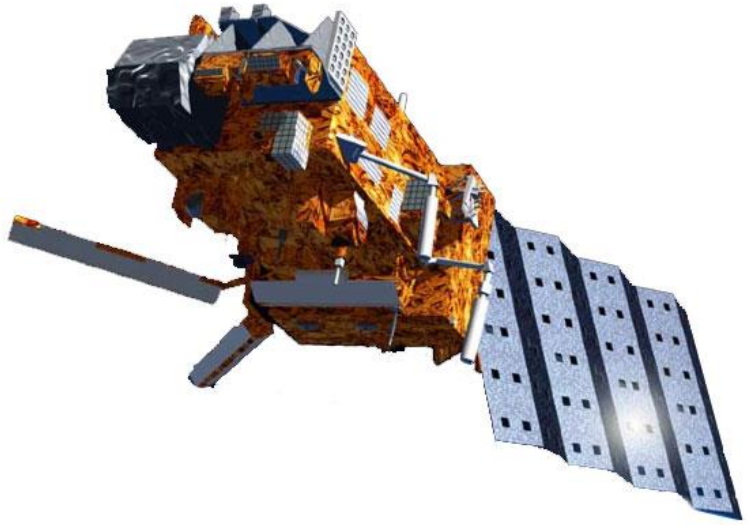
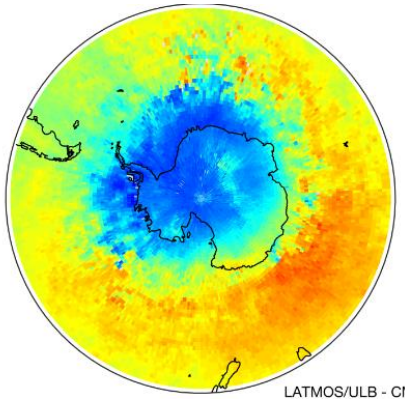
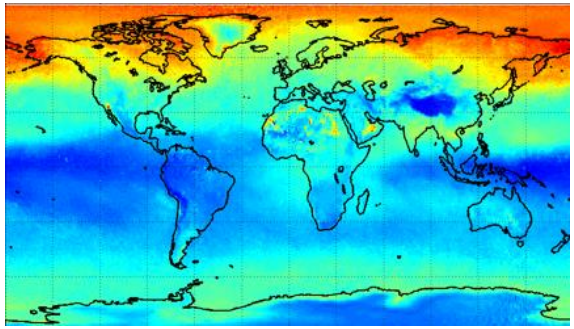
CEOS O_3 validation session
Retrieving tropospheric ozone with IASI





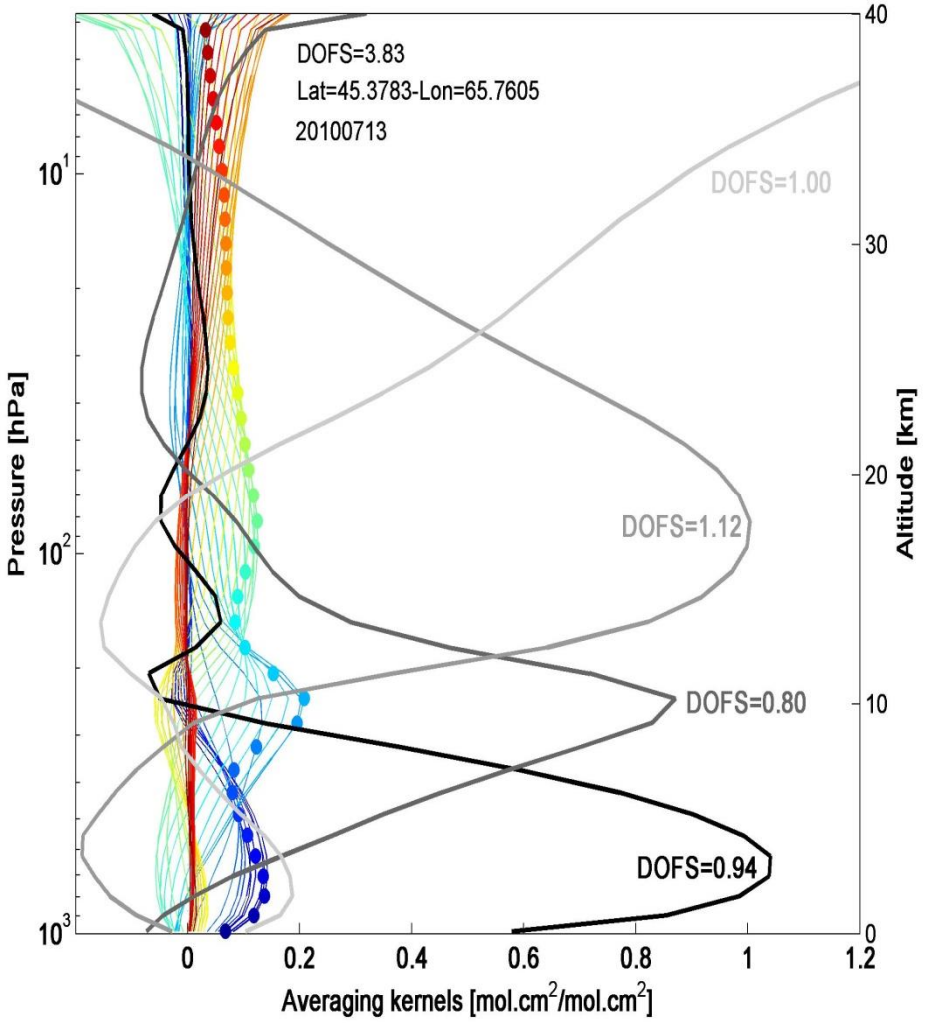


Cathy Clerbaux
and the LATMOS/ULB teams

ULB LATMOS

IASI – ozone [FORLI]

10 years of data



C. Wespes et al., 2016

EUMETSAT AC SAF

ozone cci

TOAR tropospheric ozone assessment report

C3S_312a_Lot4 Ozone

Service Readiness Review n°1 – 19 April 2017

Climate Change

Atmos. Chem. Phys., 16, 10489–10500, 2016
www.atmos-chem-phys.net/16/10489/2016/
doi:10.5194/acp-16-10489-2016

Atmospheric Chemistry and Physics
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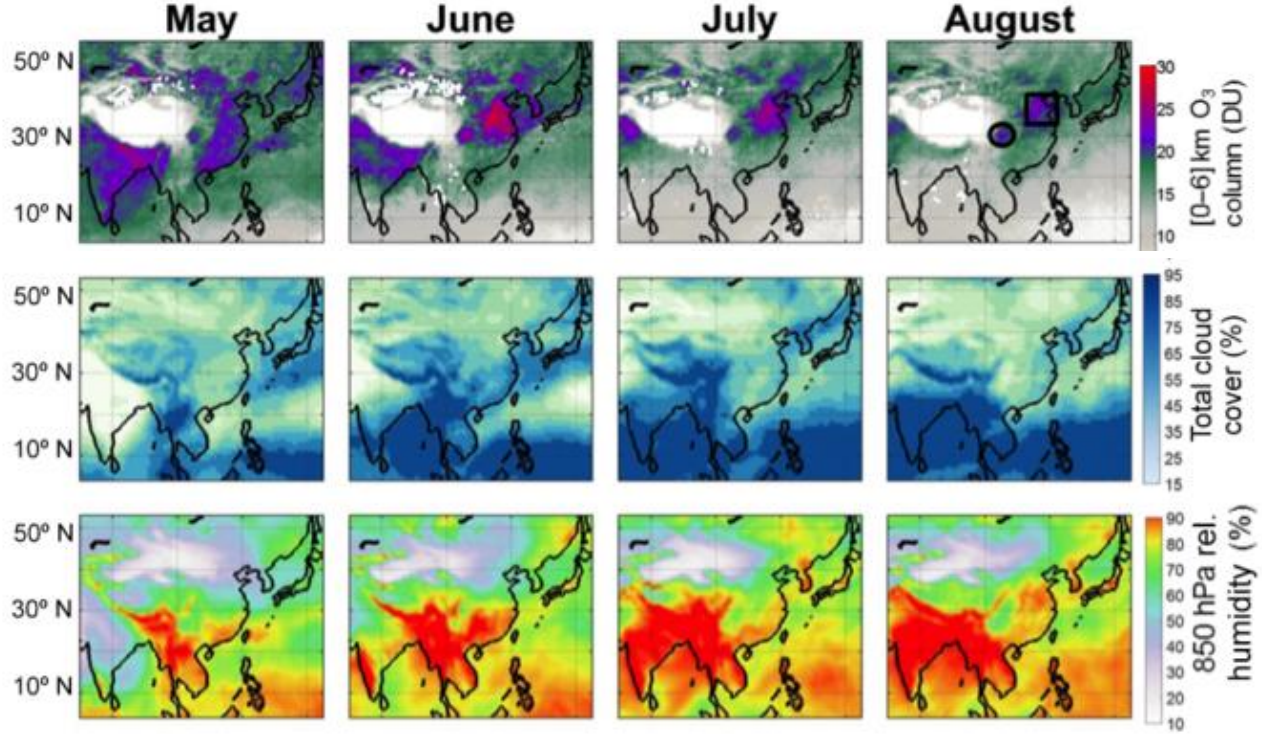
Tropospheric ozone variability during the East Asian summer monsoon as observed by satellite (IASI), aircraft (MOZAIC) and ground stations

Sarah Safieddine[1,a], Anne Boynard[1], Nan Hao[2], Fuxiang Huang[3], Lili Wang[4], Dongsheng Ji[4], Brice Barret[5], Sachin D. Ghude[6], Pierre-François Coheur[7], Daniel Hurtmans[7], and Cathy Clerbaux[1,7]



AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Atmospheres

RESEARCH ARTICLE
10.1002/2016JD025875

Key Points:
- Global assessment of the geophysical mechanisms behind the tropospheric O_3 variability using 8 years of IASI

O_3 variability in the troposphere as observed by IASI over 2008–2016: Contribution of atmospheric chemistry and dynamics

C. Wespes[1], D. Hurtmans[1], C. Clerbaux[1,2], and P.-F. Coheur[1]

Wespes et al. [2017] analyze an 8 year record of ozone from IASI and evaluate the extent to which mid-tropospheric ozone variability in different regions of the globe can be captured by regression models based on geophysical drivers (e.g. solar flux, the Quasi-Biennial Oscillation – QBO, North Atlantic Oscillation – NAO, El Nino Southern Oscillation – ENSO).

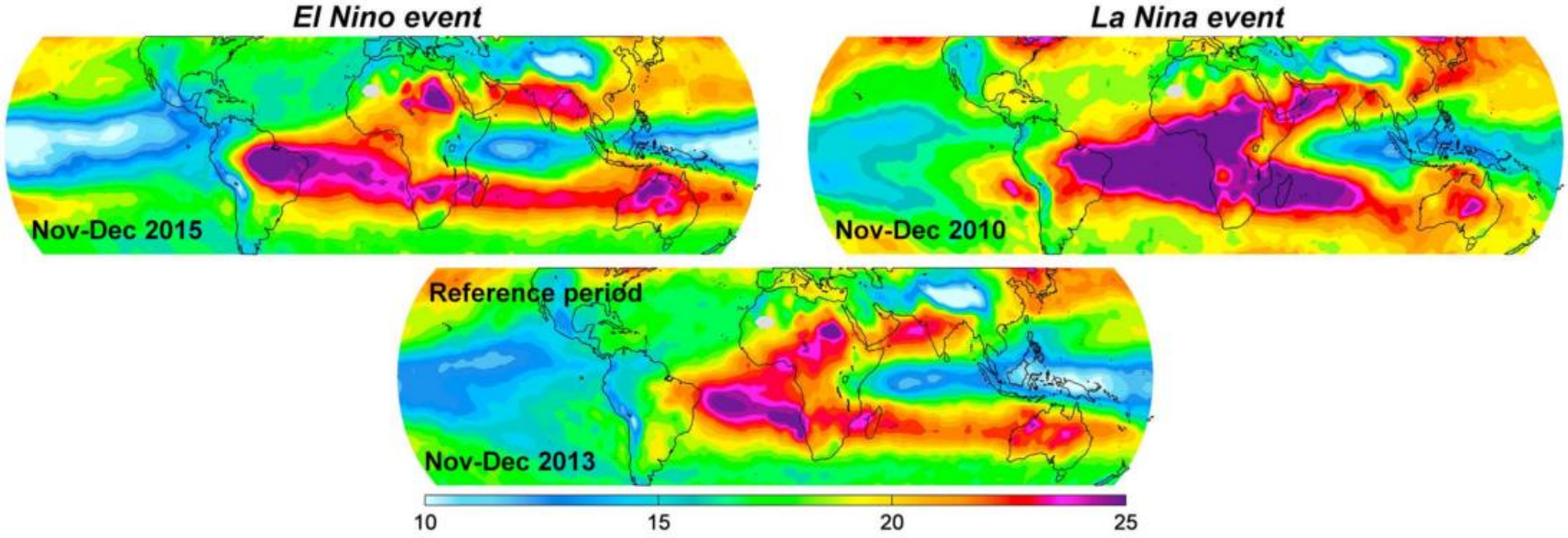
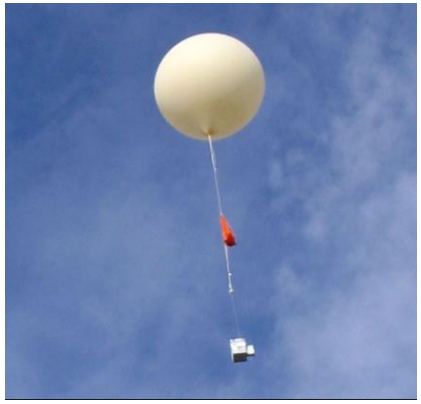


Figure 12. Global distribution of IASI O_3 tropospheric columns during (top row) strong El Niño (November–December 2015) and medium La Niña (November–December 2010) episodes compared with a (middle) reference period (November–December 2013)

Ozone validation
total columns, partial columns and profiles

satellite (GOME-2)



Ground-based (lidar, NDACC/FTS, SAOZ, sondes)

Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-403, 2017
Manuscript under review for journal Atmos. Meas. Tech.
Published: 25 January 2017

Atmospheric Measurement Techniques Discussions
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Ozone profiles by DIAL at Maïdo Observatory (Reunion Island) Part 1. Tropospheric ozone lidar: system description, performances evaluation and comparison with ancillary data

Valentin Duflot[1,2], Jean-Luc Baray[3], Guillaume Payen[2], Nicolas Marquestaut[2], Françoise Posny[1], Jean-Marc Metzger[2], Bavo Langerock[4], Corinne Vigouroux[4], Juliette Hadji-Lazaro[5], Thierry Portafaix[1], Martine De Mazière[4], Pierre-François Coheur[6], Cathy Clerbaux[5,6], and Jean-Pierre Cammas[1,2]

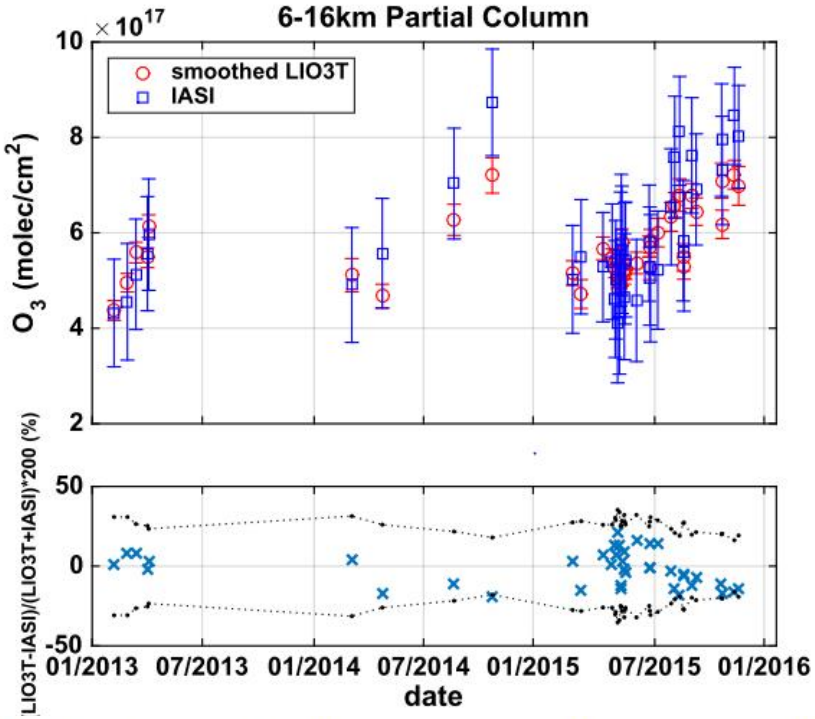


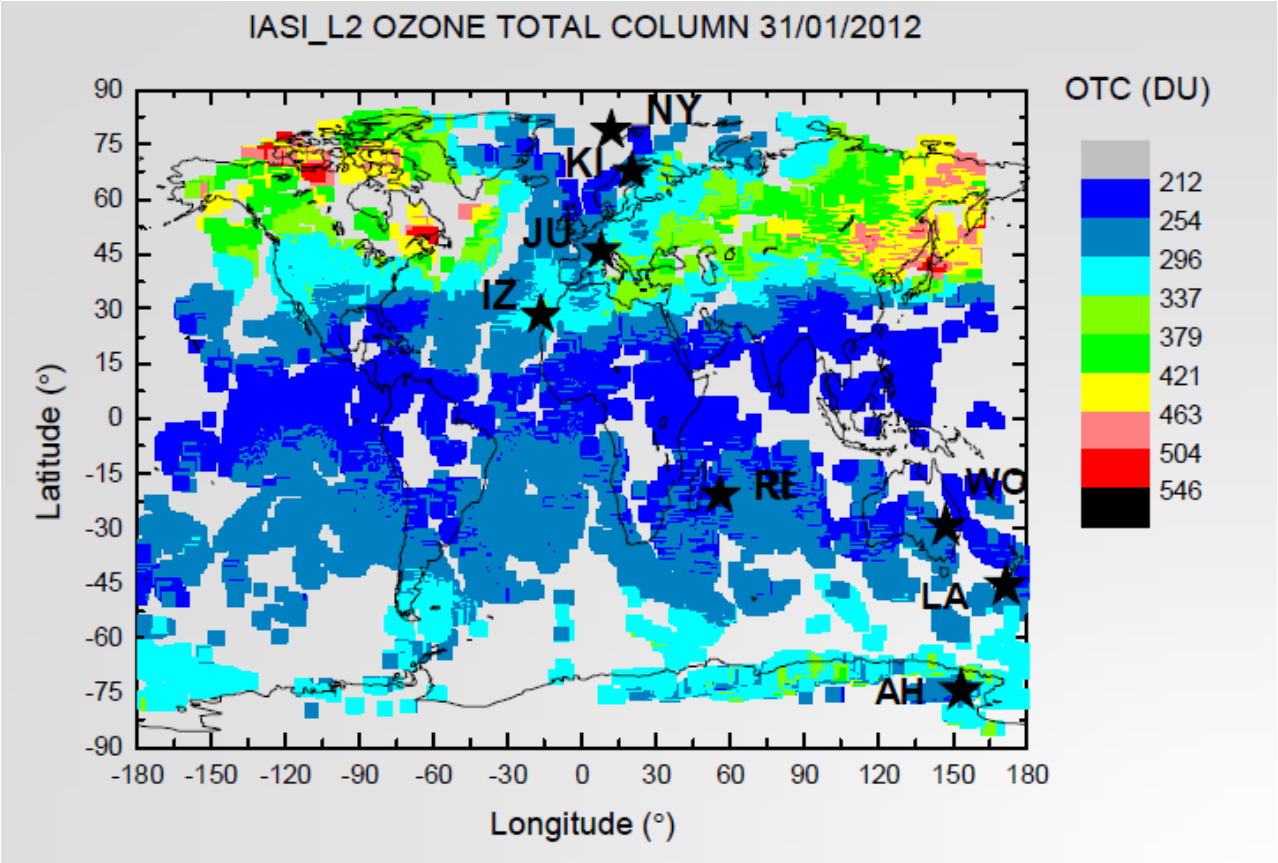
Figure 13. Upper panel: smoothed LIO3T (red circles) and IASI (blue squares) 6-16km ozone partial columns. Vertical bars give uncertainties for each measurement; Lower panel: relative difference (%) between LIO3T and IASI measurements (blue crosses) superimposed on LIO3T + IASI uncertainties around zero (black dotted lines and dots).

Ozone Total and Partial Column Amounts Comparison between satellite-based METOP-IASI and ground-based NDACC FTS

E. Sepúlveda[1,2], O.E. García[2], M. Schneider[3], T. August[4], C. Clerbaux[5,6], F. Hase[3], T. Blumenstock[3], T. Hultberg[4], E. Sanromá[2], V. Carreño[2], E. Mahieu[7], M. De Mazière[8], C. Vigouroux[8], D. Griffith[9], N. Jones[9], D. Smale[10], J. Notholt[11], M. Palm[11], A. M. De Frutos[1]

(1) Atmospheric Optics Group (GOA), University of Valladolid, Spain. E-mail contact: esepulvedah@goa.uva.es

This study analyzes the capability of the s-b MetOp-A IASI (Infrared Atmospheric Sounding Interferometer) sensor of monitoring global ozone distributions (total and partial column amounts) by comparing with eight globally distributed g-b NDACC-FTS sites. From the s-b IASI observations two retrieval codes are considered: the EUMETSAT IASI level 2 (L2) generated by the EPS Core Ground Segment (version 5 and version 6) and the Fast Optimal Retrievals on Layers for IASI (FORLI)



Site (Acronym)
Ny-Ålesund (NY)
Kiruna (KI)
Jungfraujoch (JU)
Izaña (IZ)
Reunion Island-Maido (RE)
Wollongong (WO)
Lauder (LA)
Arrival Heights (AH)

Ozone Total and Partial Column Amounts Comparison between satellite-based METOP-IASI and ground-based NDACC FTS

E. Sepúlveda[1,2], O.E. García[2], M. Schneider[3], T. August[4], C. Clerbaux[5,6], F. Hase[3], T. Blumenstock[3], T. Hultberg[4], E. Sanromá[2], V. Carreño[2], E. Mahieu[7], M. De Mazière[8], C. Vigouroux[8], D. Griffith[9], N. Jones[9], D. Smale[10], J. Notholt[11], M. Palm[11], A. M. De Frutos[1]

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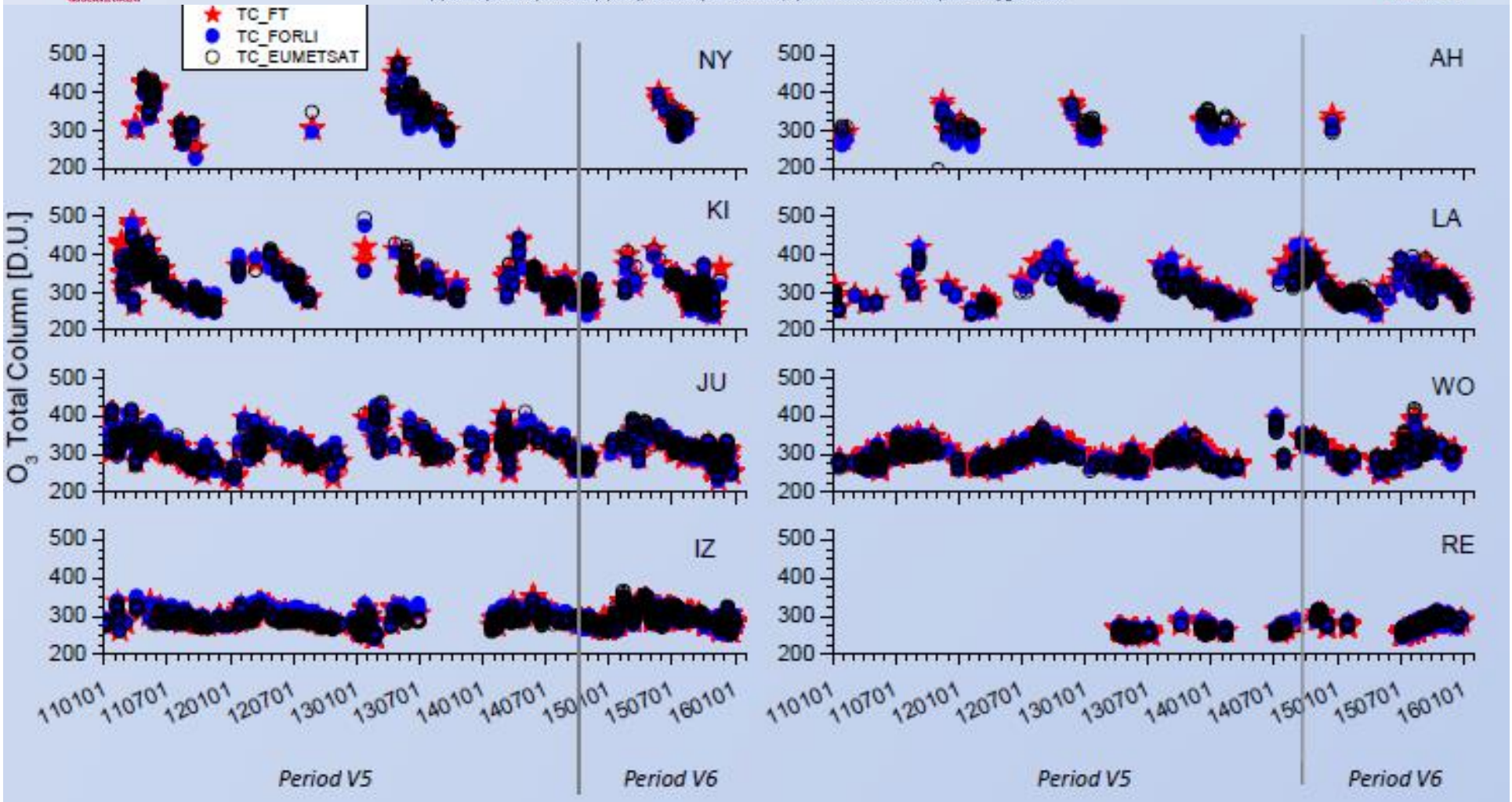

The scatter observed by EUMETSAT and FORLI O3 Total Colum is consistent with respect to the FTS (showing no latitudinal dependence). The IASI precision is between (2.5-3)%

Ozone Total and Partial Column Amounts Comparison between satellite-based METOP-IASI and ground-based NDACC FTS

E. Sepúlveda[1,2], O.E. García[2], M. Schneider[3], T. August[4], C. Clerbaux[5,6], F. Hase[3], T. Blumenstock[3], T. Hultberg[4], E. Sanromá[2], V. Carreño[2], E. Mahieu[7], M. De Mazière[8], C. Vigouroux[8], D. Griffith[9], N. Jones[9], D. Smale[10], J. Notholt[11], M. Palm[11], A. M. De Frutos[1]

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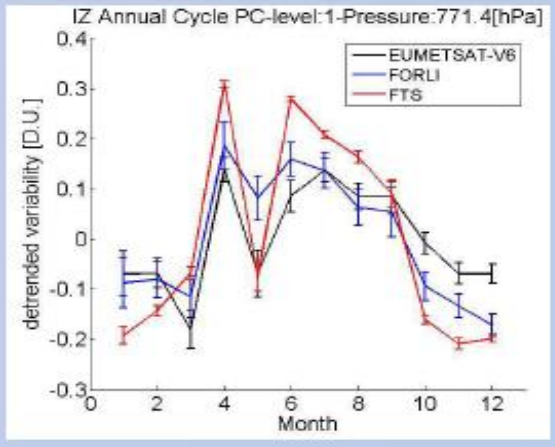
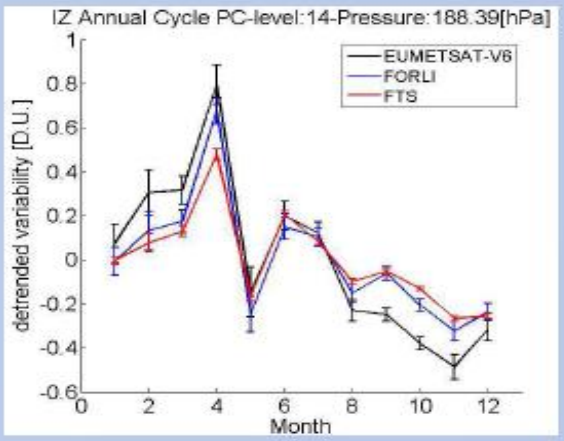
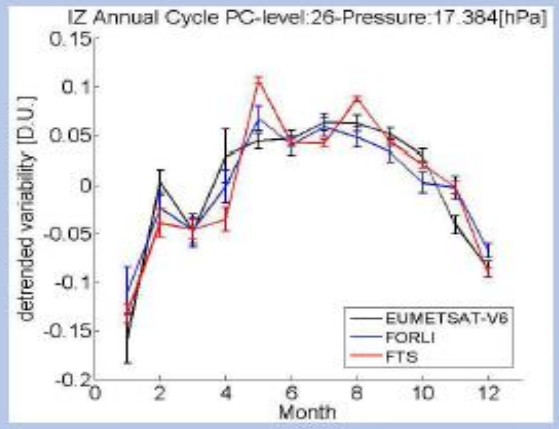
Annual cycle for Izaña site at three different levels



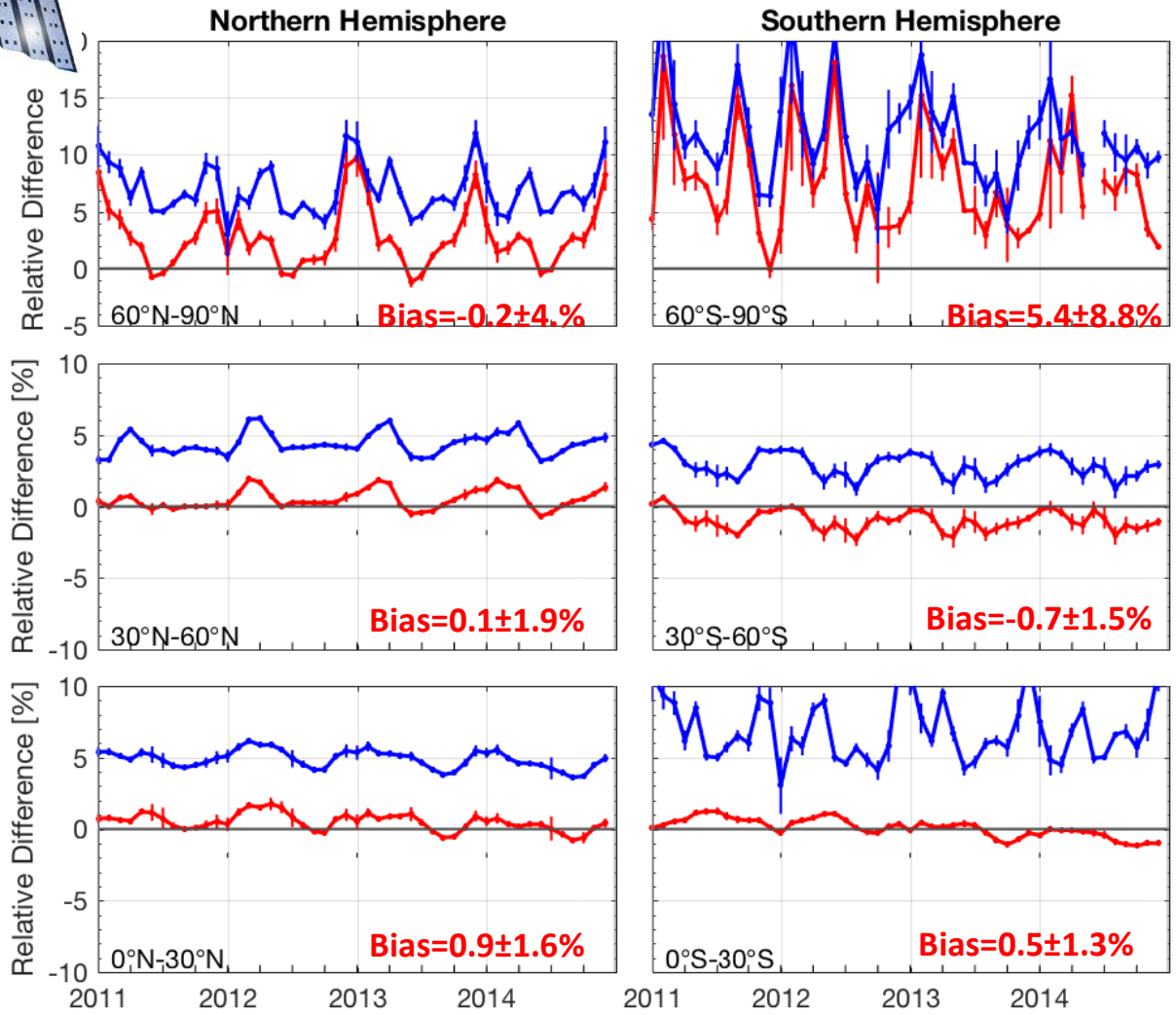




	770 [hPa] ~2[km]	*190 [hPa] ~12[km]*	*17 [hPa] ~24[km]*
Pearson Correlation			
FORLI - FTS	0.92	0.98	0.96
EUMETSAT - FTS	0.84	0.95	0.88
IP68 [%]			
FORLI - FTS	10.19	5.90	2.68
EUMETSAT - FTS	14.04	21.02	3.31

For the Partial Column Amounts, the IASI precision is below 7% for the stratosphere and below 13% for the troposphere

IASI-A TOC with GOME2-A



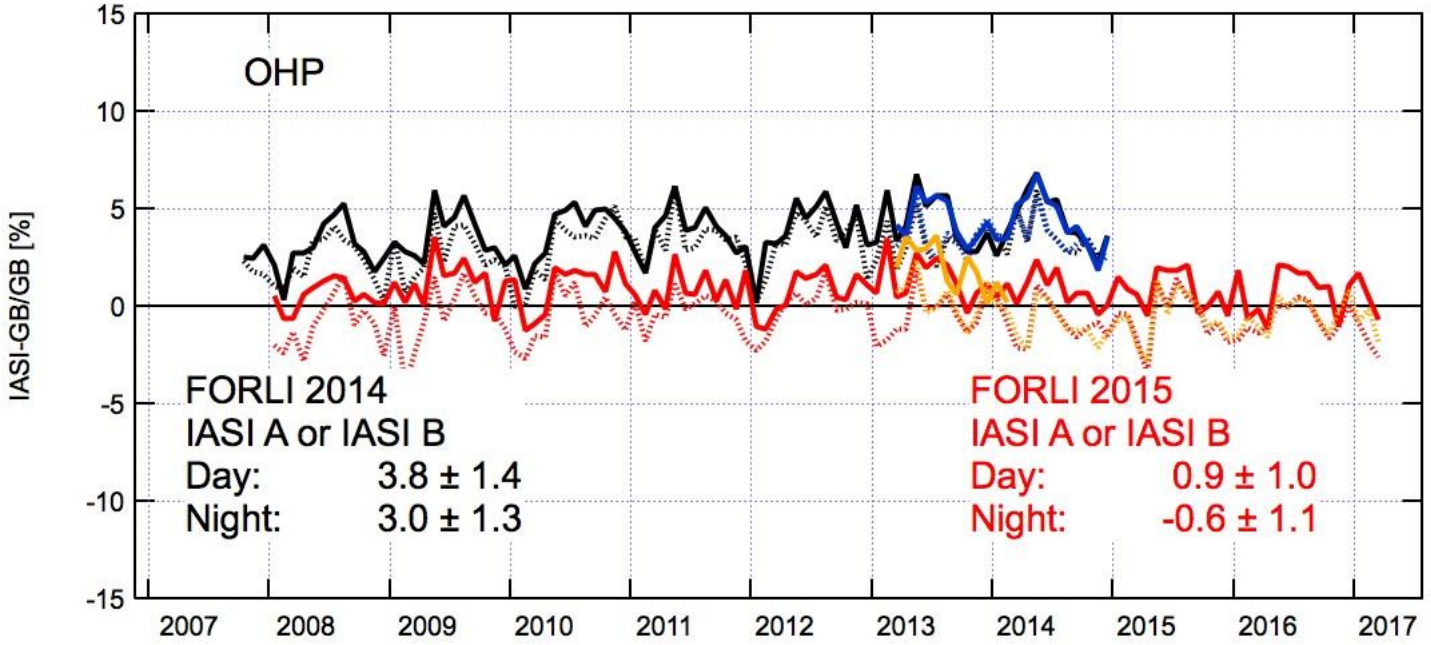
FORLI-O3 v20140922

FORLI-O3 v20151001

Credit: Anne Boynard (LATMOS)

Decrease in the bias of ~4% with FORLI-O3 v20151001. Overall bias of ~1±5%

At high latitude: discrepancies up to 20% during cold season (due to low brightness temperatures)



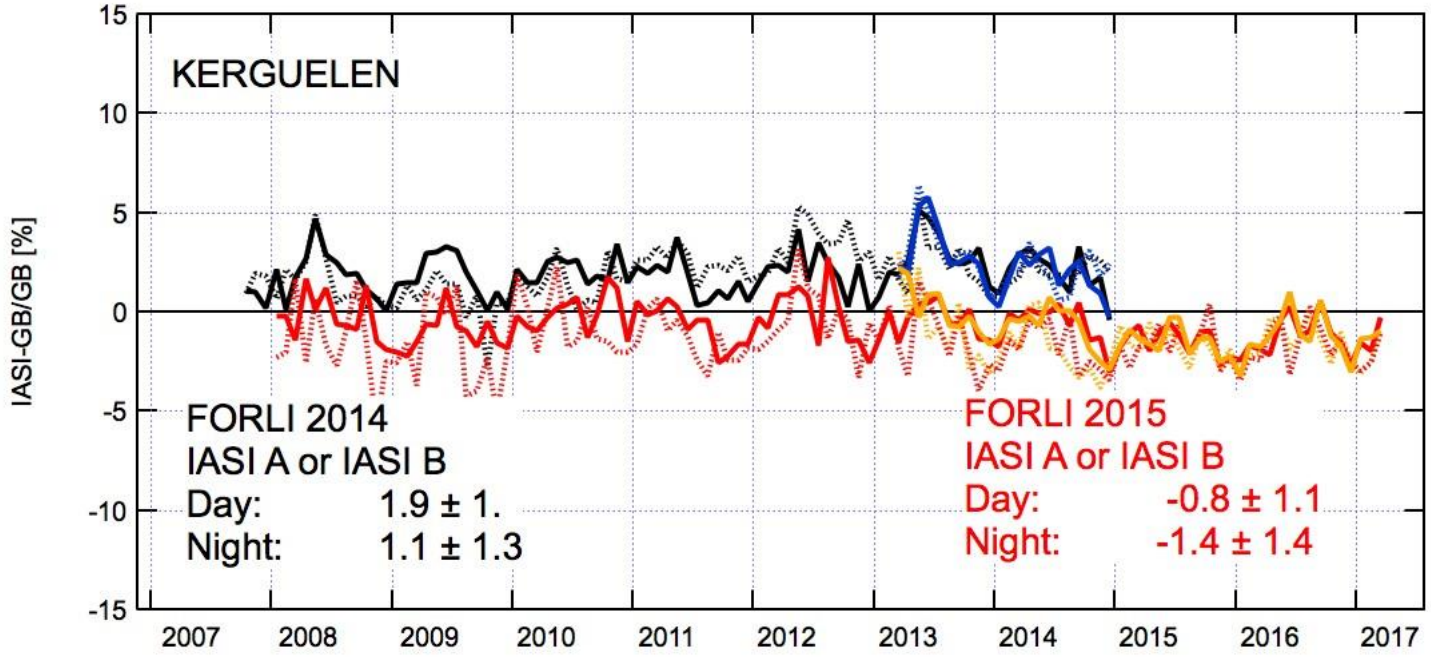
IASI-A 2014 **IASI-A 2015**

IASI-B 2014 **IASI-B 2015**

- day - day

…night …night

Courtesy Florence Goutail (LATMOS)



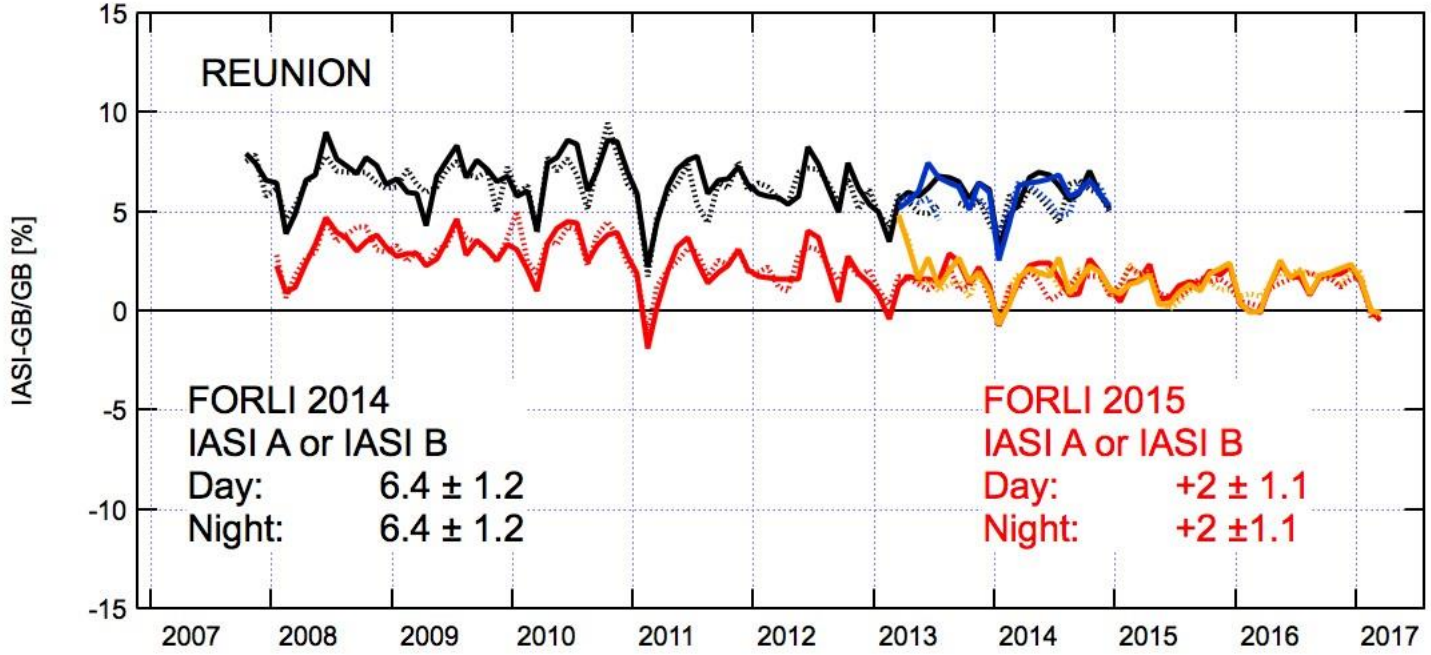
IASI-A 2014 **IASI-A 2015**

IASI-B 2014 **IASI-B 2015**

- day - day

…night …night

Courtesy Florence Goutail (LATMOS)



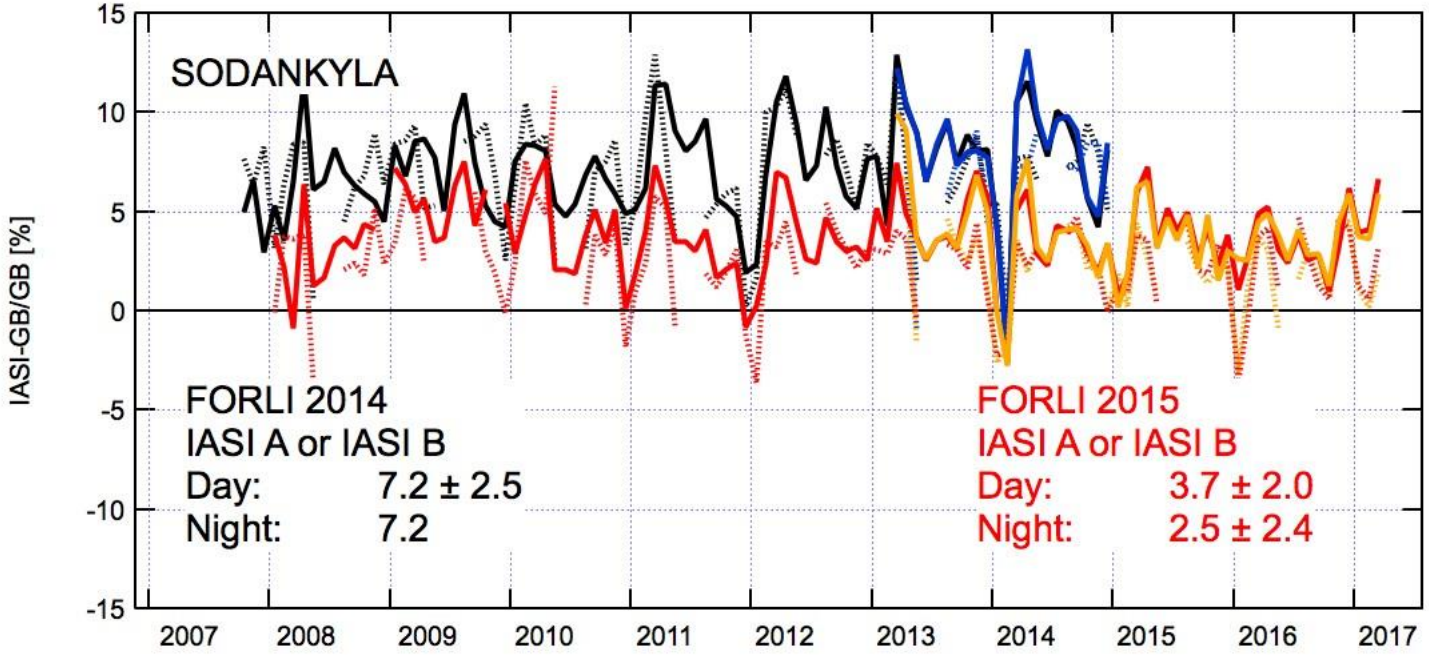
IASI-A 2014 **IASI-A 2015**

IASI-B 2014 **IASI-B 2015**

- day - day

…night …night

Courtesy Florence Goutail (LATMOS)



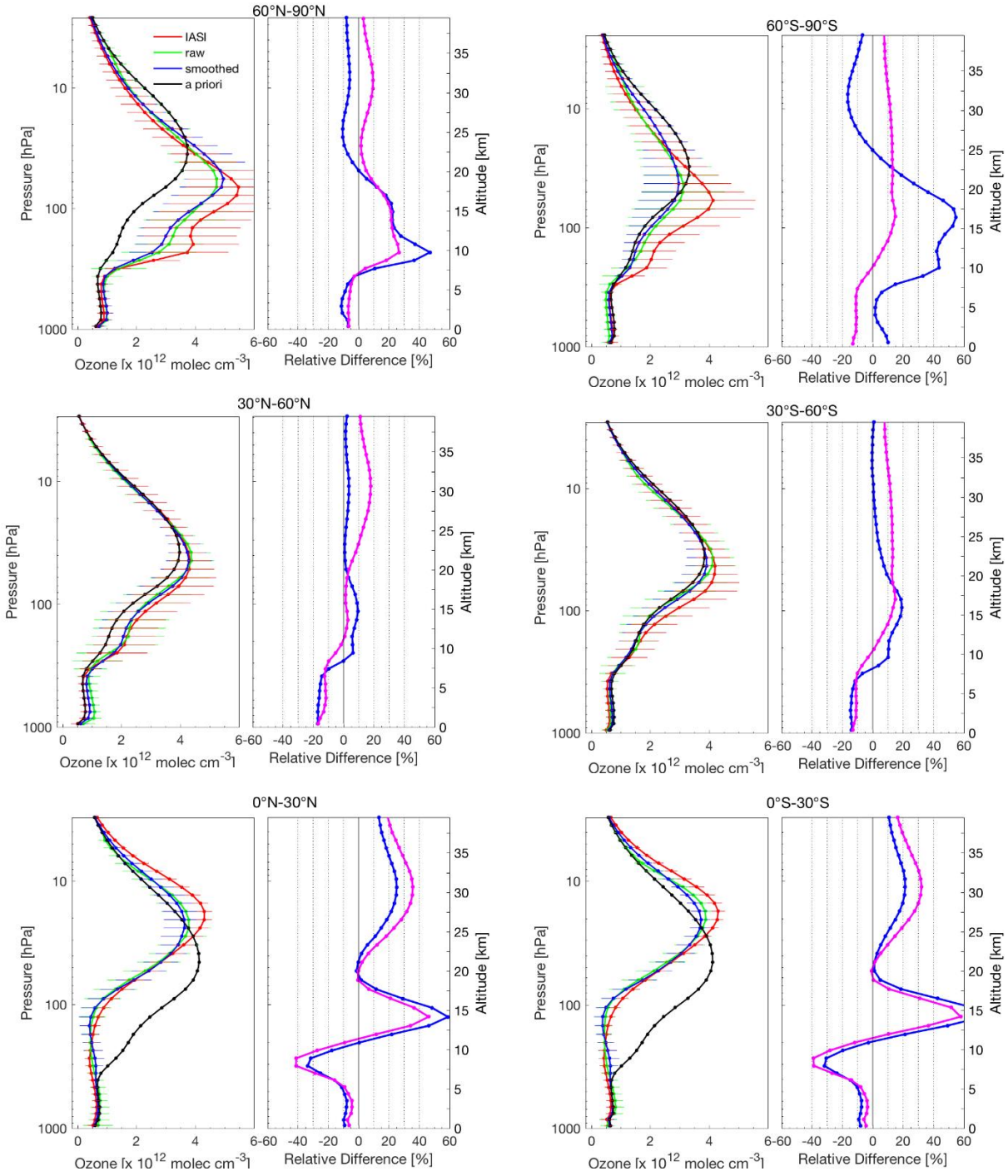
IASI-A 2014 **IASI-A 2015**

IASI-B 2014 **IASI-B 2015**

- day - day

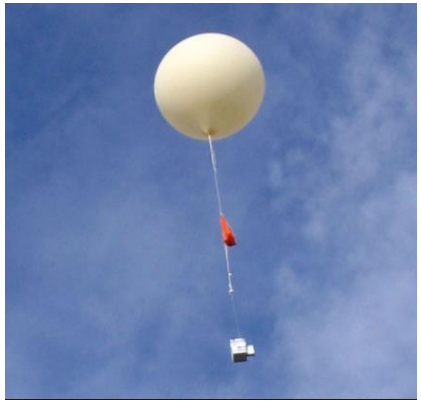
…night …night

Courtesy Florence Goutail (LATMOS)

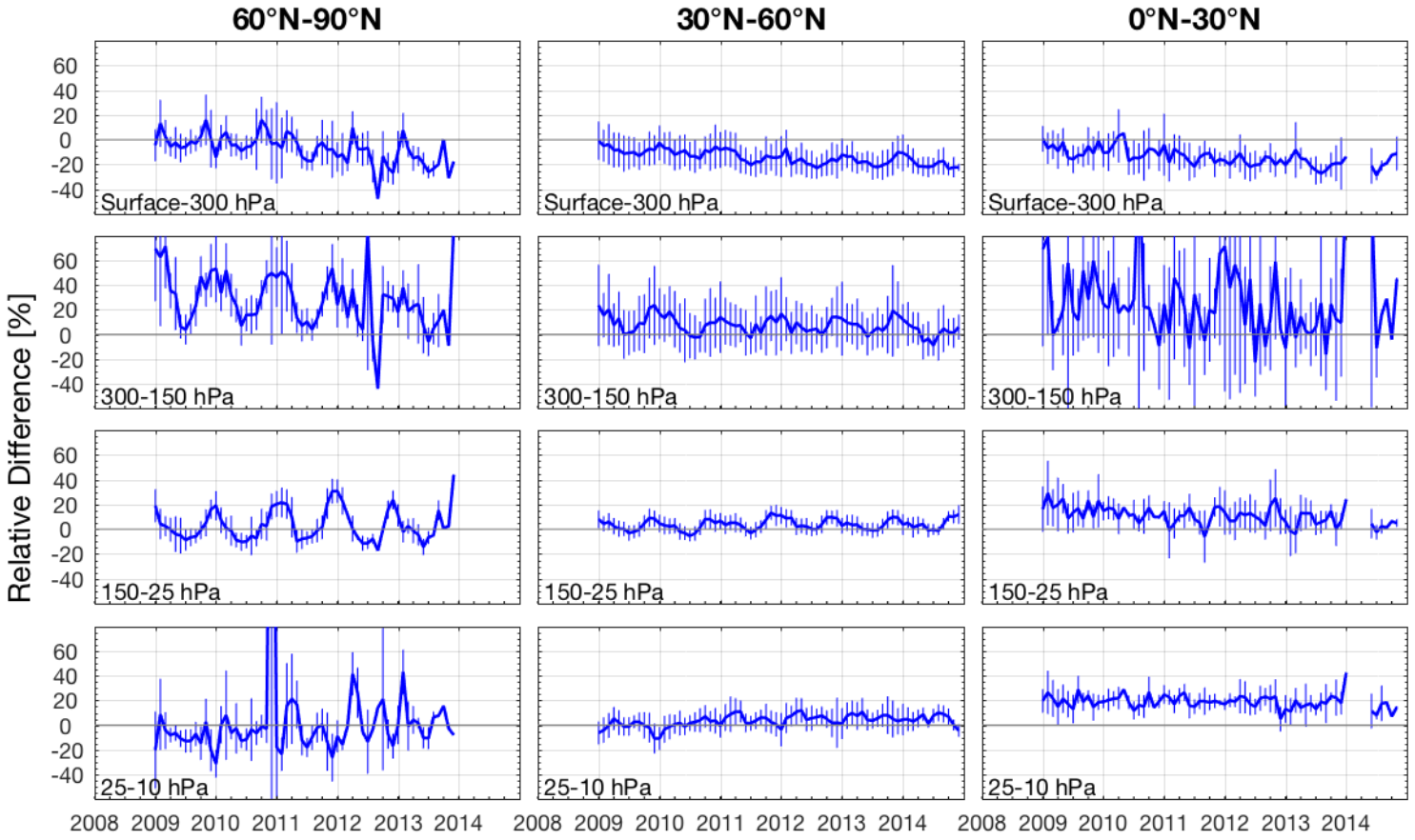


FORLI-O3 v20151001

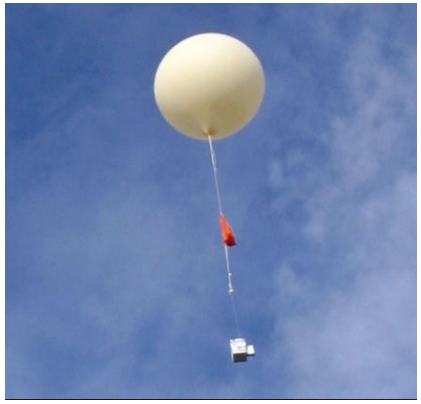
FORLI-O3 v20140922



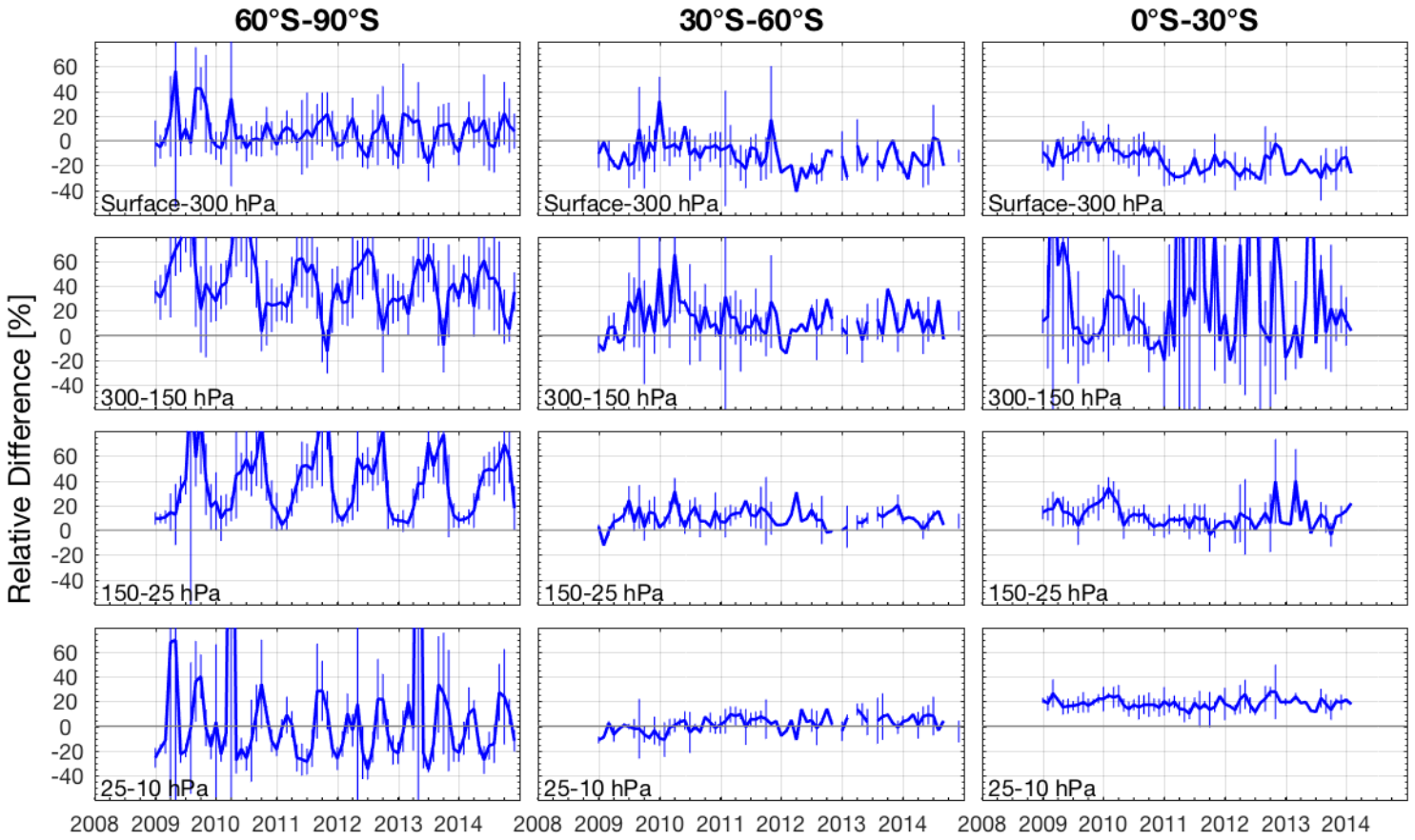
IASI-A partial columns with sondes



Credit: Anne Boynard (LATMOS)



IASI-A partial columns with sondes



Credit: Anne Boynard (LATMOS)

Conclusion

10 years of IASI data available (IASI-A & B, consistant)

The IASI FORLI retrieval algorithm is beeing implemented at Eumetsat for operational distribution (O3MSAF/AC-SAF framework)

Total column and partial colums agreements very good with GOME-2, NDACC SOAZ and lidar at Maido

Profiles : Bias still there in UTLS

Quality flags are needed (work in progress)