Multi-TASTE assessment of the quality and evolution of ENVISAT reactive and greenhouse gas data products

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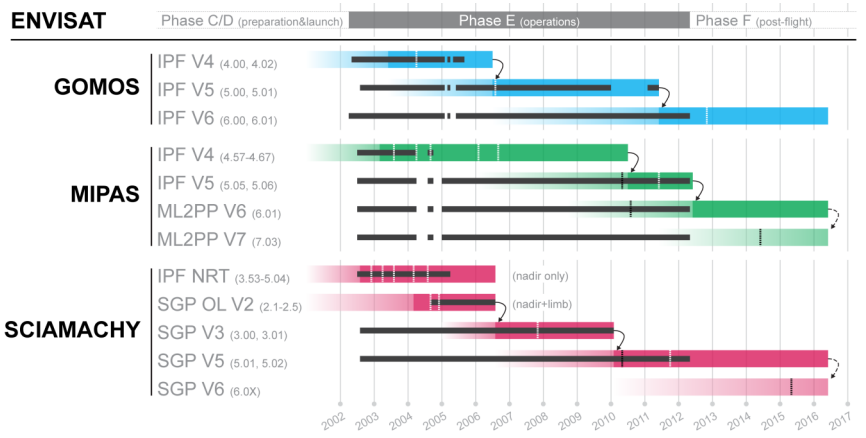
Overview

Projects: TASTE (2004-2008), Multi-TASTE (2008-2012) and TASTE Phase-F (2013-2016)

Objective: Provide ESA with Technical ASsistance To the validation of Envisat atmospheric data

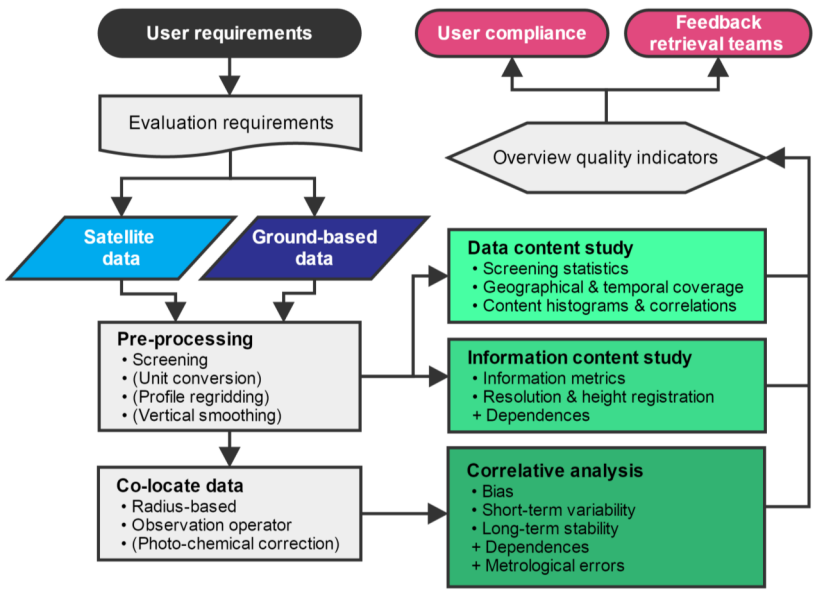
Tasks:
- Collection and fast delivery of ground-based data to the Envisat Cal/Val database;
- First ground-based validation of new Envisat data products;
- Routine geophysical validation of operational data from Envisat and Third Party Missions;
- Validation/diagnostic support to Envisat Quality Working Groups and SADDU research;
- Delta-validation of Envisat data processor upgrades;
- Long-term validation and mutual consistency of consolidated satellite data records;
- Establishment of validation strategies for new and future data products.

1. Evolution of operational processors



Legend: Prototype development phase (gradient bars); release of partial data set to validation teams (black vertical lines); operational processing phase (solid bars); switch to new minor version (white vertical lines); and data set coverage (thinner black bars).

2. The Multi-TASTE validation system



3. Atmospheric data records

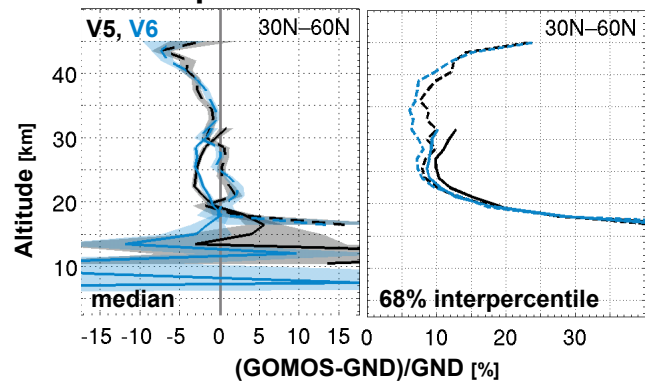
	O3	H2O	T	NO2	BrO	CO	N2O	HNO3	CH4
GOMOS	P	P	P						
MIPAS	P	P	P				P	P	P
SCIAMACHY	C, P	C		C	C, P	C			
Dobson	C								
Brewer	C								
UV-VIS	C			C	C, P				
FTIR						C	P	P	P
Ozonesonde	P	C, P	P						
Lidar	P		P						
MWR	P								

Info: **Top:** Envisat trace gas products validated within Multi-TASTE (**C:** vertical column; **P:** vertical profile). **Bottom:** Ground-based instruments used for the correlative analyses. These operate within global networks contributing to WMO's Global Atmosphere Watch, including NDACC, SHADOZ and the Dobson and Brewer networks.

4. Selection of recent validation results

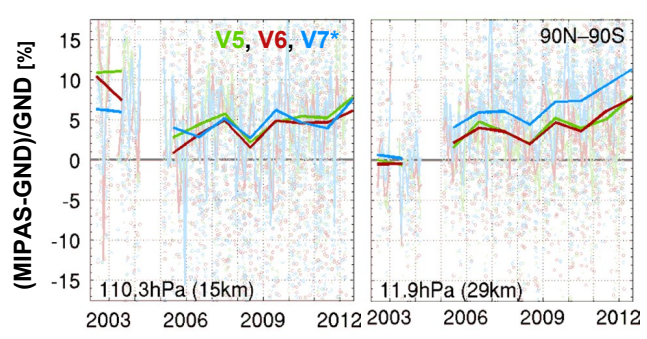
*Disclaimer: The results for MIPAS V7 and SCIAMACHY V6 originate from a δ-validation analysis, based on a partial data set (~5000 orbits) by a prototype of the operational processor. The quality of the finally released data set may slightly differ.

GOMOS O3 profile



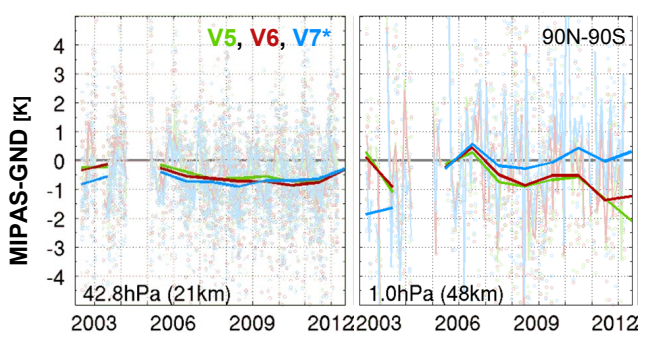
Comparison to mid-N ozonesonde and O3 lidar network.
Near-identical bias; V6 has fewer outliers.

MIPAS O3 profile



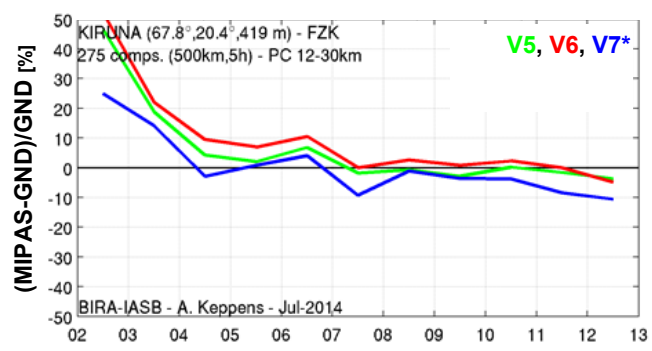
Comparison to global ozonesonde and O3 lidar network.
V7* bias is 1-2% more positive in MS.

MIPAS T profile



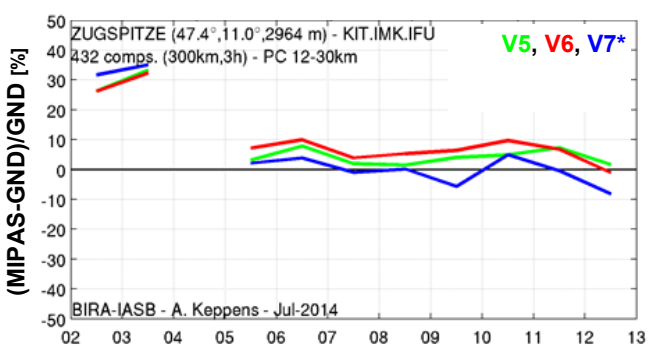
Comparison to global ozonesonde and T lidar network.
V7* differs in a) FR/OR bias and b) long-term stability.

MIPAS N2O profile



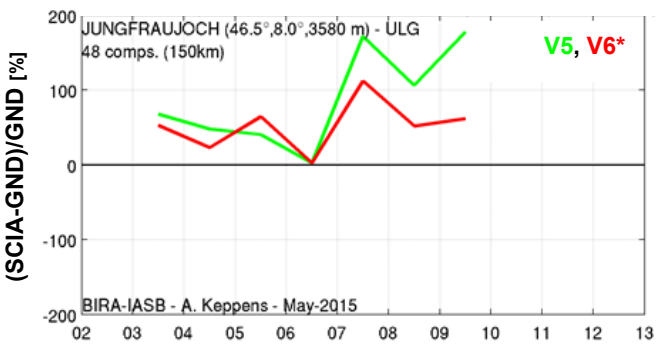
Comparison to NDACC FTIR Kiruna (12-30km part. col.).
V7* changes few % in bias.

MIPAS CH4 profile



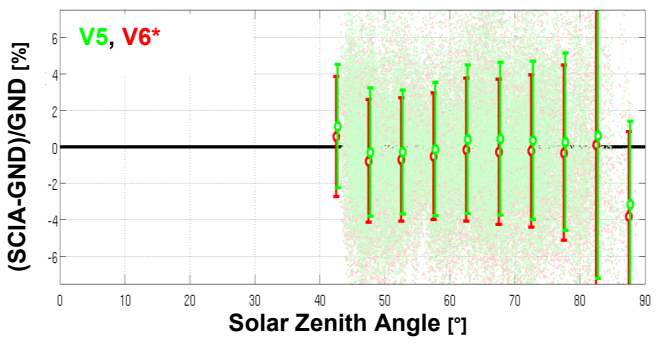
Comparison to NDACC FTIR Zugspitze (12-30km part. col.).
V7* changes few % in bias.

SCIAMACHY nadir CO column



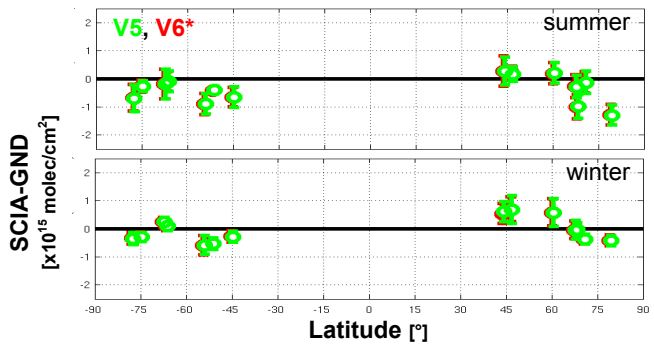
Comparison to NDACC FTIR Jungfraujoch.
V6* slightly less biased, short-term variability similar.

SCIAMACHY nadir O3 column



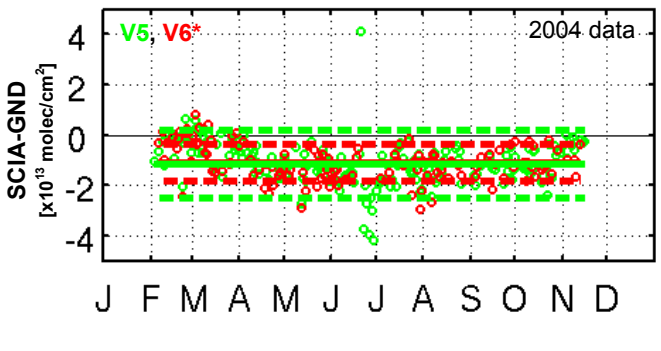
Comparison to Arctic Brewers (67N-90N).
V6* ozone is ~0.5% smaller than V5.

SCIAMACHY nadir NO2 column



Comparison to NDACC UV-vis spectrometer network.
V6* bias & seasonal dependence very similar.

SCIAMACHY nadir BrO column



Comparison to NDACC UV-vis spectrometer Harestua.
Similar bias, but fewer outliers for V6*.

5. Developments in view of future missions

- Future missions : TROPOMI, Sentinels, GEO Air Quality Constellation …;
- Adaptations to support the QA4ECV framework and guidelines;
- Improve and document operational aspects: QA/QC, fast delivery …;
- Address geostationary peculiarities, including high sampling of the diurnal cycle, high spatial resolution, and moderate to large SZA;
- Address aspects of sustainability, long term stability, network homogeneity, traceability;
- NDACC continues developments of tropospheric measurement facilities & broadens list of species in UV-visible, IR and MW ranges;
- Analyse key User Requirements, enhance visibility of compliance.

6. More details and applications

[1] Keppens *et al.*, AMT (2015): Full description of validation chain;
[2] Lambert *et al.*, Ozone_cci PVIR: Compliance of ozone FCDRs with GCOS requirements;
[3] Hubert *et al.*, AMT (2016): SI2N assessment of 14 limb/occultation ozone profilers;
[4] Verhoelst *et al.*, AMT (2015): Description of OSSSMOSE metrology simulator.

Acknowledgements

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Collaboration : ESA, NDACC WGs, Envisat QWGs, SCIAVALIG.