

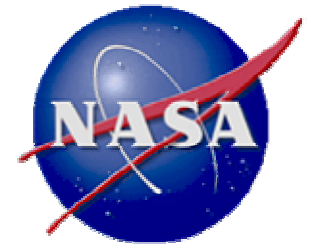
Report to WGCV-24

Atmospheric Chemistry Subgroup (ACSG)

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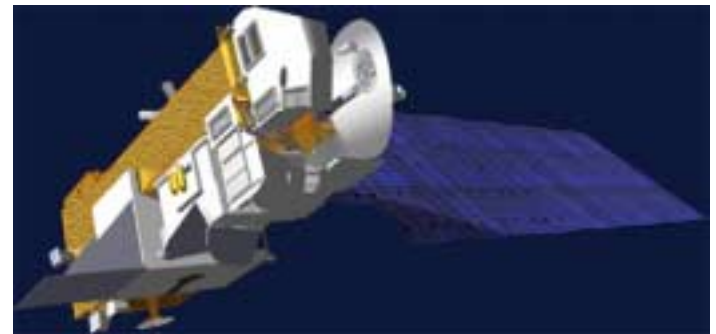


10-11 November 2005
Frascati, Italy



ACSG Goals

- Insure accurate and traceable calibration of remotely sensed atmospheric chemistry radiance data and validation of higher level products, for application to atmospheric chemistry and climate research
- Support the calibration/validation recommendations of WMO/CEOS #140 and IGOS/IGACO.
- 19 instruments on 10 missions for observing atmospheric chemistry will be flown by 2015.



Atmospheric Chemistry Satellite Timeline (19 instruments, 10 Missions → 2015)

In orbit

TOMS

SBUV/2

SAGE II, III

OSIRIS

ACE

MAESTRO

GOME-1

GOMOS

MIPAS

SCIAMACHY

MOPITT

HIRDLS/Aura

OMI/Aura

MLS/Aura

TES/Aura

To be launched

OMPS/NPP/NPOES 2007-2015

GOME-2/Eumetsat 2006-2015

IASI/Eumetsat “ “

New chemistry TBD

Post Metop 2020 →



ACSG Objectives-1

- **Promote international collaboration and technical exchange to ensure sufficient use and maintenance of calibration/validation resources required for atmospheric chemistry missions.**
- **Verify accurate scientific products encouraging an end-to-end approach to the calibration and validation of Level 1 and Level 2 data products and subsequent re-calibration and reprocessing.**
- **Ensure that validation sensors are calibrated to traceable national standards with documented statements of accuracy and repeatability**
- **Encourage interaction between calibration scientists and data users to enable a better understanding of data uncertainties and user requirements.**

ACSG Objectives-2

- Develop comprehensive data validation methods that employ ground, aircraft, balloon, and satellite measurements and data assimilation with chemical transport models.
- Recommend a network of validation sites and to encourage continuous observation and quality control of data through the use of standard procedures and inter-comparisons.
- Specify a comprehensive, consistent and quality- controlled multi-mission validation data base in an accepted format employing user friendly tools.

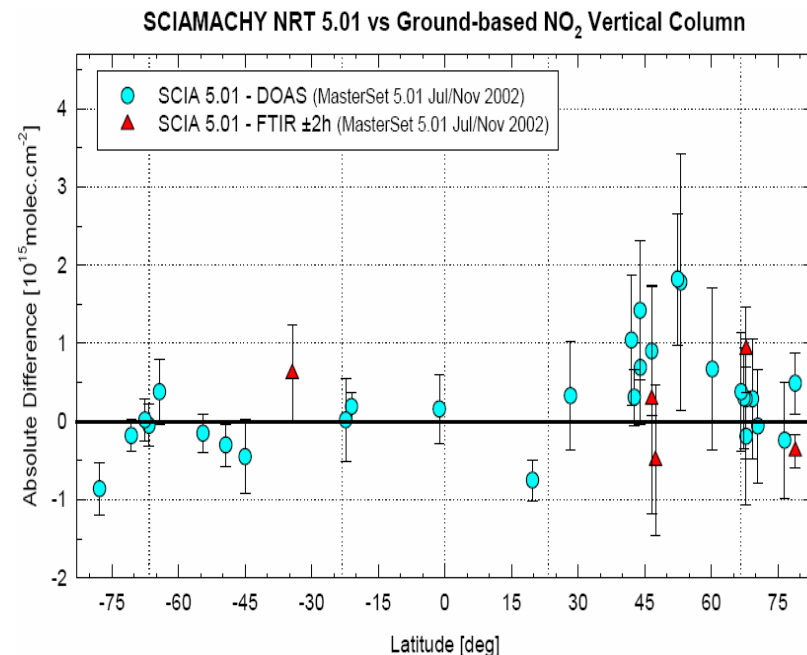
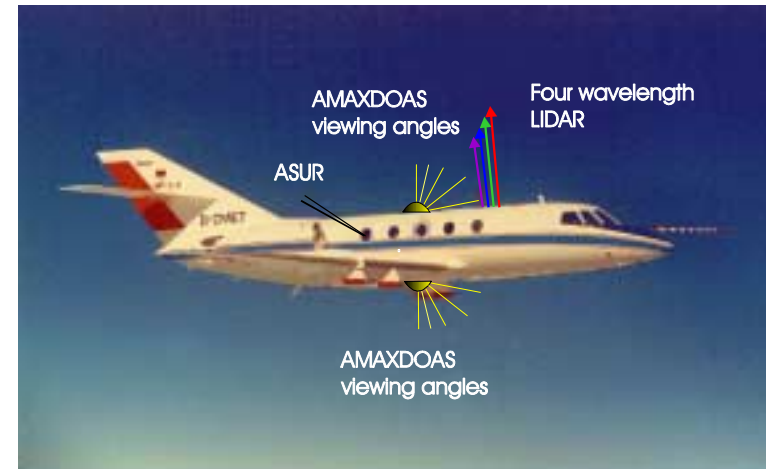


ACSG - Status

- **Participants (15 members):**
 - CNES, DLR, ESA, JAXA, NASA, KNMI, MSC, NOAA, IASB, EC, WMO, U. of Bremen, CSA (U of Toronto), Eumetsat, British National Space Center (BNSC)
- **Meetings: Four Subgroup meetings held:**
 - May '02 (Ottawa), December '02 (Frascati), July '03 (Toulouse), May '04 (Frascati)
- **ACSG Projects Approved/Underway and planned:**
 - Collaboration between Aura and Envisat Validation Data Centers (**Approved**)
 - Ground station cross calibration (**Approved**)
 - Eureka (Canada) station re-opened (**Approved**)
 - High latitude ozone campaign (**Planning**)
 - Collaboration on future missions: Metop, NPP, NPOESS, and post Metop (**Planning**)

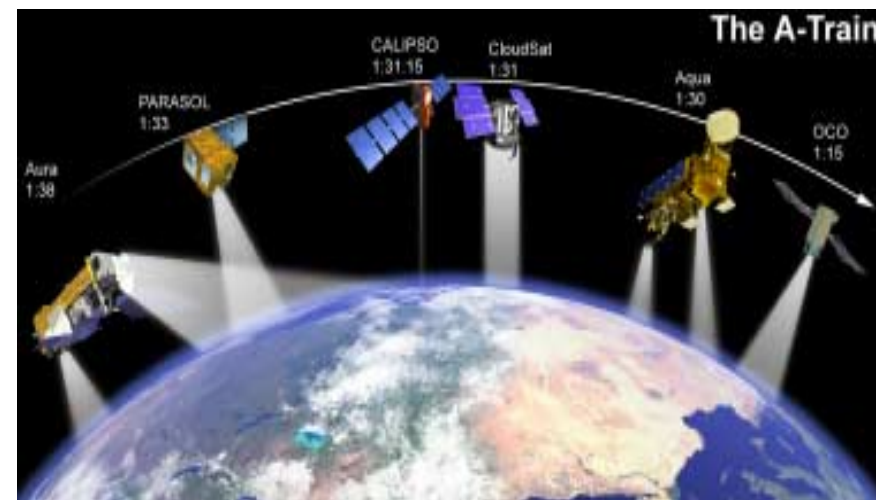
Envisat Validation Status

- **ESA Coordinated: Ground, aircraft, and balloon, main phase complete 2002-2004**
- **Additional balloon soundings 2005**
 - Brazil June/July 2005
 - France Sept/Oct 2005
- http://www.esa.int/esaLP/SEM76G6DIAE_LPcampaigns_0.html
- **Polar campaign Sweden**
 - Jan/Feb 2006
- **Continued validation analysis**
 - U. of Bremen (DL)
 - BIRA (BE)
 - RIVM (NL)
- ***Aura/Envisat joint science team Meeting, NL, Nov 7-11, 2005***
- **Third ESA Validation Workshop**
 - June 2006, ESRIN IT

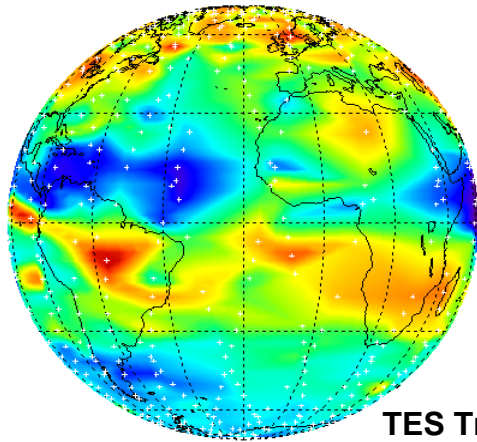


EOS Aura – Atmospheric Chemistry

- Third large EOS Observatory following Terra and Aqua
- Four instruments (UV to microwave)
- Polar orbit at 1:38 PM crossing
- Second year of operations
- Science Objectives
 - Tracking ozone layer
 - Global measurements of air quality
 - Connecting atmospheric chemistry with climate
 - Synergy with A-Train



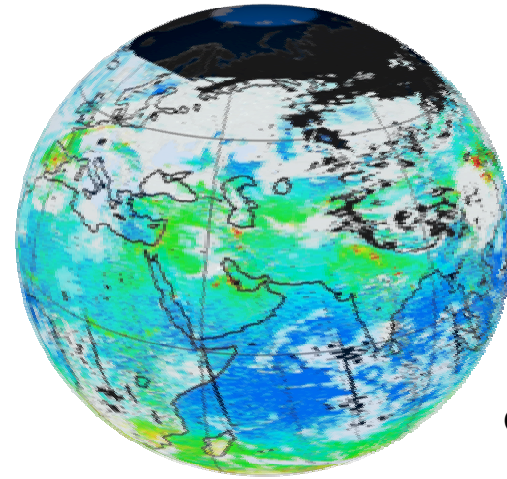
Aura Results – Pollution and Trends



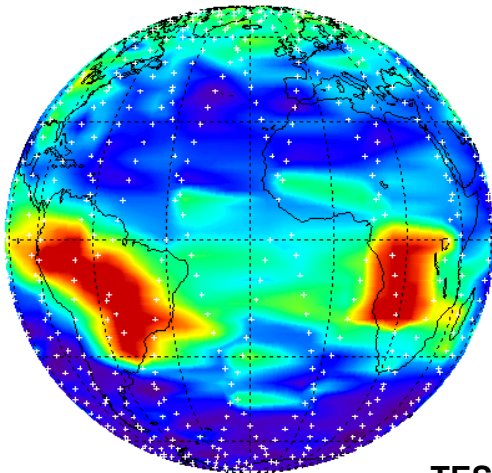
TES Trop O₃

Ozone Volume Mixing Ratio (ppb)

<10 20 30 40 50 60 >70



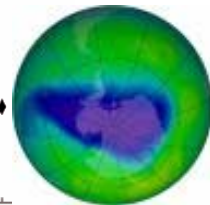
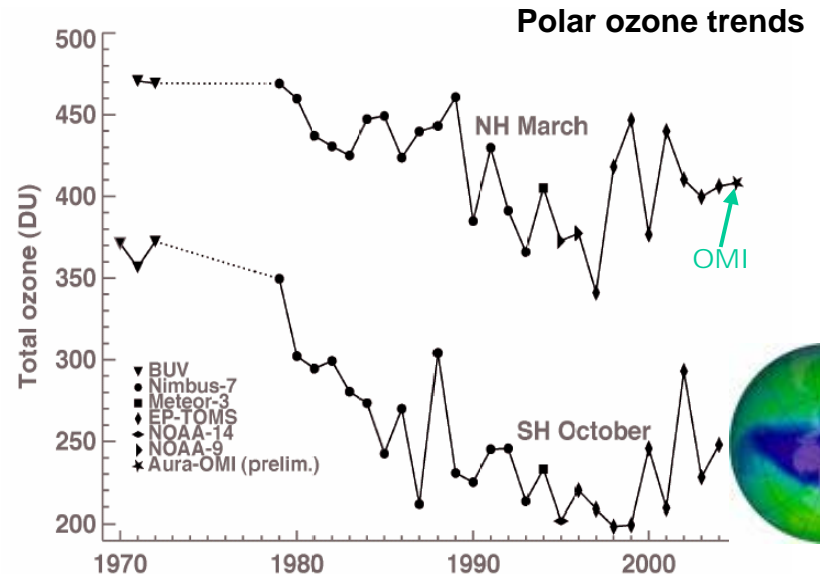
OMI NO₂



TES CO

CO Volume Mixing Ratio (ppb)

<40 60 80 100 120 140 160 180 >200



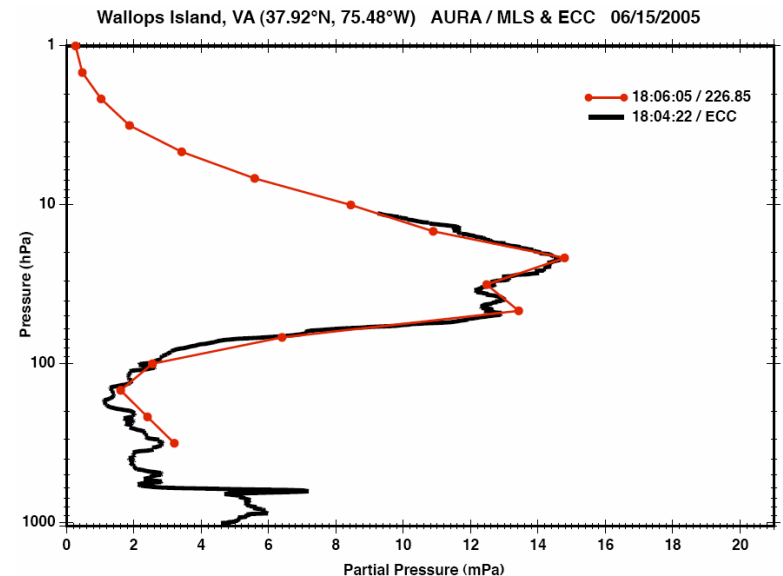
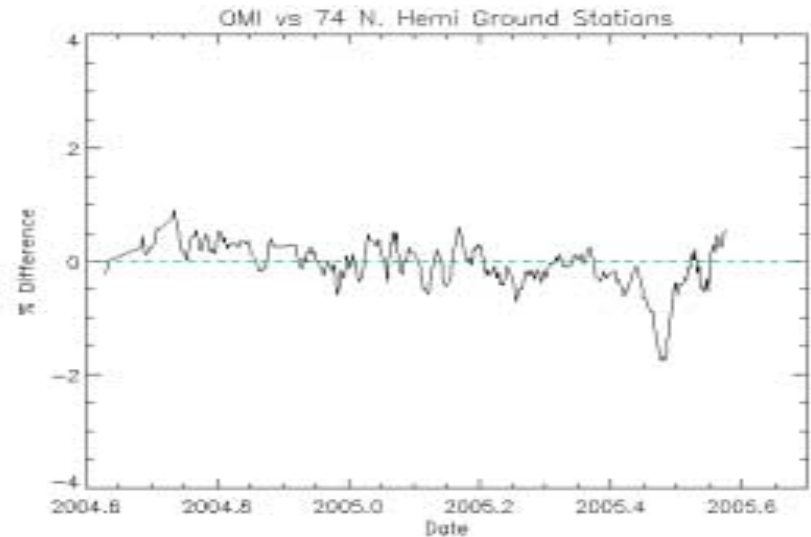
Aura Validation Program – 63 data products

- **Nine Aircraft field Campaigns - 2007**
 - Three major tropical UT/LS
 - Two transcontinental outflow
 - Polar Winter/Spring
 - Regular mini-aircraft missions (AVE)
 - UAV component
- **Ground based measurements and mobile trailer system for in situ and profile measurements focused on the troposphere**
- **Special high altitude instrumented balloon flights**
Additional H₂O and O₃ sondes (Costa Rica)
- **High latitude ozone campaign**
- **Aura Validation Data Center (AVDC) for inter-satellite data hosting and mission planning**
- **Comparison with 5 other international satellites**
- **Multinational collaboration: NASA, ESA, KNMI, FMI, NDSC**

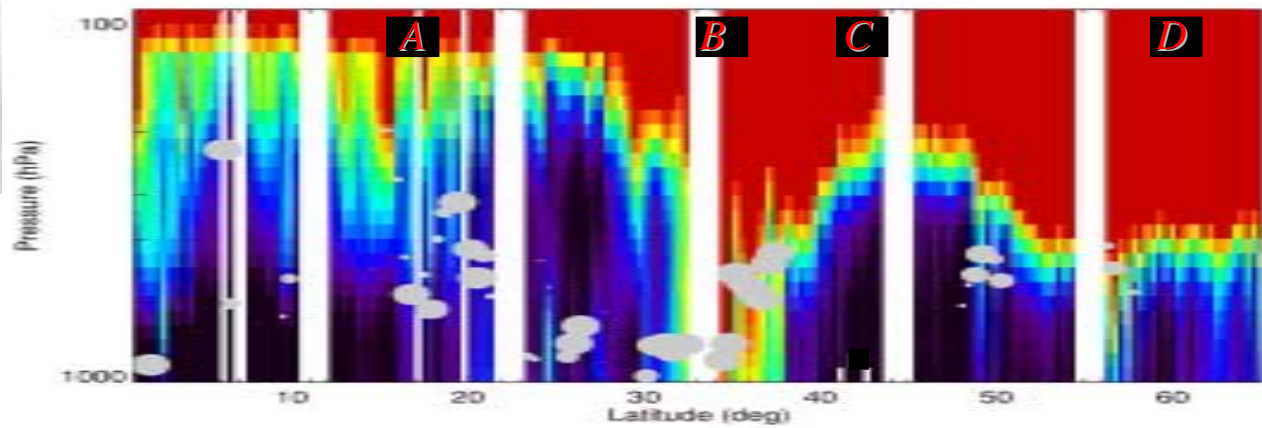
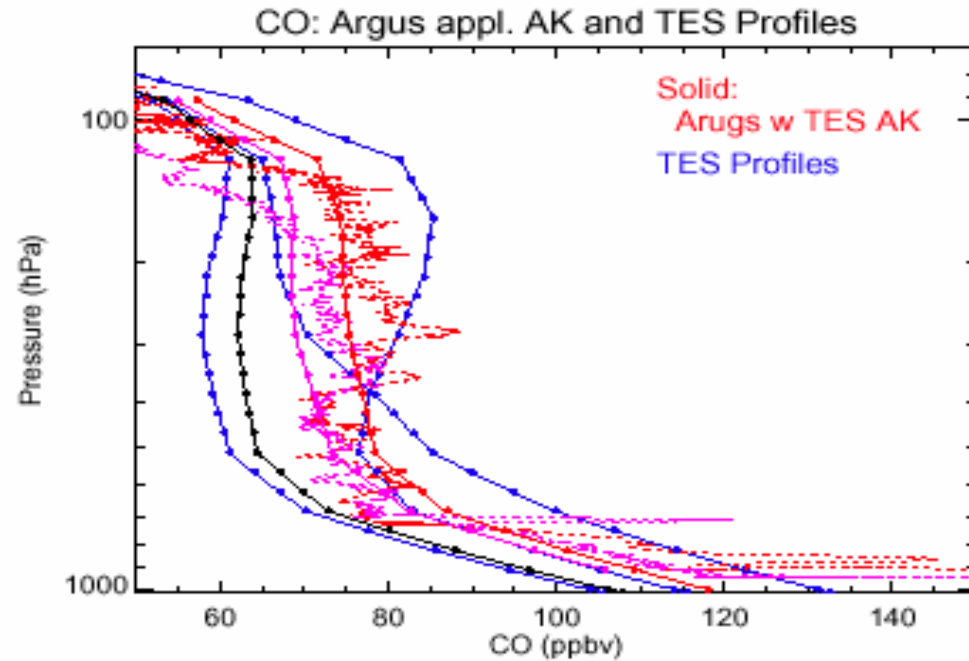
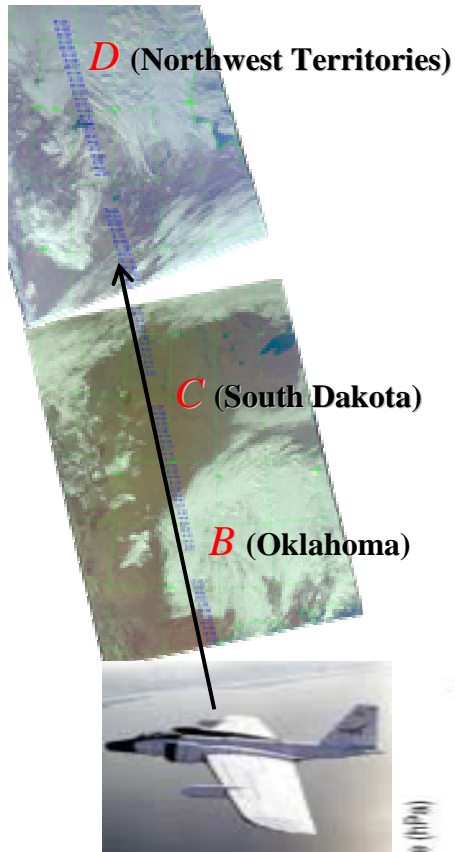


Ozone Validation

- All four Aura instruments measured ozone
- Ozone amounts validated
 - Total column
 - Troposphere and stratosphere column
 - troposphere and stratosphere profiles
- Compared with:
 - Balloons and LIDAR
 - Aircraft
 - Other Aura instruments
 - Other satellite instruments



Tropospheric CO Validation



TES
Ozone

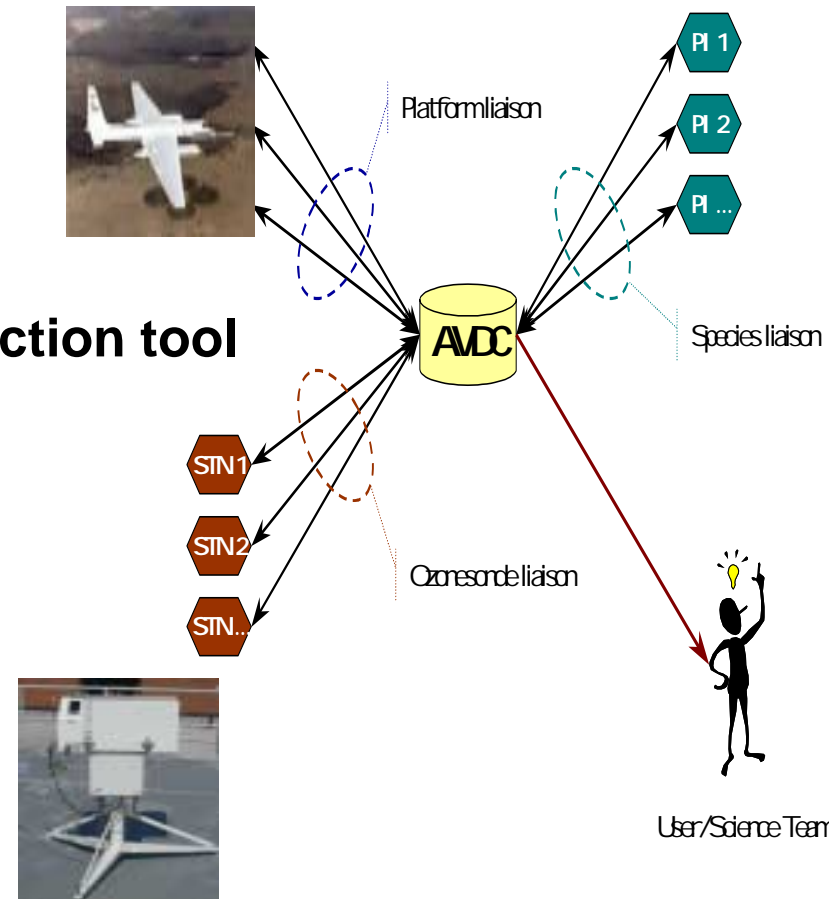
Aura Validation Data Center

- Active archive and distribution center for ground, balloon, aircraft, and some satellite data for Aura validation
- Collaborative effort with ESA Envisat Cal/Val and Canadian ACE mission (data exchange)
- AVDC operational (February 10, 2005)
- Web access: <http://avdc.gsfc.nasa.gov>
- Access restrictions: AVDC data protocol
- As of October, 2005:
 - 154 registered users
 - 100 Gb of validation data, 1.4 Tb of subsetted satellite data
 - In addition to Aura, support ACE, OSIRIS, SBUV/2 subsets



AVDC Functionality

- **Continuity in file format: AVDC/Envisat HDF**
 - Numerous tools for end users
 - ASCII to HDF,
 - IDL on-line,
 - Linux, OSX, Windows
- **Collocation tools**
 - Relational Database
 - Searchable (4-D, species, etc)
- **Aura Instrument Field of View prediction tool**
 - Aircraft mission planning/scheduling
 - Ground based/Aura FOV coincidences
- **Aura instrument data subsetting**
 - Aircraft flight path
 - Ground stations (Aeronet, NDSC)





Network for the Detection of Stratospheric Change (NDSC) Satellite Working Group

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References](#)[Links](#)

ERS-2/Envisat tandem flight (from pictures kindly provided by ESA)

Welcome to the NDSC Satellite Working Group
Homepage!

The objective of the Satellite Working Group is to foster collaboration among atmospheric scientists involved in the NDSC and in satellite missions. This website is a guide to ground-based researchers, space agencies and other interested parties to practical information on atmospheric chemistry satellite missions.

Enjoy your visit!



Site hosted by



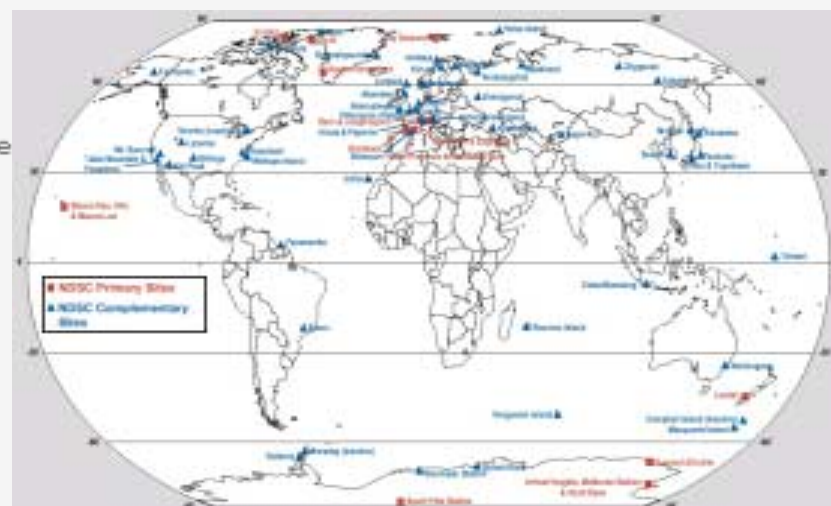
BIRA-IASB

Contact: [Webmaster](#)
Last update: Oct. 2005

For further questions or suggestions, please contact the
Steering Committee:

[Ir. Jean-Christopher LAMBERT](#)

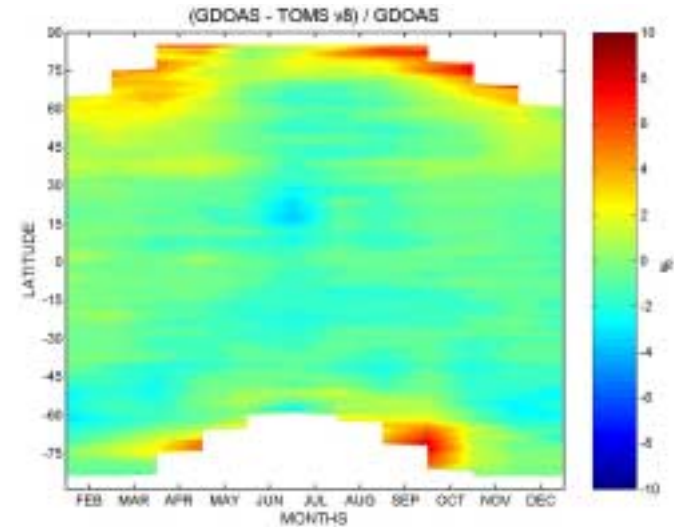
Pole Espace/Belgian Institute for Space Aeronomy
(BIRA-IASB)
Avenue Circulaire 3, 1180 Brussels, Belgium



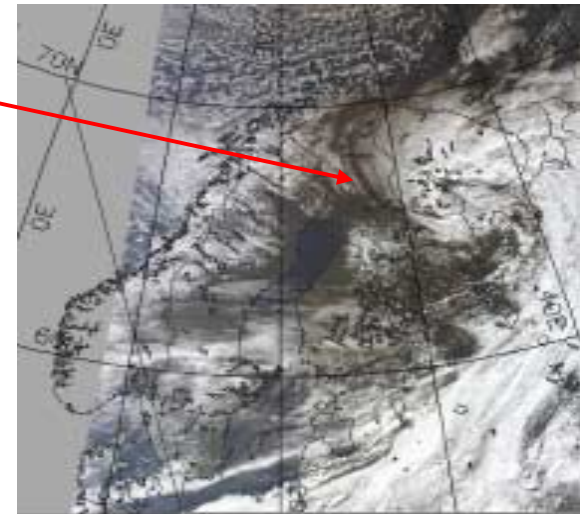
Sodankylä, Finland Campaign

Aura and Envisat (chemistry)

- 5-10% differences persist between satellites and ground stations at high latitudes and high SZA
- Ozone trends are largest in polar regions: track for ozone recovery
- Intercomparison campaign hosted by the FMI April, 2006
- Ground based: Lidar, Brewer, Dobson, SAOZ, balloon, DOAS
- Satellites: Aura, Envisat, ERS-2
- Supported by: NASA, FMI, ESA, KNMI, NDSC



Sodankylä,
Finland
67N, 27E



ACSG Action Items

- **Continue to lobby for stable funding from space agencies for ground based network to insure data quality and timely archiving**
- **Coordinate Envisat (chemistry) and Aura validation – NASA/ ESA discussions continue for near term and long term coordination**
- **Coordination of validation activities for next generation operational systems: Metop and NPOESS. Representatives are members of ACSG**
- **Consider universal policy for publication, referencing and citation of validation data – AVDC is a test bed**
- **Respond to GEOSS, IGOS, and GMES requirements**

ACSG and GEOSS

- **ACSG deals with atmospheric constituents and responds to three GEOSS Societal Benefit Areas (SBAs)**
- **Not included in ACSG:**
 - Aerosols
 - Greenhouse gases,
 - Meteorological parameters (temp, winds, H₂O vapor)
- **With these included an expanded Atmospheric Subgroup would respond to 6 of 9 GEOSS SBAs**
- **Should ACSG expand?**
- **Additional subgroups?**



GEOSS and WGCV/ACSG

- **GEOSS Ten Year Implementation Plan**

GEOSS will be based on existing observing, data-processing, data-exchange and dissemination systems, while fostering and accommodating new systems operated by GEO Members and Participating Organizations, as needs and capabilities develop. The technical commitments of a GEO Member or Participating Organization will apply only to those contributions that they have identified.

Long-term continuity of existing observations is required. In addition, activities to facilitate research, capacity building, and outreach will be carried out and coordination focal points will be provided.

GEOSS, collectively, has several functional components:

- to address identified common user requirements
- to acquire observational data
- to process data into useful products
- to exchange, disseminate, and archive shared data, metadata and products, and
- to monitor performance against the defined requirements and intended benefits.

- **Data quality via Cal/Val is a GEOSS assumption**
- **WGCV must demonstrate that Cal/Val is an integral and continuing GEOSS requirement**

Back Up

Metop and NPOESS AC Instruments Cal/Val Plans

- **GOME-2**
 - Performance verification and long term tracking
 - Validate Level-1 and Level-2 with feedback
 - Algorithm revision data base for QC
 - Validation data center planned
 - Commitment to reprocessing is not clear
- **IASI**
 - Technical Expert Center at CNES for Level 1 validation
 - Level 2 validation TBD: AIRS heritage, Distributed responsibility
- **OMPS**
 - Instrument contractor responsible for pre and post launch calibration using heritage techniques
 - Government oversight
 - User (NOAA, NASA, DoD) responsible for Level 2 validation
 - Cal/Val formulation and implementation is under development
 - Reprocessing is user responsibility

ACSG Activities

- **Envisat validation (Claus)**
 - Envisat ACVT Workshop
 - Upcoming plans
- **Aura launch and validation program**
 - NASA and ESA validation PI's selected
 - Aura Validation Data Center
 - Three aircraft (B57, DC8) missions conducted
- **IGOS/IGACO Report**
- **Operational Metop and NPOESS Chemistry instruments**
 - Cal/Val
 - NOAA process GOME-2 chemistry data products
 - Validation Data Center (based on Aura Validation Data Center)
- **Post Metop (>2019) planning for atmospheric composition**
- **Respond to GEOSS requirements**

IGOS/IGACO Theme

IGOS seeks to provide a framework to harmonize space-based and in-situ systems for global observation.

Produce comprehensive global and regional data to satisfy the environmental information needs of policy-makers and support scientific and operational environmental programs.

Cal/Val is a major component of IGOS and IGACO

Strong connection between ACSG and IGACO

