

Atmospheric Composition Sub-Group Report

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Outline

- ✓ Introduction
- ✓ Review of atmospheric composition missions
- ✓ 2007 sub-group activities
- ✓ Status of past recommendations
- ✓ New sub-group activities

What is the ACSG?

- ✓ The focus of ACSG is atmospheric chemistry (ozone, nitrogen dioxide) and composition (aerosols and greenhouse gases)
- ✓ ACSG consists of 15 members from space agencies and other relevant agencies and organizations with experience in calibration, algorithm development, groundbased instrumentation, modeling and validation
- ✓ ACSG is a forum that fosters interactions between mission scientists and data users, recommends network validation sites, develops comprehensive validation methodologies involving ground-based and space-borne assets, and specifies comprehensive and consistent multi-mission validation datasets

Status of AC missions

✓ Current:

- *ESA Envisat (3/'02): 3 AC instruments (GOMOS, MIPAS, SCIAMACHY) operating well; fuel depleted in 2010/11 timeframe*
- *NASA Aura (7/'04): nominal operations of AC instruments (HIRDLS, OMI, MLS, TES); platform fuel through 2015*
- *A-Train: Aqua, Calipso, CloudSat, Parosol (and Aura) operating nominally*
- *MetOp-A (10/'06): GOME-2 and IASI operations nominal*
- *ERS-2 GOME, NOAA-16/17/18 SBUV/2, Odin OSIRIS/SMR, SCISAT-1 ACE*

✓ Failures:

- *EarthProbe (EP) TOMS: transmitter failure in December 2006; shutdown in May 2007*

Status of AC missions

✓ Up-and-coming:

- *JAXA/NIES GOSAT: global CO₂ and CH₄ measurements, to be launched in August 2008*
- *NASA Glory mission: aerosols/black carbon, to join A-Train December 2008*
- *NASA OCO: global CO₂ measurements; instrument problems; to join A-Train December 2008*
- *NSMC/CMA FY-3a with SBUS and TOU ozone instruments, to be launched April 2009*
- *ESA ADM-Aeolus: wind and aerosols, to be launched June 2009*
- *NPOESS Preparatory Project (NPP) launch scheduled for October 2009, in A-Train orbit.*

2007 sub-group activities

- ✓ Preparations and contributions to GEO/CEOS Cal/Val Workshop
 - *Held preparatory meeting (April 2007)*
 - *Workshop attended by sub-group members*
- ✓ Synchronization of ESA and NASA atmospheric composition cal/val activities/priorities:
 - *Mission planning, including groundbased ozone calibration, NO₂ intercomparison, aerosol/H₂O lidar homogenization/intercomparison*
 - *In situ and satellite data sharing, formats and data requirements (information content)*
 - *NASA AVDC, ESA GECA (including cal/val leading experts)*

2007 sub-group activities (2)

- ✓ Coordinated GHG mission validation preparations
 - *Initial focus on carbon dioxide (CO₂)*
 - *NASA, ESA, JAXA/NIES, TCCON, NDACC, plus aerosol teams*
 - *Coordination meeting in May 2008 at CalTech for OCO and GOSAT*
- ✓ Preparation of ACSG workshop on the evaluation of data assimilation for data product generation and validation
 - *Organized by NASA, ESA, NILU*
 - *Spring 2009 at NASA GSFC or ESA ESRIN (logistics dependent)*
 - *Focus on tropospheric ozone:*
 - Many different products derived from assimilation/domain filling/modeling
 - Numerous validation datasets from satellite and in situ
 - Will address critical issues like true information content and resolution/smoothing differences

Review of past recommendations

- ✓ WGCV-27 rec. 1: Ground-based ozone networks calibration
 - *ESA supporting efforts through INM, DWD, FMI*
 - *NASA with NOAA ESRL*
 - *8 campaigns planned in 2008-2012, involving European, US and African sites*
 - *First campaign: July 2008 at Arosa, Switzerland*
 - *Second campaign: September/October 2008, Izaña, Canary Islands, Spain*
- ✓ WGCV-27 rec. 2: laboratory cross-section measurement
 - *ESA supporting efforts at the University of Bremen*
 - *To be completed by 2010*

Review of past recommendations (2)

- ✓ WGCV-27 rec. 3: NO₂ ground-based instrument intercomparison
 - *NASA-ESA lead*
 - *To include European, US, Chinese and Japanese teams*
 - *Supported by UAV and possible ultra-lite aircraft*
 - *Delayed to Summer 2009 due to site selection and organizational constraints*
- ✓ WGCV-26 rec. 2 (WGCV-27 rec. 4): Data sharing/requirement coordination:
 - *On-going through AVDC and GECA projects*
 - *To integrate GHG validation datasets*

Activities: Green House Gases

- ✓ Applicable GEO tasks: EC-06-01 (carbon cycle), DA-07-03 (constellations), DA-07-04 (sensor web for in situ)
- ✓ Status
 - Numerous science/experimental products already available: Envisat-Sciamachy, Aura-TES, Aqua-AIRS, etc.
 - Two upcoming missions with CO₂ focus: GOSAT (JAXA/NIES) and OCO (NASA)
 - Need for validation data from satellite and ground-based instruments

Activities: Green House Gases (2)

- ✓ **ESA-JAXA/NIES-NASA through WGCV/ACSG**
 - *are working towards inter-agency data sharing of satellite datasets for validation*
 - *are trying to identify and formulate satellite needs/requirements from ground-based assets and aircraft*
 - *are arranging for timely ground (and aircraft) data availability*
 - *are identifying key targets (stations) for routine sub-setting*

ACSG is organizing a meeting May 16 at CalTech bringing agencies and ground-based teams together for planning/kick-off

Activities: validation protocols

- ✓ Applicable GEO tasks: DA-06-02 (data quality), DA-06-04 (data/metadata), DA-07-03 (constellations)
- ✓ ACSG members are active in a large number of AC cal/val protocol activities:
 - WMO total ozone instrument calibration improvements.
 - NDACC profile measurement □ information content reporting.
 - Evaluation of GMES Service Element for Atmosphere (PROMOTE) validation methods (ozone and UV, AQ, aerosols, GHG, air control support) and the fitness for purpose of actual validation with respect to user requirements.
 - PROMOTE Validation Protocol (and other GSE protocols): top level definition of validation principles applicable to all PROMOTE services.
 - EC FP6 IP GEOMon: Better integration of groundbased and satellite data, including validation and data assimilation.
 - ESA GECA: generic user requirements and related Cal/Val operations, small but effective consortium of experts in atmospheric validation.
 - Ad hoc working groups on water vapor, ozone etc.

Activities: validation protocols (2)

✓ ACSG contributions include:

- *Formulation of space-borne instrument validation data needs*
- *Defining validation/evaluation criteria (co-location, information content, etc.)*
- *Developing in situ and satellite data “FOV” interpretation tools*
- *Fostering/promoting in-situ validation capability improvements*
- *Organizing field campaigns addressing specific validation capabilities such as network instrument discrepancies*
- *Defining metadata, and file packaging and most importantly content information for in situ data*
- *Providing routine co-located satellite data to ground and campaigns*

Activities: val. protocols evolution

- ✓ Now, many recent/new algorithms, particularly addressing Societal Benefit Areas such as Health (air quality) and Weather (tropospheric ozone), rely on some form of post L2 processing/merging using domain filling/transformations, model evolution, chemistry-transport data assimilation, neural networks, etc.
- ✓ In addition to the original L2 algorithm inputs (RT models, climatologies, constraints on profile shape, assumptions on atmospheric variability), these “hybrid” algorithms also have additional inputs such as from meteorological fields, the use of kinetic parameters, etc.

Activities: val. protocols evolution (2)

- ✓ The nominal validation approaches of these hybrid products usually excludes rigorous validation of the hybrid algorithms and algorithm inputs themselves. They rely on in-situ validation datasets - which for new species may be very limited - and even on simple visualization and statistical analysis of the final product without use of any independent observation

The ACSG data assimilation workshop (2009) will attempt to quantify this issue for the most commonly measured species tropospheric ozone

ACSG recommendations WGCV-28

- ✓ ACSG Recommendation #1 to WGCV (ref. EC-06-01, action 3):
 - *Recommend ACSG GHG validation coordination efforts to be supported by space agencies*
- ✓ ACSG Recommendation #2 to WGCV (ref. EC-07-03):
 - *Recommend ACSG GHG validation efforts for carbon dioxide as a new project for the Atmospheric Composition Constellation (ACC)*

ACSG recommendations WGCV-28 (2)

- ✓ ACSG Recommendation #3 to WGCV (ref. DA-06-02):
 - *CEOS validation protocols and methodologies for Cal/Val should be consistently used along the entire data product generation chain, including the production of hybrid level-2, level-3 and level-4 data products using numerical models, data assimilation systems, etc.*

Thank you