IASI Ozone product validation: total and tropospheric columns

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Atmos. Meas. Tech., 11, 5125–5152, 2018
https://doi.org/10.5194/amt-11-5125-2018

Atmospheric Measurement Techniques
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EGU

Validation of the IASI FORLI/EUMETSAT ozone products using satellite (GOME-2), ground-based (Brewer–Dobson, SAOZ, FTIR) and ozonesonde measurements

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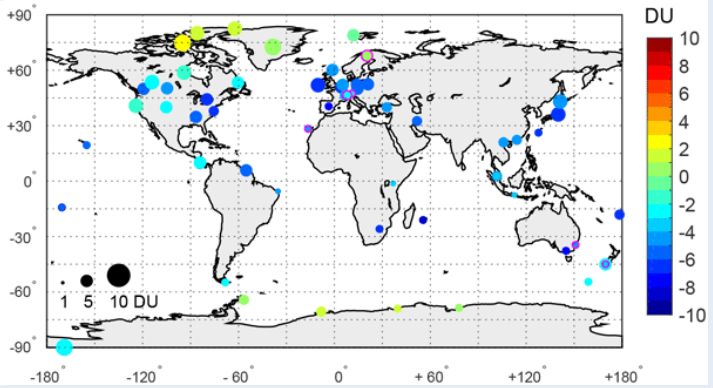
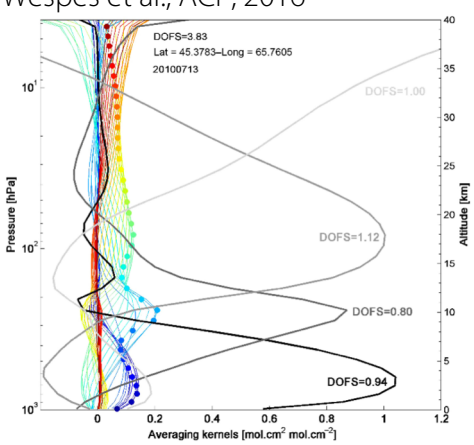


CEOS meeting – 12 June 2019

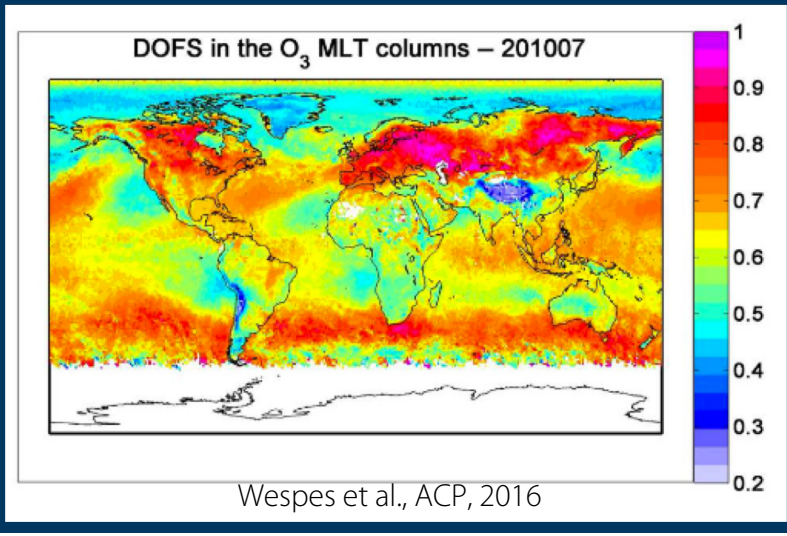
The IASI FORLI O_3 algorithm (v20151001)

- Retrievals performed in the 1025–1075 cm^{-1} spectral range using:
  - the optimal estimation method (OEM) (Rodgers, 2000)
  - tabulated absorption cross sections at various pressures and temperatures to speed up the radiative transfer calculation
- HITRAN 2012
- a priori information (one single O_3 a priori profile and variance–covariance matrix): O_3 climatology from McPeters et al. (2007)
- P, T, H2O, clouds : EUMETSAT Level 2 data
- Retrievals performed only for clear or almost clear scenes (fractional cloud cover < 13%)

Wespes et al., ACP, 2016



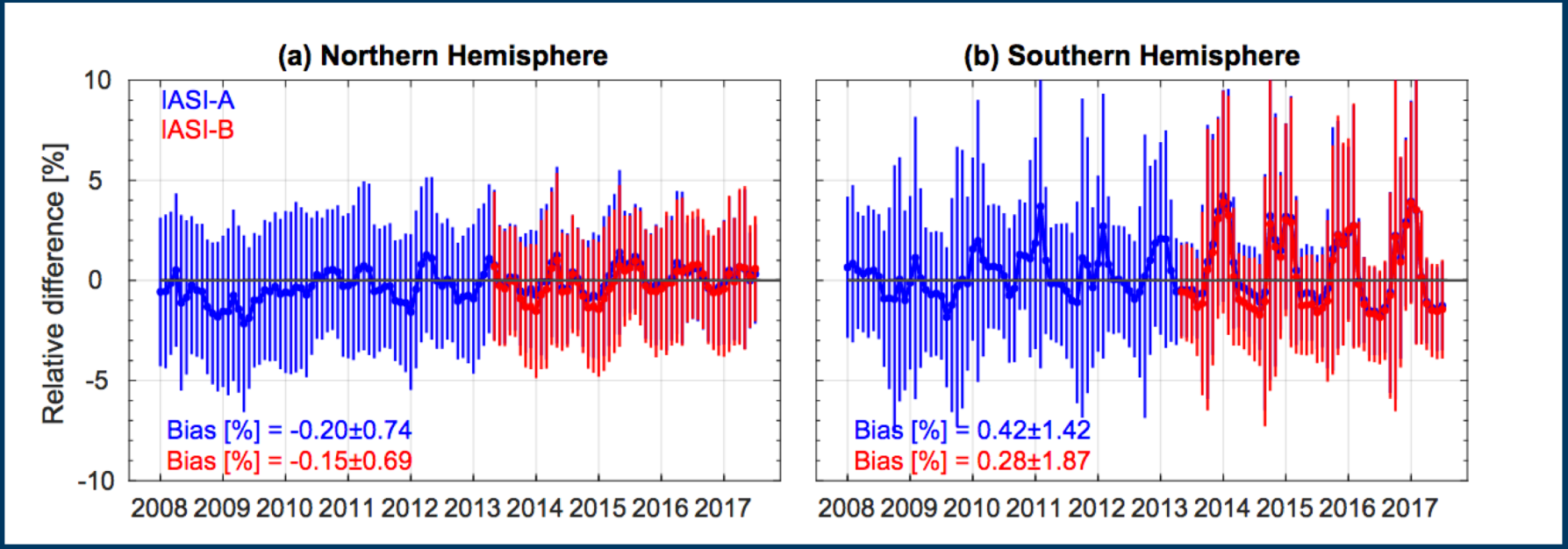
- 25-3 hPa
- 150-25 hPa
- 300-150 hPa
- Surface-300hPa (MLT)



Wespes et al., ACP, 2016

Total ozone columns: validation with satellite data: GOME-2

[%diff=100x(IASI-GOME2)/GOME2]

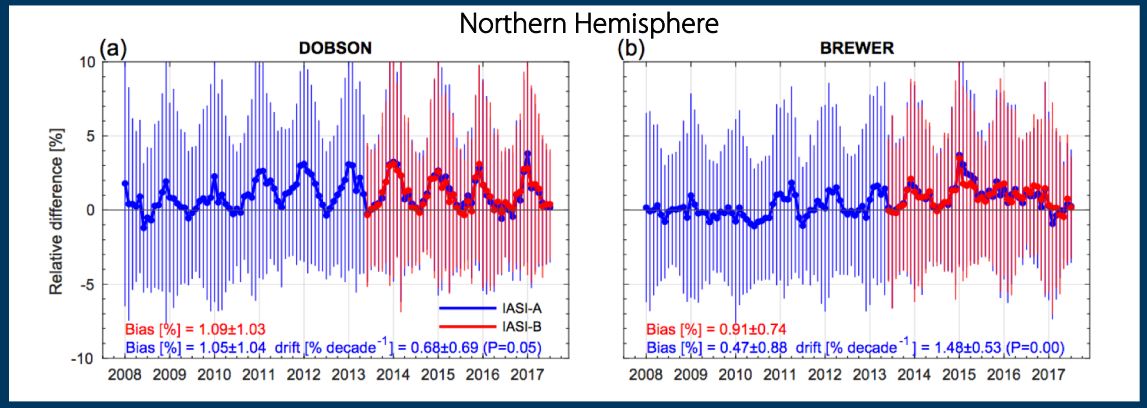


- Excellent agreement between IASI-A/IASI-B and GOME-2 TOC: <0.4% bias
- Larger bias found during the austral summer (related to larger differences in the southern high latitudes)

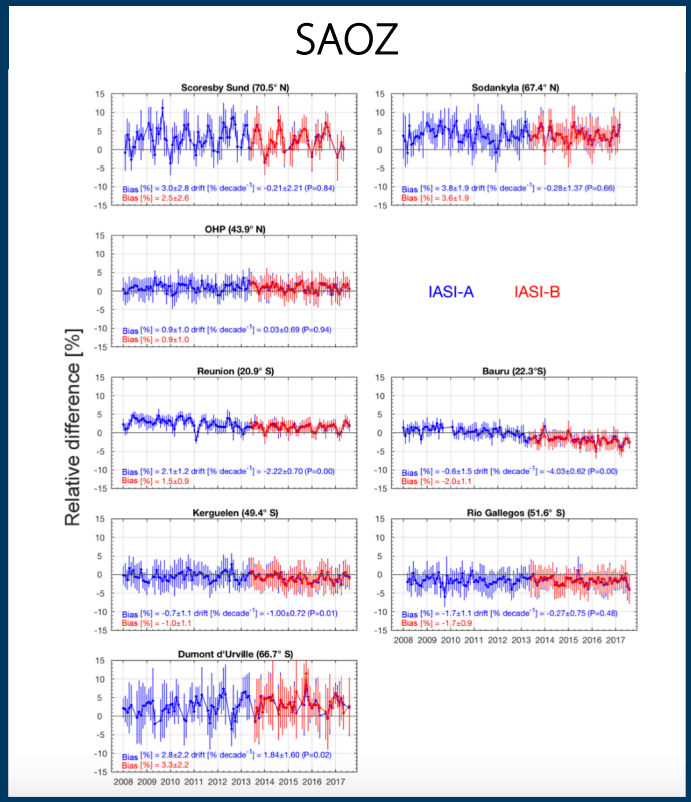
Boynard et al., AMT, 2018

Total ozone columns: validation with ground-based data: Brewer/Dobson and SAOZ

[%diff=100x(IASI-GB)/GB]



- Bias of 0.5–1.1 % (IASI product overestimating the TOC)
- Seasonal variability in the differences caused by the GB measurements
- Small drift satisfying the 1-3%/decade Ozone_cci requirements showing the long-term stability of the current IASI-A TOC products.

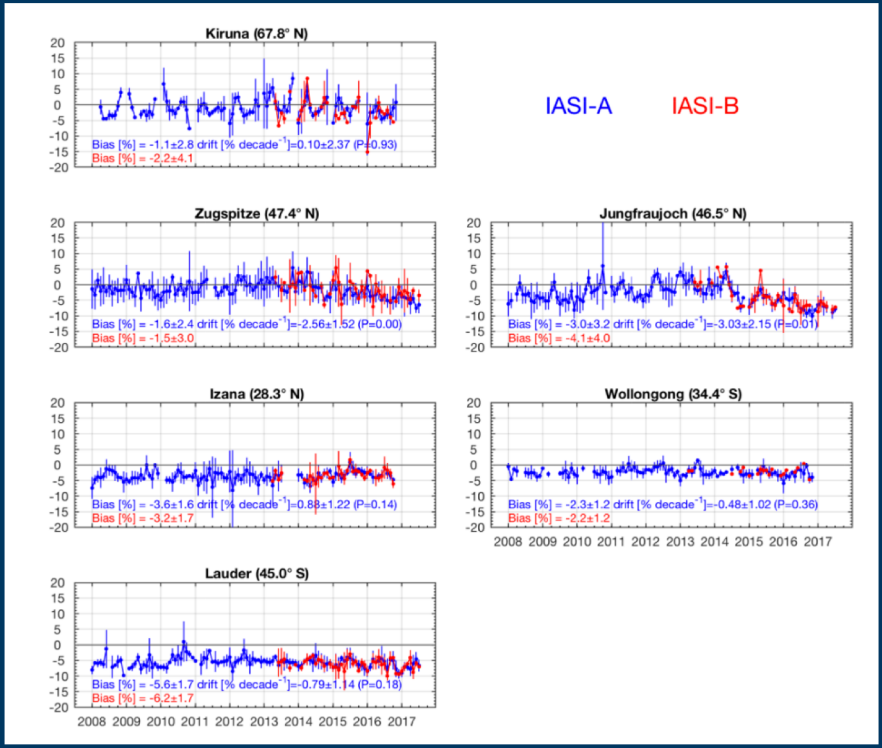


- Tropics/mid-latitudes: bias of 0.6–2 %
- High latitudes: bias of 2.5–3.8 %

Boynard et al., AMT, 2018

Total ozone columns: validation with ground-based data: FTIR

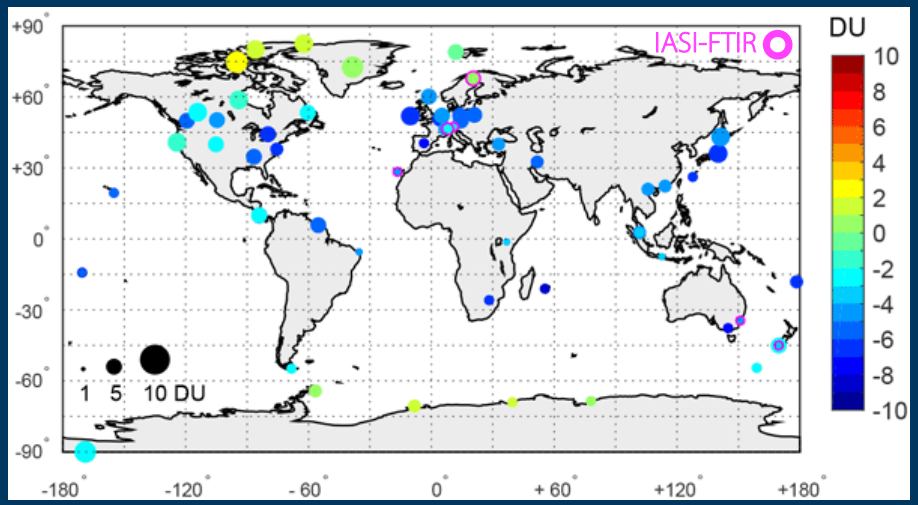
[%diff=100x(IASI-GB)/GB]



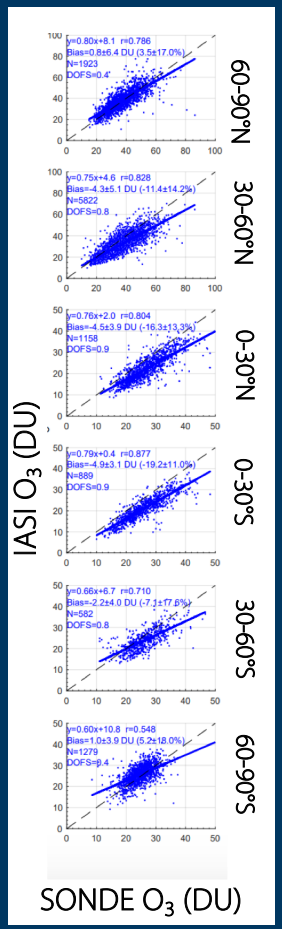
- Good agreement between IASI and FTIR TOC product, with IASI underestimating the TOC by 1.1–6.2 %.
- The largest bias found at Lauder is likely due to the FTIR data that might be biased high by 1.5–2 % at this station

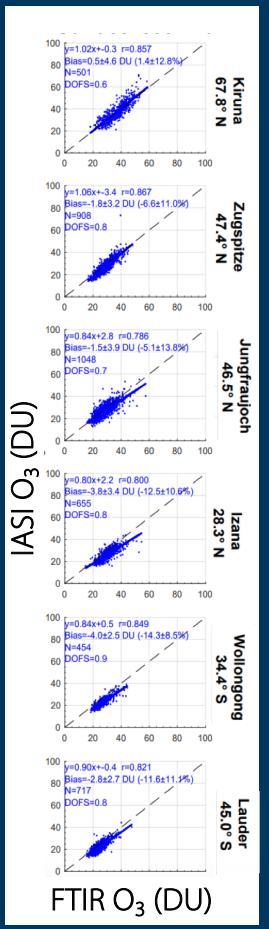
Boynard et al., AMT, 2018

Tropospheric ozone columns (surface-300hPa column): validation with ozonesonde and FTIR data



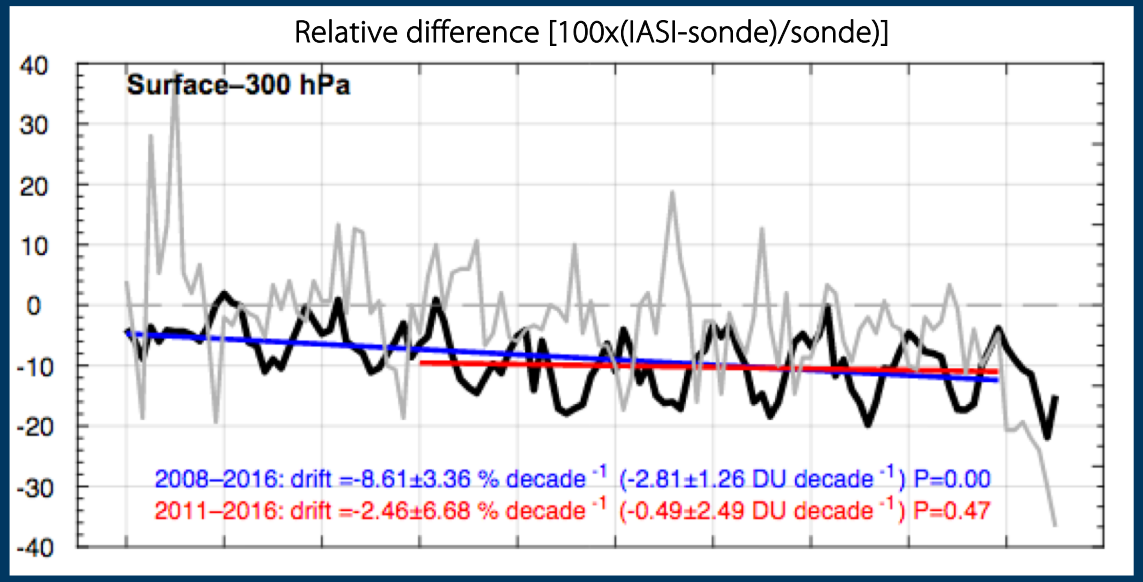
- Midlatitudes and tropics: the IASI TROPO O_3 product underestimates the O_3 abundance
- High latitudes: the IASI TROPO O_3 product overestimates the O_3 abundance
- DOFS ~0.8-0.9 in the midlatitudes/tropics





Boynard et al., AMT, 2018

Assessment of the long-term stability of the IASI-A TROPO O_3 product



- Significant negative drifts of the IASI-A TROPO O_3 product (–8 % and–16 %/decade) over the period 2008-2017 (sonde/FTIR),

=>might be taken into consideration when deriving trends from this product and this time period.

=> Further investigations for the reasons are in progress

Boynard et al., AMT, 2018

Summary

1. Total Ozone column:
   - Excellent agreement between IASI and satellite/GB data
   - Larger differences found in Antarctica => further investigations are needed
   - Small drift found in the TOC (<3%/decade) showing the long-term stability of the current IASI-A TOC products.

2. Tropospheric Ozone column (surface-300hPa):
   - Good agreement between IASI and sonde/FTIR data (bias <13% for the mid latitudes)
   - Significant negative drifts of the IASI-A TROPO O_3 product (ranging between –8 % and–16 %/decade)

   ⇒ Further investigations for the reasons are in progress

3. The IASI/FORLI O_3 products will be the operational Eumetsat product in 2019