Harmonised validation system for tropospheric ozone and ozone profile retrievals from GOME to the Copernicus Sentinels

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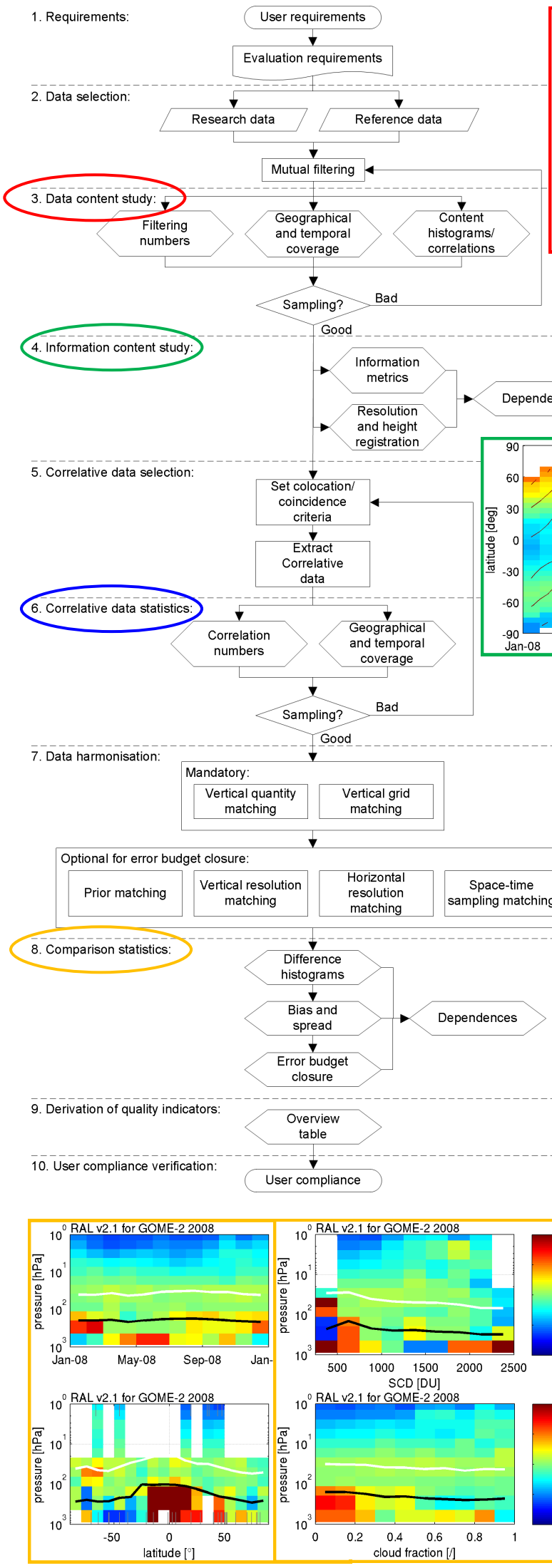
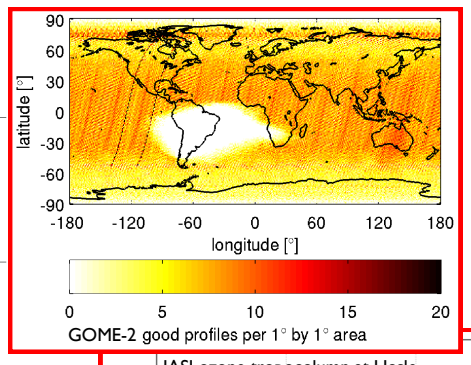
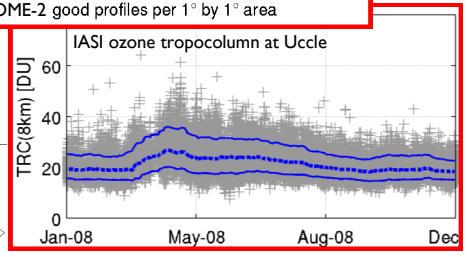
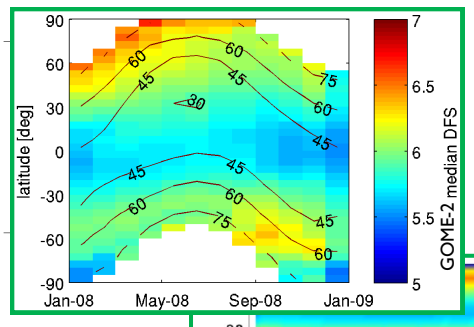
A harmonised validation system for assessing the quality of atmospheric data from multiple satellites has been developed at BIRA-IASB. It runs in pre-operational mode on Phase E (GOME-2, IASI) and Phase F (GOME, Envisat, 14 limb sounders...) data, following a generic and fully traceable flow of operations:

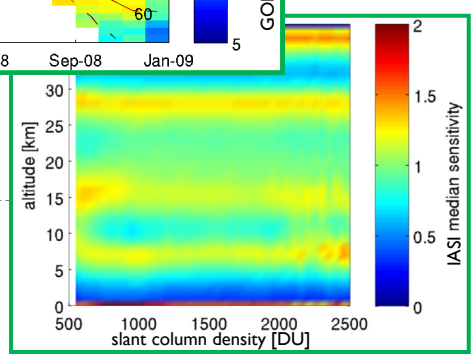


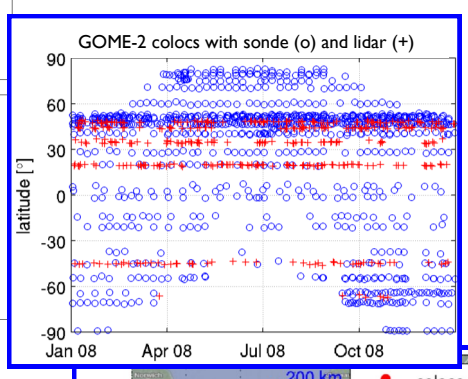
The broad applicability of the QA/validation system to virtually all atmospheric composition data is demonstrated here with two very different ESA Ozone_cci datasets: GOME-2 ozone profile retrievals by RAL (v2.1) and IASI tropospheric ozone column retrievals by ULB FORLI (v20100815), both for 2008:

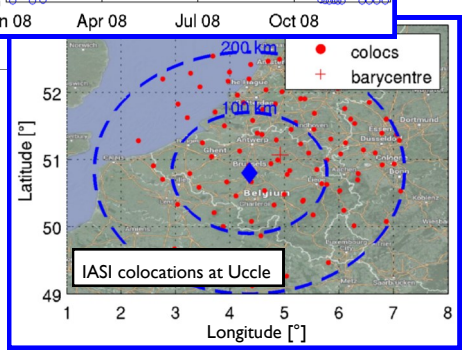


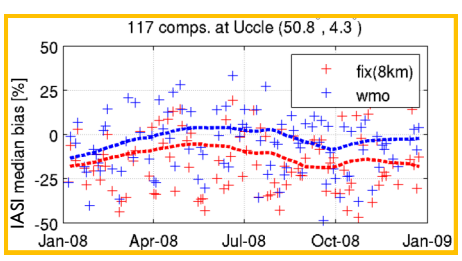






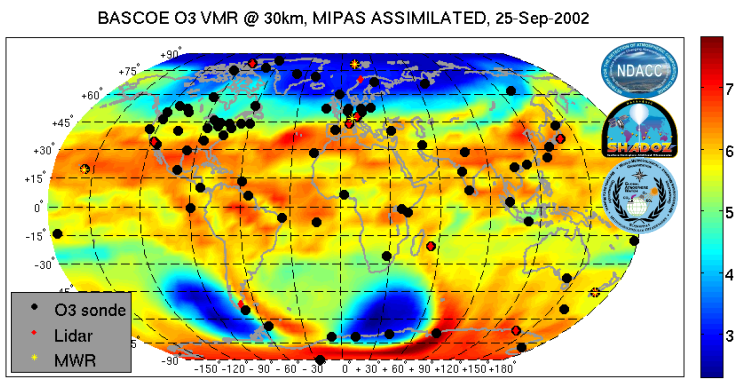






The backbone of the validation system consists of:

- Characterization of satellite and reference data: dataset content, information content, co-located datasets characterization, and data harmonization.
- Metrologically traceable confrontation of profiles or (tropospheric) columns with ground-based reference data acquired by established networks of ozonesonde and lidar stations: NDACC, SHADOZ, WMO GAW...



- Derivation of Quality Indicators enabling users to evaluate the fitness for purpose of the satellite data.

SENTINELS SPECIFICS

TROPOMI ozone data validation, as planned in the S5PVT AO project "CHEOPS-5p" (ID28587), and the future Copernicus Sentinels, raise a list of new challenges:

- Large rate and amount of data;
- High horizontal resolution;
- Need for NRT quality monitoring;
- Broad scope of applications: air quality, climate...
- Need for improved error characterisation (including error budget closure);
- Competing evaluation approaches and tropopause definitions for tropospheric ozone columns;
- Cloud-induced bias for height-resolved ozone;
- Different accuracy and vertical range of reference instruments: ozonesonde, tropospheric lidar, stratospheric lidar, microwave radiometer, FTIR spectrometer;
- And more challenges for other Sentinel missions, e.g. related to S4 geostationary orbit...

THEREFORE

Current developments of the QA/validation system address the above challenges and make the system evolve into an operational phase:

- *User Requirements* are formulated in a homogenised format to set up the suite of validation operations, addressed using a tick-box approach.
- *Data selection* and *post-processing* is largely automated, but operational subset selection is required for NRT evaluation. Automated filtering is based on data flags.
- *Selection of correlative data* is based on tailorable space-time colocation criteria using a library of observation operators. For large datasets the correlative data selection can be done by orbit prediction.
- *Data harmonisation* of the units and vertical grid: tailorable column or profile manipulations are applied, resulting in a full view on known error contributions. Horizontal resolution, vertical resolution, sampling and co-location mismatch errors can be estimated using the OSSSMOSE metrology simulator (see poster by Verhoelst et al.)
- *Comparison statistics* are operationally determined from difference histograms and include their dependence on preselected parameters of importance, including e.g. season, tropopause, clouds, temperature contrast...

S5PVT AO project CHEOPS-5p (ID28587): Validation of Copernicus HEight-resolved Ozone data Products from Sentinel-5P TROPOMI
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