Atmospheric Composition Sub-Group Report

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Outline

- ✓ Introduction
- ✓ Review of atmospheric composition missions
- ✓ On the coherence and integration of AC measurement systems
  - *Federating projects and initiatives*
  - *Observation operators*
  - *Site classification*
- ✓ GMES Atmospheric Service (GAS) quality strategy

Review of AC missions: current

- ✓ ERS-2 GOME (03/1995), NOAA-16/17/18 SBUV/2, Odin OSIRIS/SMR (02/2001), SCISAT-1 ACE (08/2003) performing well
- ✓ ESA Envisat (03/2002): MIPAS and SCIAMACHY operating well; problems with GOMOS; PB-EO approved today mission extension to 2013
- ✓ NASA Aura (07/2004): nominal operation of OMI, MLS, TES; HIRDLS instrument failure in March 2008; platform fuel through 2015
- ✓ A-Train (Aqua, Calipso, CloudSat, Parasol, Aura): nominal operation
- ✓ EUMETSAT MetOp-A (10/2006) GOME-2 and IASI nominal operation
- ✓ CMA/NSMC FY-3A SBUS/TOU (05/2008): O_3 P/C (SBUV/TOMS)
- ✓ JAXA/NIES TANSO/GOSAT (01/2009): global CO_2 and CH_4
- ✓ NASA OCO (global CO_2): launch failed in 02/2009

Review of AC missions: future

- ✓ NASA Glory : aerosols/black carbon, to join A-Train in 10/2009
- ✓ ESA ADM-Aeolus: wind and aerosols, to be launched in 2010
- ✓ NPOESS Preparatory Project (NPP) launch scheduled for 2011
- ✓ ISS/JEM/SMILES, STEAM, SWIFT
- ✓ Under study
  - *BIRA-IASB ALTIUS*
  - *CSA SOAR, STEP, CLIM/AQ mission*
  - *ESA Earth Explorers: A-SCOPE, PREMIER, TRAQ*
  - *EU/ESA/EUMETSAT GMES Sentinels 4 & 5, S5 precursor*
  - *NASA's EDS CLARREO, GEO-CAPE, ACE, GACM, CASS*
- ✓ Important: mission gap expected after Envisat and Aura !

On the coherence and integration of AC measurement systems

- ✓ WMO/IGACO-O3-UV/IO3C/NDACC Ozone Theme Meeting 2009 on ozone absorption cross sections, held at WMO HQ on May 11-13, 2009.

  ACSG recommendations :

  - *O_3 cross sections harmonisation should be carried out over the entire spectral range (not limited to Huggins/Hartley bands)*
  - *NO_2 and SO_2 cross sections at least need similar effort*
  - *(Too) slow process if done on voluntary basis. Motivation and appropriate funding to come most likely from space agencies (ESA started with NO_2 XS studies in the past and more recently with a project revisiting GOME FM XS).*

On the coherence and integration of AC measurement systems (2)

- ✓ ACSG-triggered ESA-funded instrument intercomparison project:
  - CINDI: NO_2 instrument intercomparison at Cabauw (Netherlands)

Building on DANDELIONS (and SAUNA and NDACC campaigns)
To take place in June-July 2009

  - Brewer/Dobson calibration at Izaña (Tenerife) at the Regional Brewer Calibration Centre for WMO RA-VI Region (Europe)

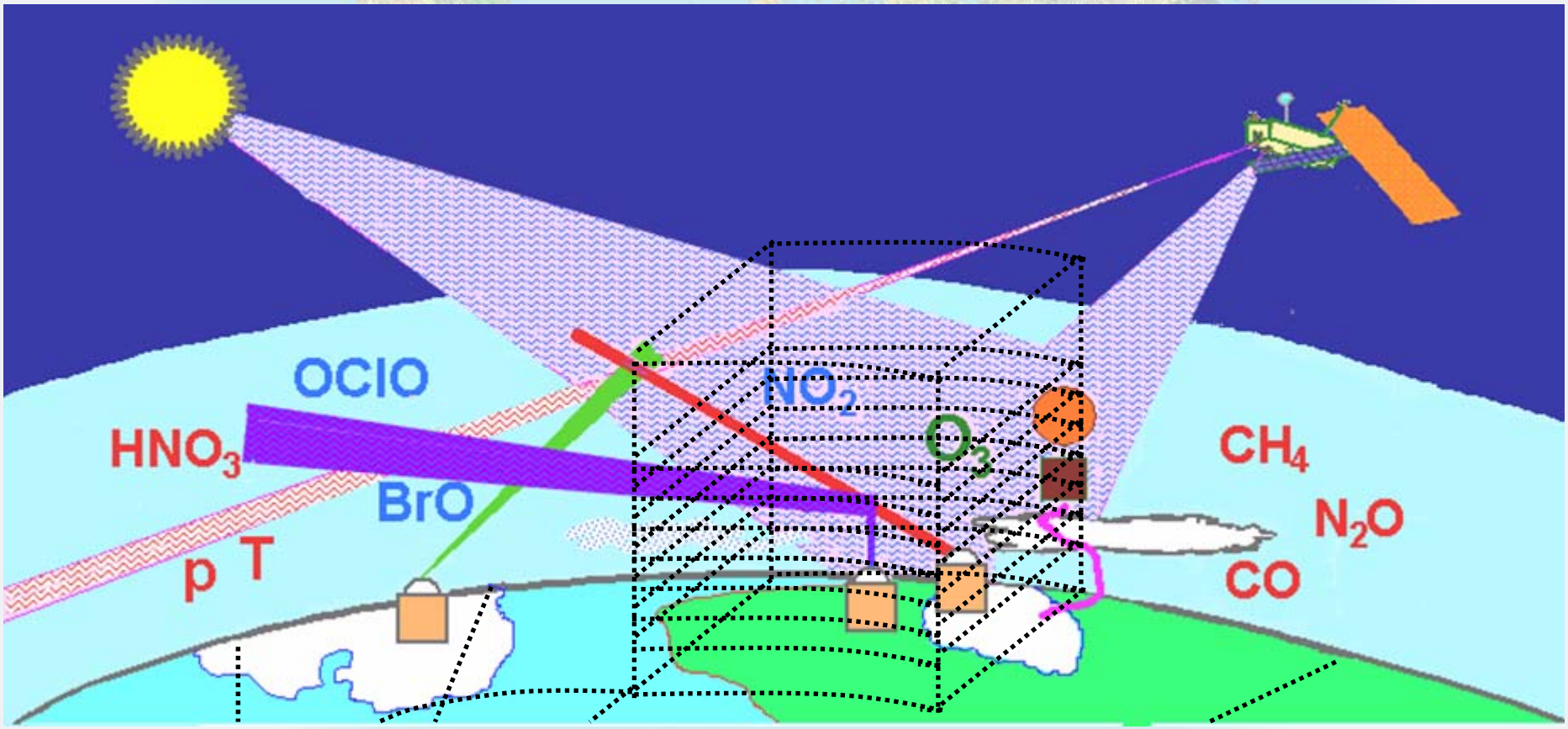
Building on SAUNA campaigns results

  - European aerosol LIDAR (EarliNet) traveling calibration support

On the coherence and integration of AC measurement systems (3)

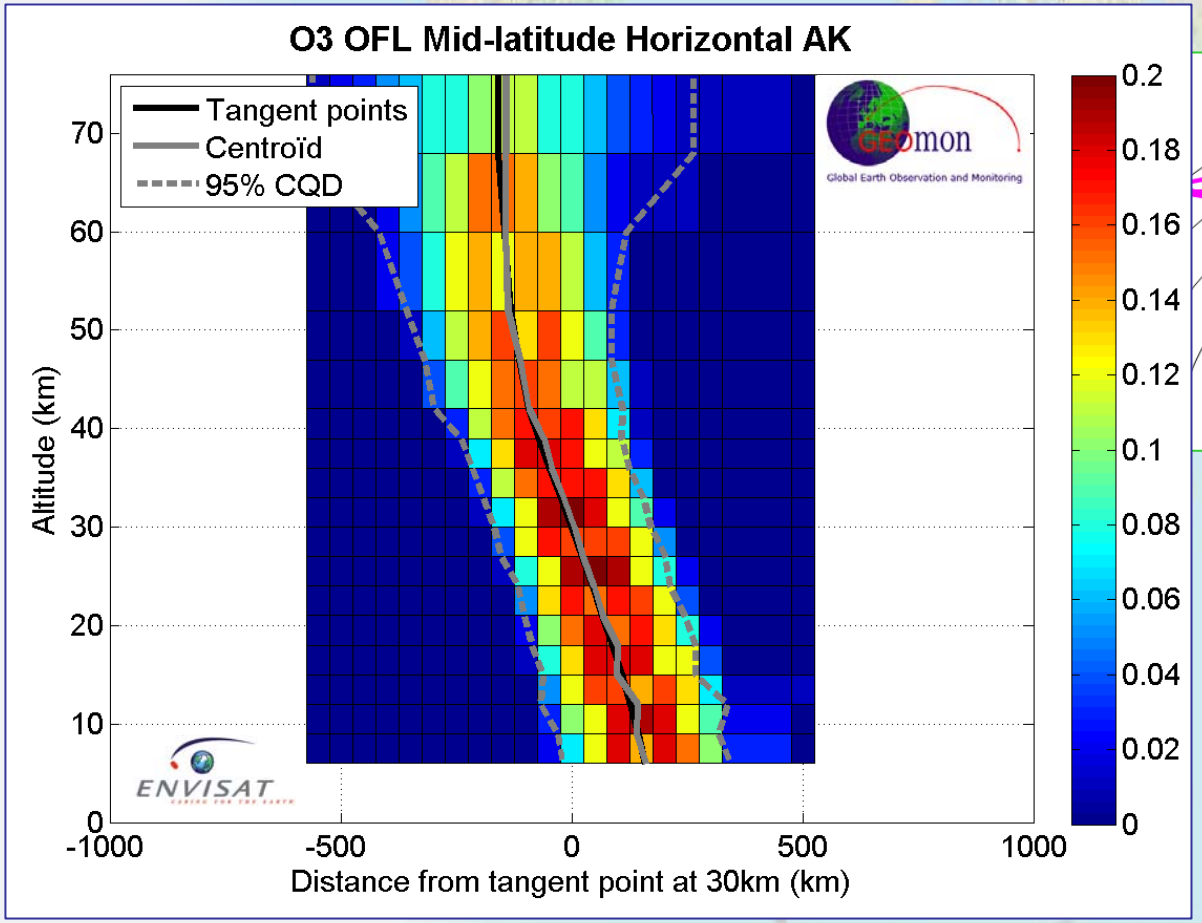
- ✓ EC FP6 Integrated Project GEOmon (Global Earth Observation and Monitoring of the Atmosphere, 2007-2011) is to:
  - *Unify and harmonize the main Europeans networks of surface- and aircraft-based measurements for greenhouse gases, air quality/pollution, aerosols, and stratospheric ozone*
  - *Support data gathering at existing networks*
  - *Coordinate access to data and data-products at a common data centre*
  - *Integrate surface measurements with those of satellites*
  - *Develop new methodologies to use these data for satellite validation*
  - *Enable new ground-based measurements complementary to satellites*
  - *Reduce biases and random errors in satellite observations*

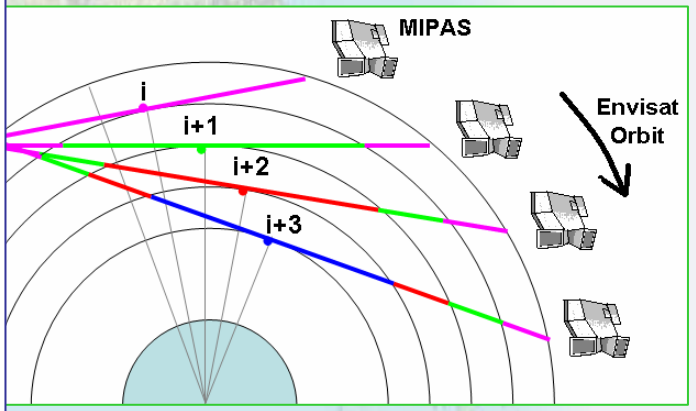
Progress with observation operators and site classification

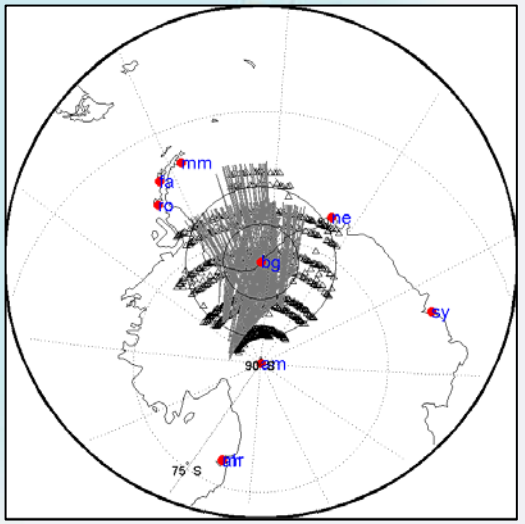


$$\varepsilon_{smoothing} = f\left((A_1 - A_2).S_{atmos}.(A_1 - A_2)^T \right)$$

Progress with observation operators and site classification (2)





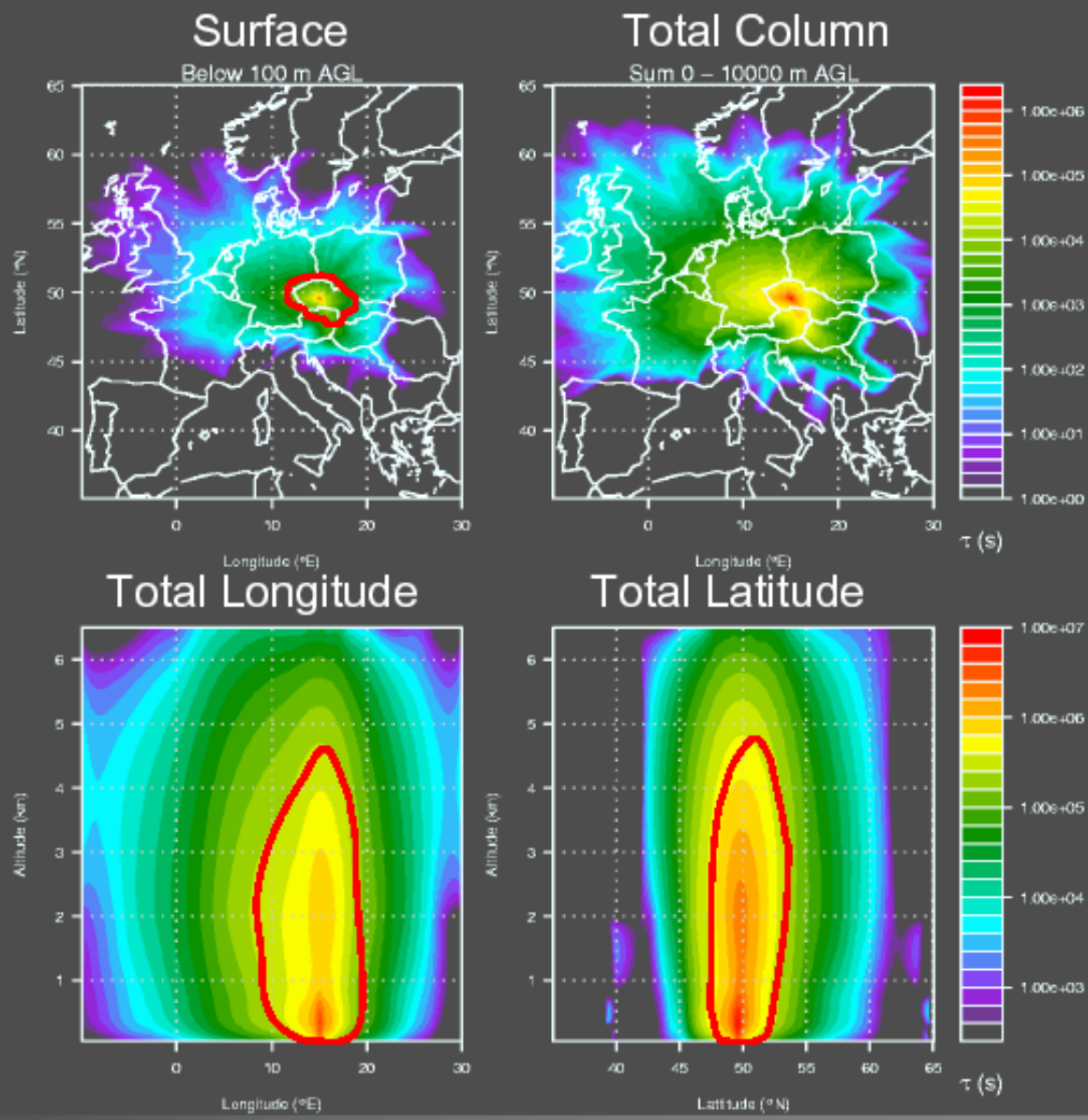


von Clarmann et al, The horizontal resolution of MIPAS, AMT, 2, 47-54, 2009

Definition of Surface Catchment

- **Volume of largest res. time containing 50 % of total (not surface!) res. time**
- **No major contribution of individual grid points outside determined catchment**
- **Defined for different integration intervals (12h, 24h, 48h)**

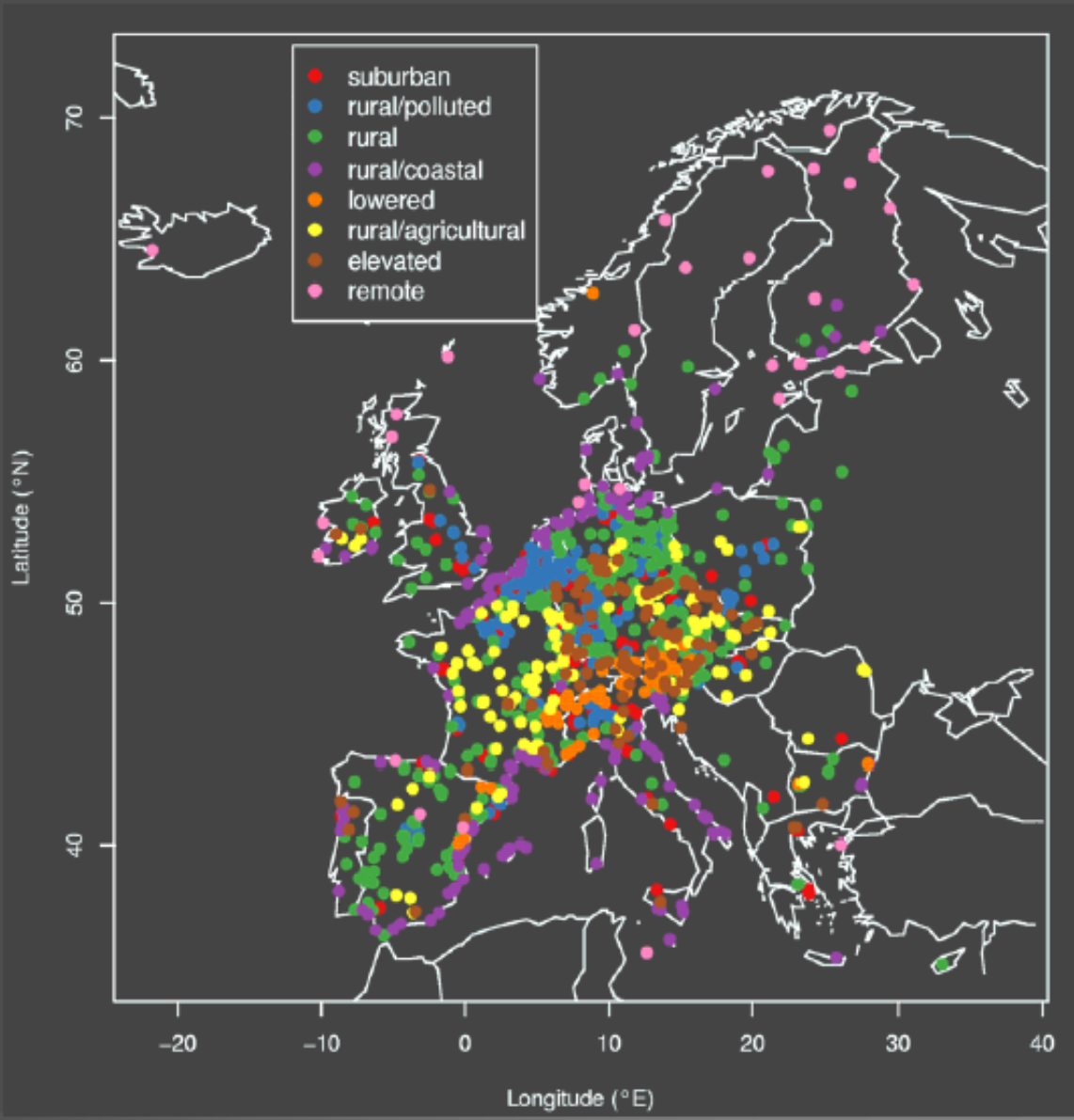
Total residence time
Kosetice 24 hours



Clustering Result

8 categories

- suburban
- rural/polluted
- rural
- rural/coastal
- lowered
- rural/agricultural
- elevated
- remote



GMES Atmospheric Service (GAS) quality strategy

- ✓ ESA's GSE pioneering quality strategy for services: PROMOTE for the atmosphere, but also GSE projects for marine/coastal, land, polar, food, risk, humanitarian… ⇒ major precursors of QA4EO implementation (before QA4EO birth)
- ✓ Sustained reciprocical exchanges between "QA4EO Committee", data providers, service providers and users are crucial. Exchange mechanisms developed within GSEs work: Central QA Office, User Federation and User Executive Board, protocols, SLAs, reporting procedures and templates…
- ✓ Dissemination of QA4EO philosophy also in progress in upstream contributors to the future GAS, in satellite validation, data product generation and networks: AVDC/EVDC, GECA, ACCENT AT-2, EUMETSAT O3M-SAF, COSPAR Commission A11, GEOmon, NDACC *ad hoc* WG on metadata, ESA DUE Glob, ISSI H_2O WG…

GMES Atmospheric Service (GAS) quality strategy

- ✓ The GAS Architecture Implementation Group recognises the need for an independent unit dealing with quality issues ("QA Office").
- ✓ GMES Atmospheric Core service (MACC) and GMES Atmospheric Downstream services (PASODOBLE, EVOSS…) projects: seeking for QA4EO and INSPIRE compliance of implementation and of documentation is an explicit task of System Engineering and Management WPs.
- ✓ Conclusion: GAS data quality strategy is being established with inspirations from the meteo, satellite and ground network communities. But desirable to increase awareness of several stakeholders on current achievements and developments of QA4EO flavour. Perhaps via parallel action of WGCV SGs? Also, significant uncertainties about sustainability, evolution and upscaling of QA mechanisms when GAS will become operational.

Issues to be addressed
(reminder of SanYa concerns)

- ✓ Practical implementation, particularly regarding uncertainty estimation of algorithms inputs (models, climatologies, constraints, assumptions) and their weight in the retrieved data product (information content actually contributed by the measurement), is unclear.

- ✓ New/recent algorithms, particularly in air quality, rely on some form of post Level-2 processing using models (domain filling, filtering, assimilation, etc.). How does one estimate uncertainties and information content?

Where does the process begin and/or end?

Issues to be addressed (2)
(reminder of SanYa concerns)

- ✓ In addition to the established AC QA processes - new/recent initiatives, such as the EC FP6/7, GMES, GAS IGs, WMO WIS, GCOS GRUAN etc., with similar, uncoordinated and sometimes redundant specifications have emerged - imposing different and competing requirements, and often ignoring established best practices.

- ✓ Some requirements are cross-disciplinary (for example aerosols) and need to be addressed across the WGCV sub-groups.

Various

- ✓ The ACCENT-Troposat-2 Network of Excellence (AT-2) is publishing a book on tropospheric measurements from space, including a chapter on validation.
- ✓ Water vapour and aerosol validation (protocols) are becoming a major activity in ACSG and elsewhere (COST, ISSI, CCI…)
- ✓ FORMATS: After 10 years of effort, HDF is becoming accepted and implemented by a large part of the AC community. Most "end-users", particularly in climate thematic domains, are asking for netCDF and CF metadata... This is now being build in many places incl. NCAR, NASA, Harvard, SAFs... It has been adopted for the GlobSnow and GlobVapour products... And this will be a requirement for all ESA CCIs…

Thank you !