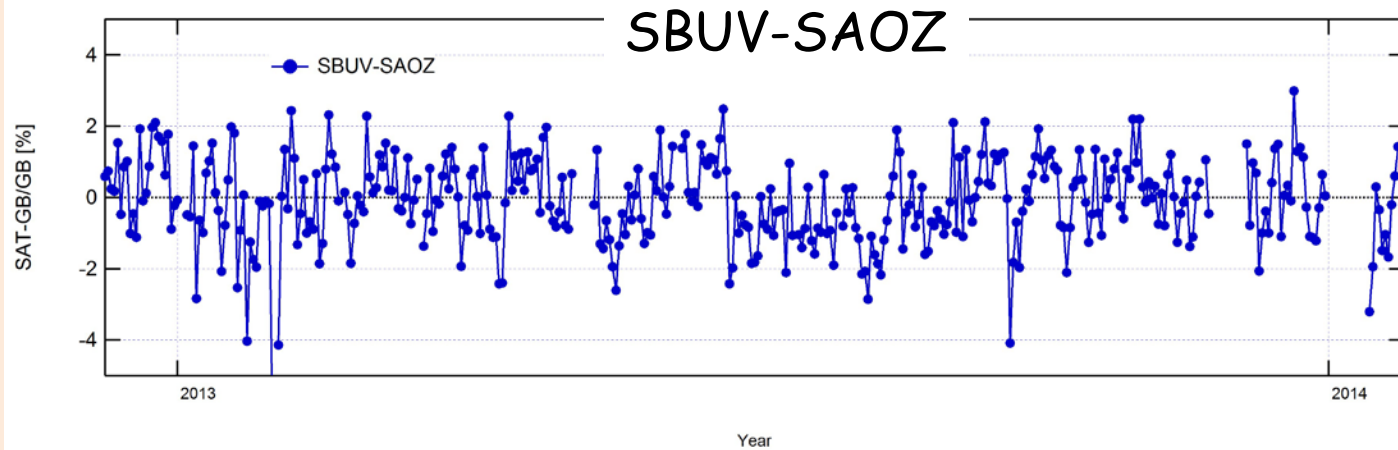
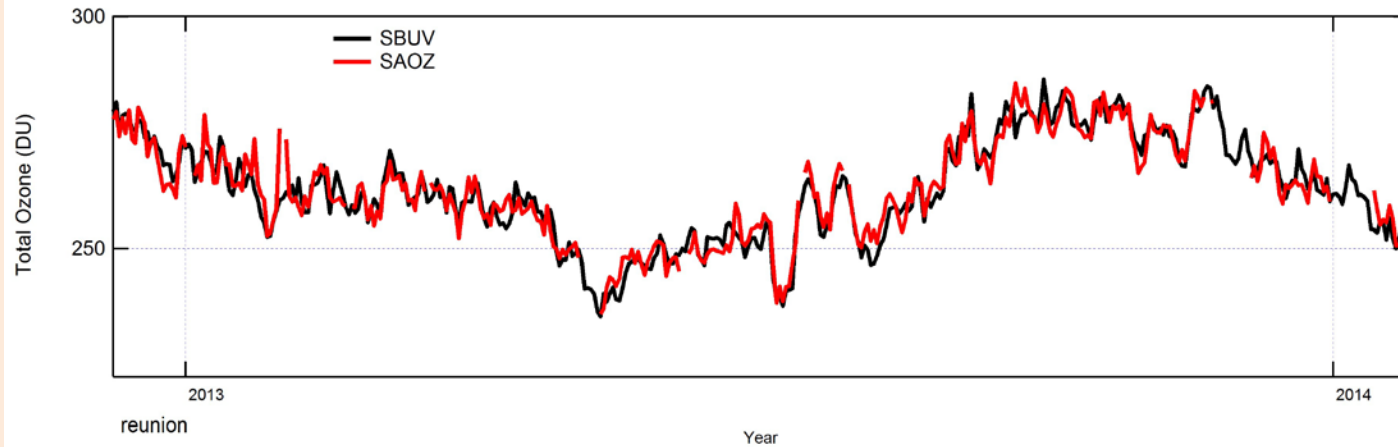
- OMI-T, OMI-D, 1.6% seasonality <2012, OMI-CCI 2.4%
 - Seasonality reduction with all satellites after 2012
- Negative peaks in SH summer on OMI-T and OMI-CCI OMI

Satellite-SAOZ monthly mean (3)

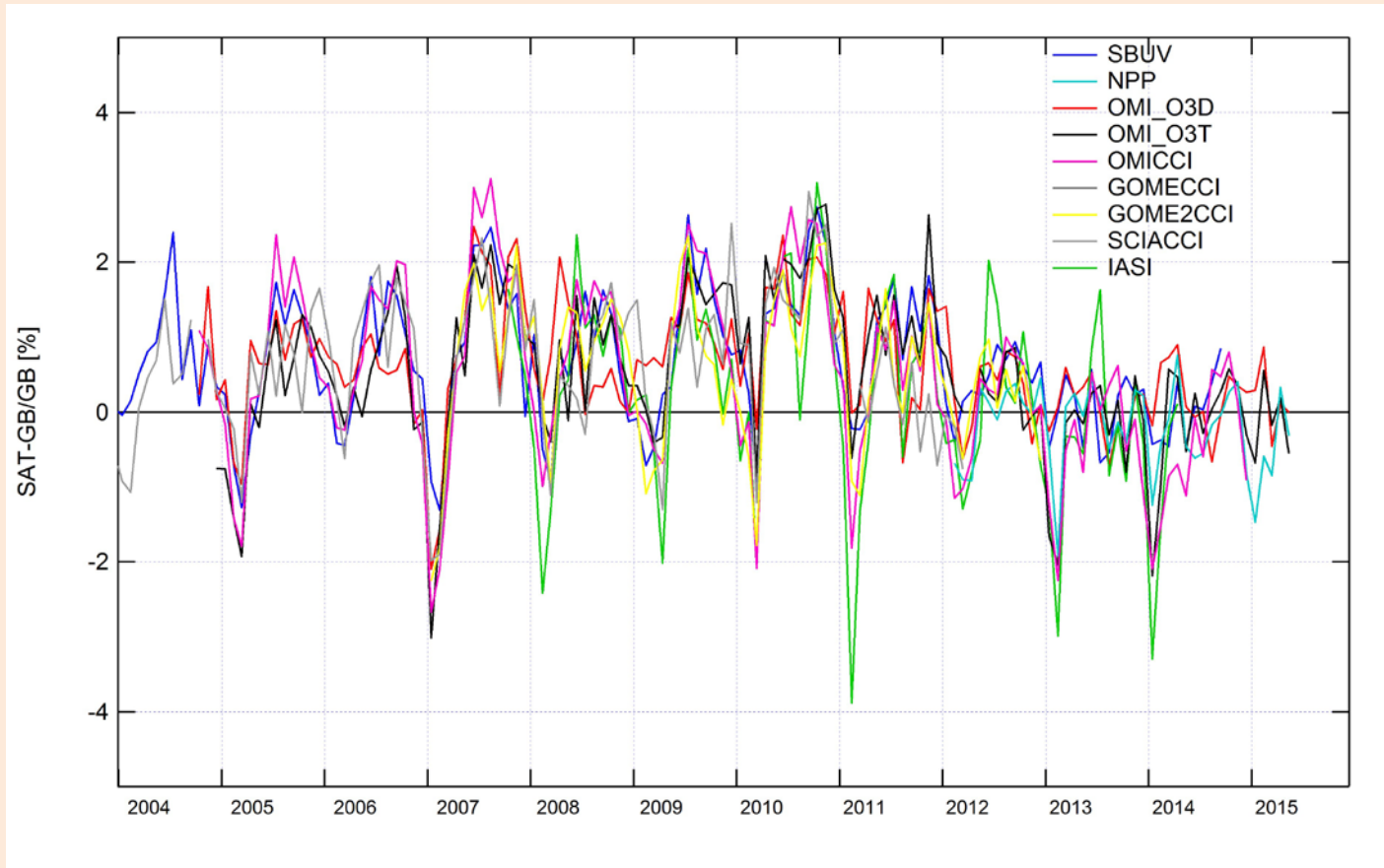


- Seasonality prior to 2012: IASI 2.6%, SBUV 2.2%
 - Reduced on all satellites after 2012
- Negative peaks of 3-4% on IASI, 1% on NPP, OMI-T, OMI-CCI, absent on SBUV

DAILY SBUV-SAOZ IN 2013 $< \pm 1\%$



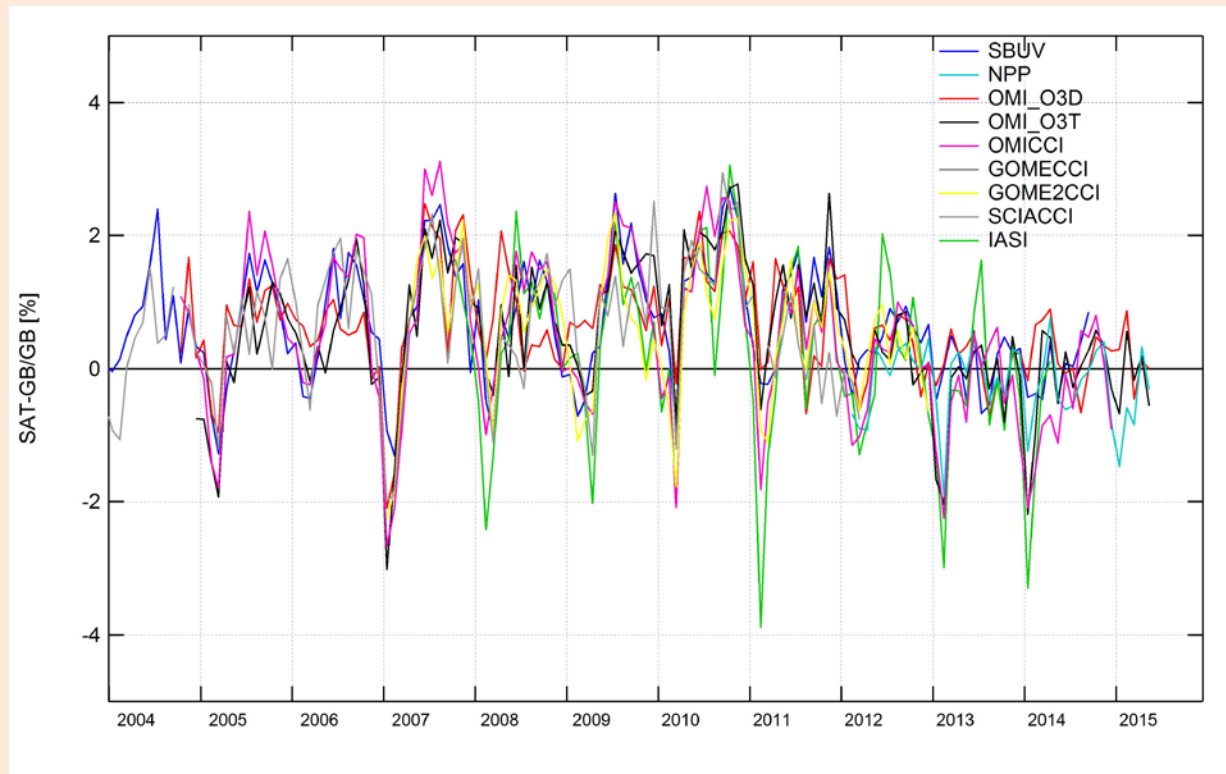
All Satellite-SAOZ monthly mean corrected for mean biases



SEASONALITY OF VARIABLE AMPLITUDE

- max in 2007, 2009, 2010
- decrease after 2012
- of less than $\pm 0.5\%$ after 2013

All Satellite-SAOZ monthly mean corrected for mean biases



NEGATIVE PEAKS (smaller Satellites or larger SAOZ)

- every SH summer
- on individual year only
- on IASI, OMI-T, OMI-CCI, NPP, SCIA-CCI and GOME-2 CCI
 - absent in SBUV, OMI-D

Discussion

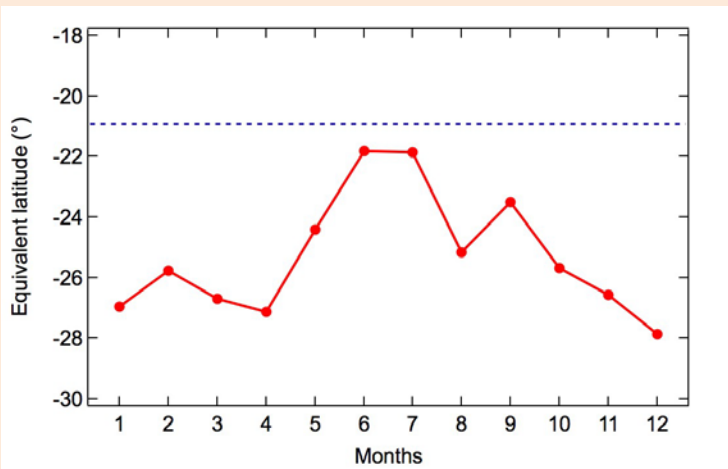
1. Seasonality

- Since in phase on all satellites and reducing simultaneously after 2012, **must come from SAOZ**
- SAOZ instrument installed in 1998. **No change identified since then.**
- **Same SAOZ V3 retrieval procedure applied to all data**
- SAOZ AMF derived from mean TOMS V8 ozone profile zonal climatology between 15° - 25° S, interpolated at 20.9° S.
AMF variations not properly taken into account ??

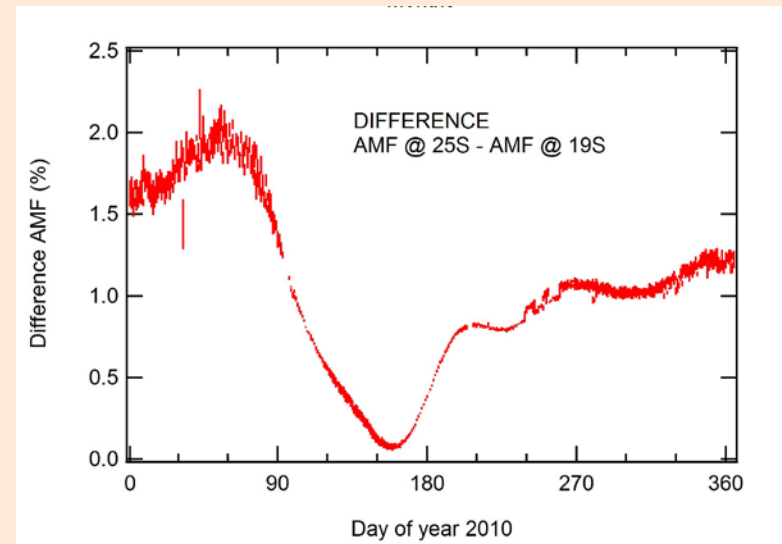
Equivalent Latitude seasonality



ITCZ near Reunion in SH summer, shifted to northern tropics in the SH winter



Equivalent latitude seasonality at Reunion Island

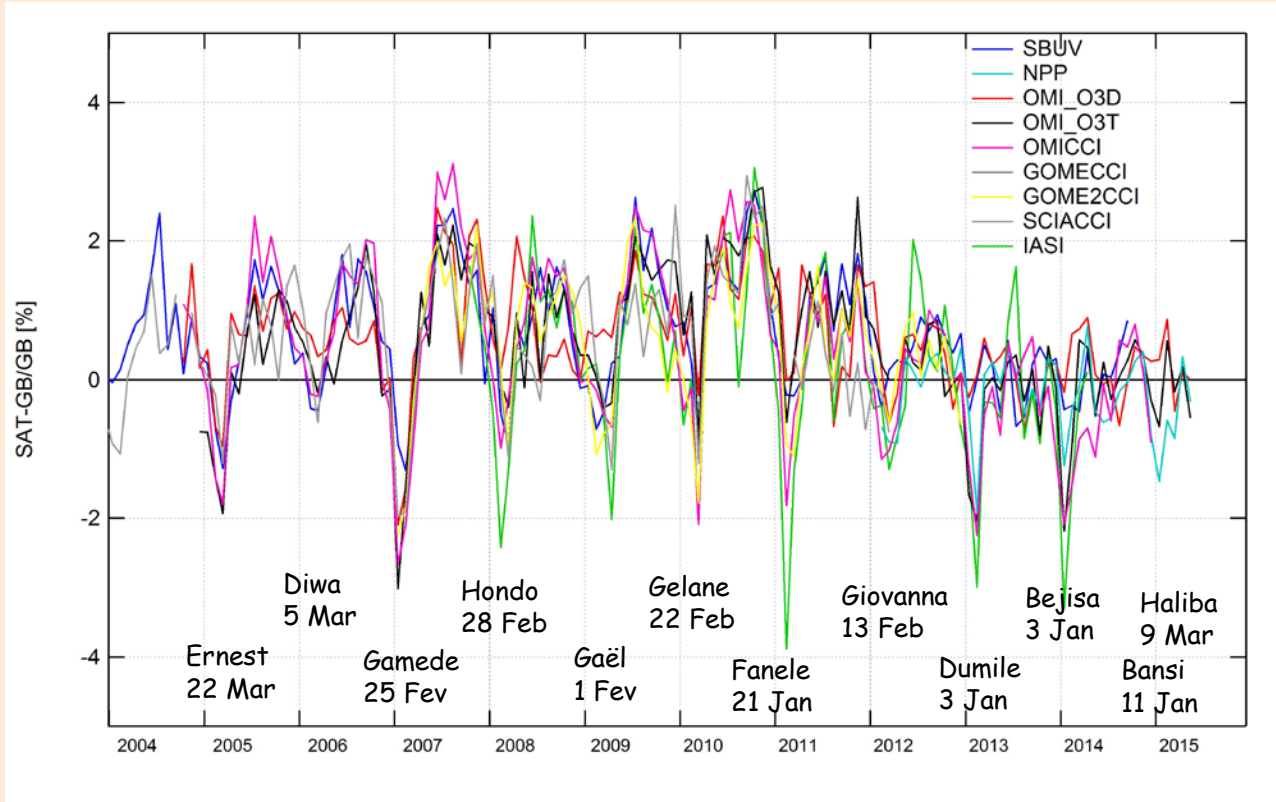


Difference % between Air Mass Factor calculated at 21° and 25° S.

Smaller AMF in the summer if southern equivalent latitude taken into account

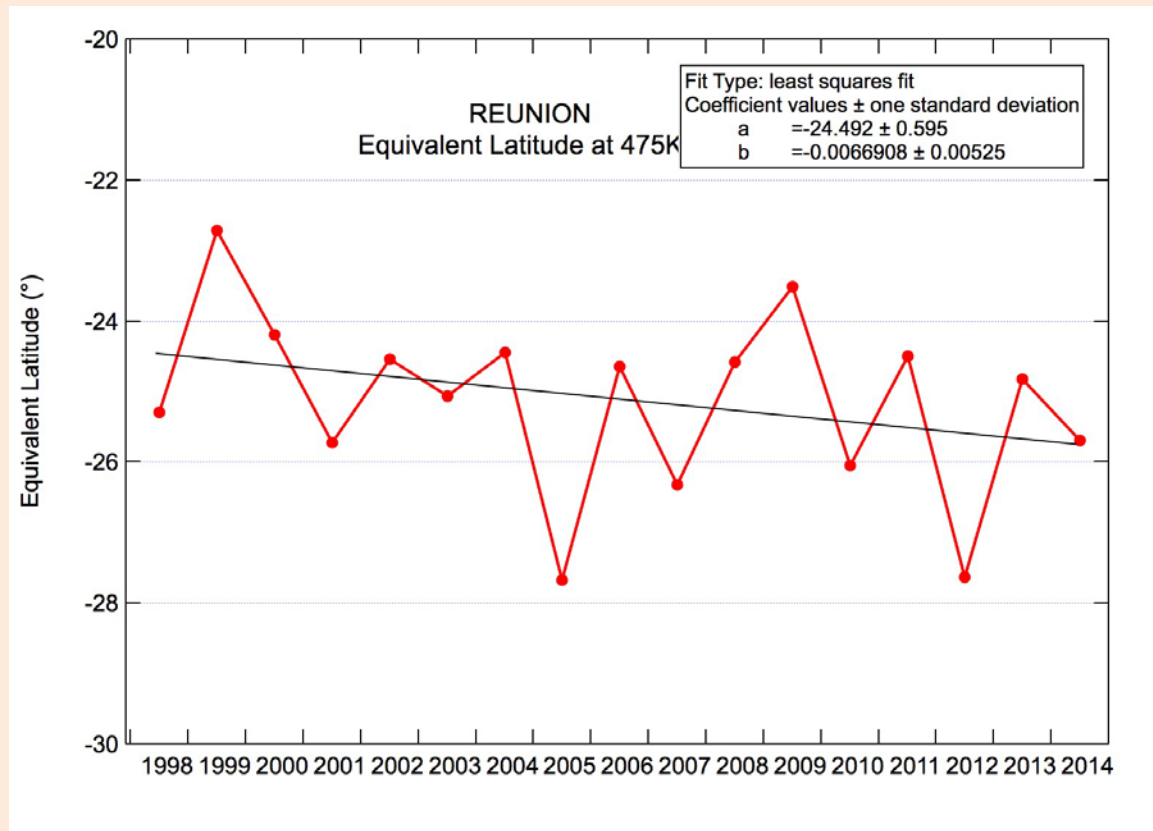
Satellite-SAOZ seasonality due to equivalent latitude change ?

2. Satellite-SAOZ minima



- **SAT-SAOZ minima coincident with Hurricane on the same month**
- Hurricane days removed from SAOZ from detection of H₂O and O₄ peaks
 - Hurricane signature on IASI, OMI-T, OMI-CCI and NPP
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- **Satellites cleansing procedure for high clouds in the tropics requires improvement.**

3. Equivalent latitude at 475 K (altitude of maximum ozone concentration)



- High variability of Eq Lat seasonality (but no direct correlation with Sat-SAOZ O3 seasonality)
- Equivalent latitude slow increase at 475K
- Is it enough for explaining the change of Sat-SAOZ ozone seasonality after 2012?

CONCLUSIONS

- Difference between Satellites and SAOZ of similar shape with all satellites but of variable amplitude
- Seasonality could be coming from ignorance of seasonal change of equivalent latitude in AMF calculations
- Perturbations of satellite measurements by hurricanes high clouds not properly identified in IASI, OMI-T, OMI-CCI, NPP, SCIA, GOME2
- Slow increase of Reunion Island Equivalent Latitude

PERSPECTIVE

- Improved detection and correction for very high clouds in satellite data
 - Improved Air Mass Factor calculations