



Aura Validation Data Center (AVDC)

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Outline

Overview

- ▣ *Mission, implementation and status*

Highlights of current activities

- ▣ *Aura validation, sub-setting and campaign support*

Additional direction

- ▣ *Long-term validation of A-Train and other NASA satellites, production of co-located/merged datasets, collection of international datasets, etc.*



Overview



AVDC mission

The Aura Validation Data Center (AVDC) was established in 2004 to support the platform-wide validation activities (airborne missions, ground-based, balloons, other satellites) of the four Aura instruments (HIRDLS, MLS, OMI, TES)

AVDC supports the Aura instrument teams, NRA PIs (Aura and other), NASA campaigns, ESA PIs, NDACC PIs, and independent validation contributors, in the validation and improvement of Aura data products



What is the AVDC?

AVDC is a science driven facility located at GSFC with four core activities:

- ▣ *Data collection and archiving*

- Ground-based, sub-orbital and satellite datasets

- ▣ *Aura L2/L3 data sub-setting and co-location for data comparison*

- ▣ *Validation and science campaign support*

- Aura instrument FOV predictions, facilitate data access, etc.

- ▣ *Generic data usage support*

- Aura related information, validation and dataset documentation, tools (conversion, search, etc.), Science Team presentations, etc.



Implementation

□ Central facility located at NASA GSSFC: <http://avdc.gsfc.nasa.gov> □

Access for non-NASA datasets limited as per negotiated agreements and protocols

9-Xserve cluster, 14 TB capacity

Modeled on the ESA Envisat Cal/Val facility (at NILU, Norway)

Strict data requirements including metadata and nomenclature
(compliance check on all incoming files)

Maintains compatibility with Envisat Cal/Val formats to reduce burden on providers/users



AVDC status

Operational since February 2005

Originally planned as a 4 year activity

■ *May 2004 - April 2008*

AVE campaign support and L2 sub-setting began in the Fall 2004

AVDC has 310+ users worldwide who signed the data disclosure agreement

- *~ 150/day login access (to restricted pages)*
- *1.5×10^6 pages accessed in the last 4 months*
- *2.6 TB downloads in last 4 months (~56 GB/day)*
- *total correlative data volume: 360+ GB*
- *correlative satellite datasets: ~2 TB*

AVDC stores all Aura L2 and L3 data locally



Example: Mapping of OMI NO₂

L3 OMI NO₂ tropospheric column
and NO₂ total column

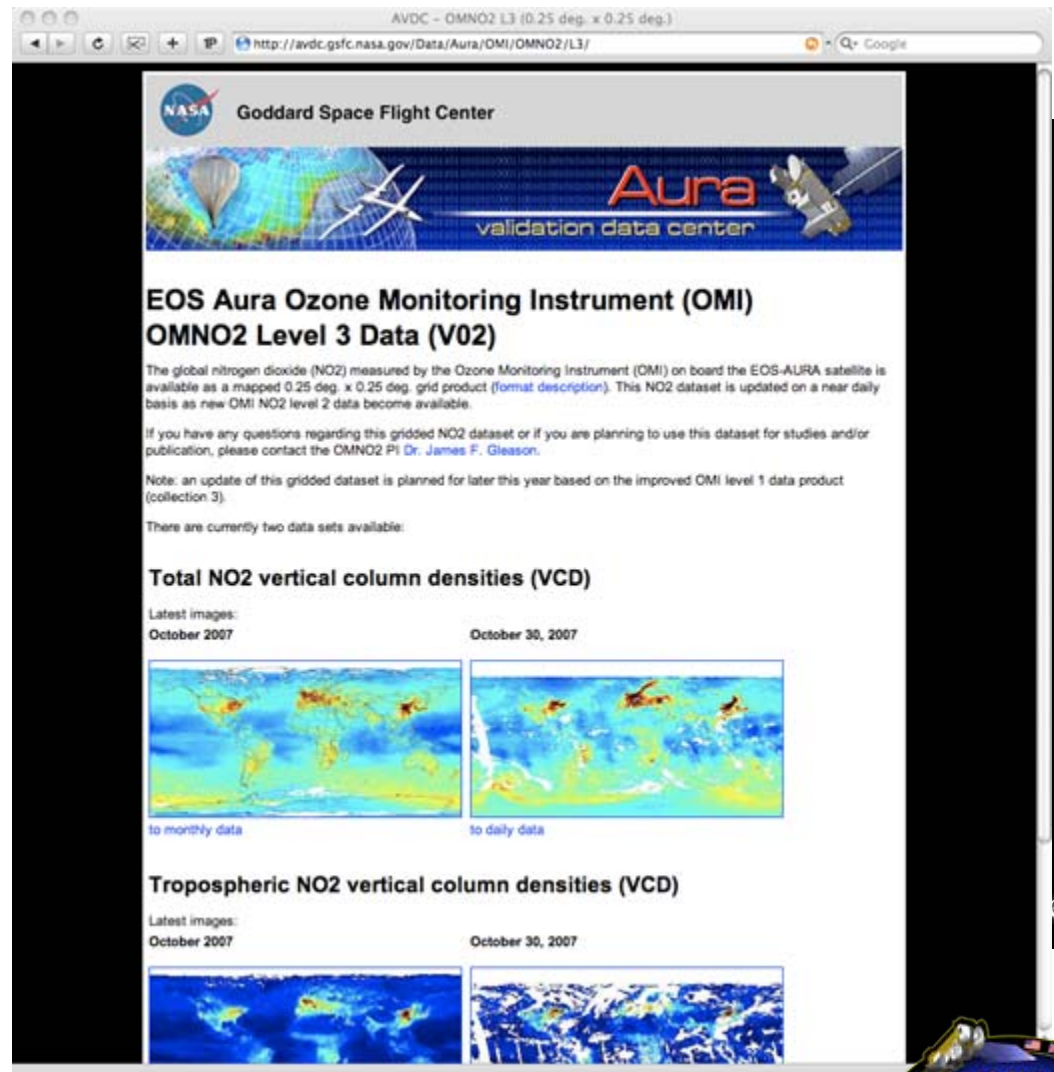
Sci. product for OMI NO₂ PI

Updated daily from L2 data

Generating:

- *Daily maps*
- *Monthly averages*
- *Data files and images*
- *Google Earth functionalities*

800k downloads since Oct. '07



Highlights of current activities



Data collection and archiving

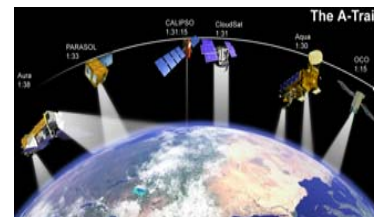
AVDC actively collects correlative data, including:

- *Ground-based (NDACC, WMO, etc.).*
- *Sub-orbital (NASA aircraft and large balloons).*
- *NASA campaign data (AVE, INTEx, small campaigns).*
- *Mirrors established facilities such as Langley and Ames aircraft repositories.*
- *Constituent data from A-Train, NOAA, ESA, CSA satellites.*



AVDC established **informal data sharing arrangements** with PIs, agencies and networks:

- *NDACC NRT arrangement.*
- *Envisat cal/val and satellite data sharing.*
- *CSA ACE and Odin data access.*
- *NRT Environment Canada data access.*
- *etc.*



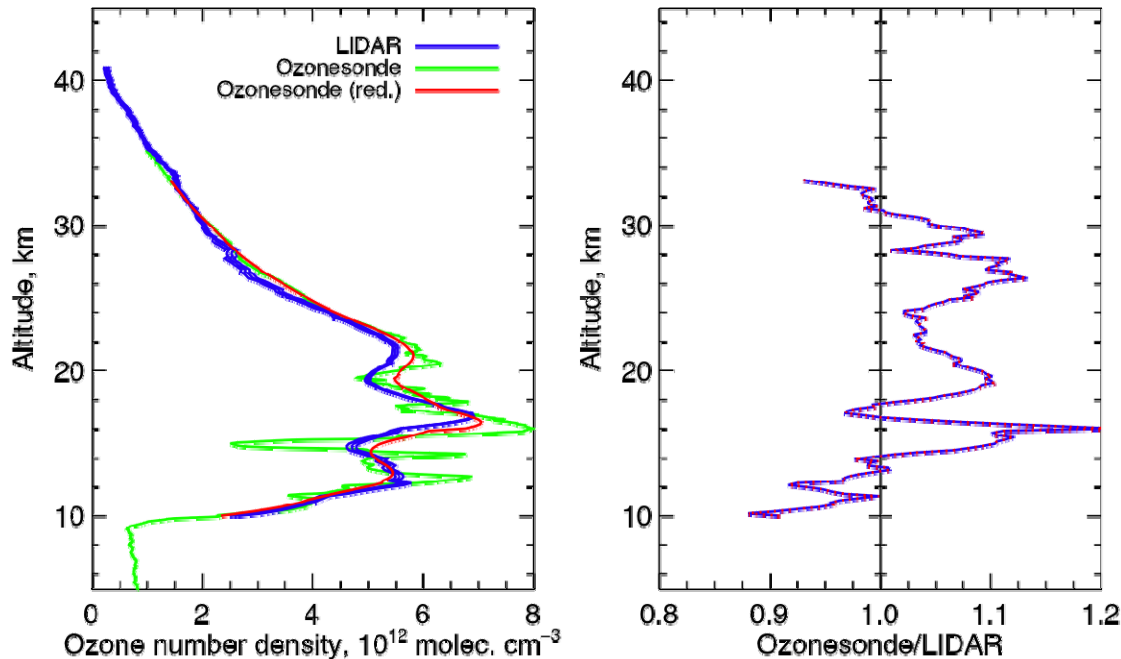
Data sharing arrangements have been set-up either through direct contact or facilitated through CEOS ACSG, and are protected through the AVDC data sharing protocol



Example: Typical ground-based data at AVDC

SAUNA: March 31, 2006 – 00UT

Ozonesonde vs. LIDAR



Measurements made coincident to an Aura MLS/TES overpass during the SAUNA campaign (Finland)



AVDC ground-based collection

AVDC has lead data reporting homogenization efforts with the NDACC and the ESA Envisat cal/val program:

- *Homogeneous* reporting format (AVDC HDF)
- Data *completeness* for interpretation (for example averaging kernels, temporal resolution, etc.)
- *Documentation* at <http://avdc.gsfc.nasa.gov/Documentation/Metadata>

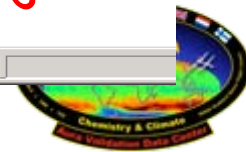
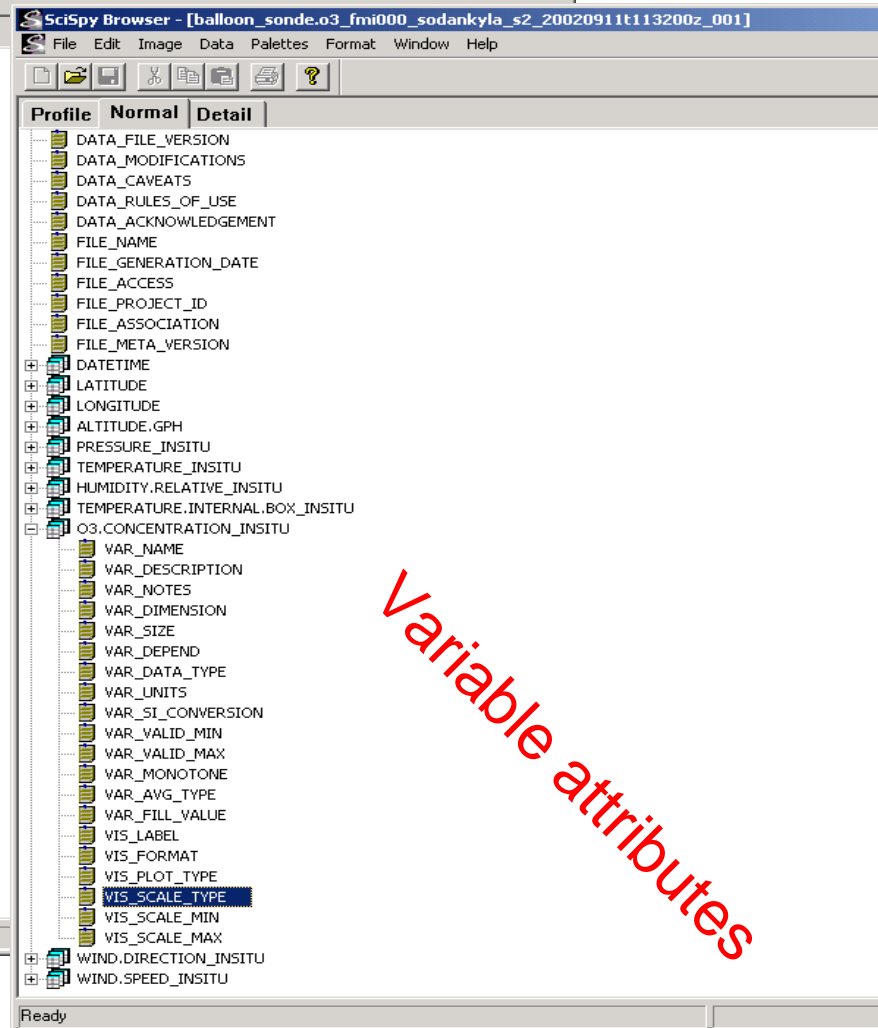
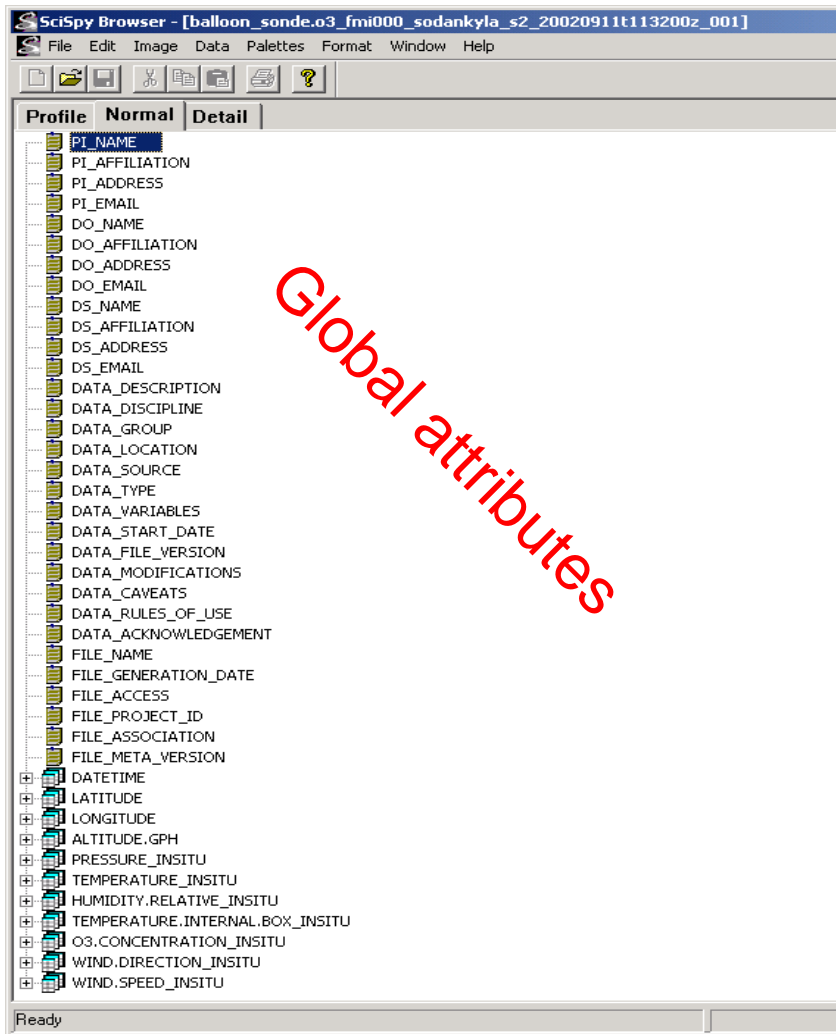
AVDC efforts resulted in a changed paradigm and leads to improved data usability/usefulness for the satellite community

- *currently all profiling measurements have been **harmonized** (microwave radiometers, LIDAR, FTIR and balloon instruments)*
- *UV-VIS and WMO core atmospheric measurements in process*

AVDC approach/requirements also adopted for the ESA Generic Environment for Cal/Val Analysis (GECA) system and will be recommended for adoption by CEOS WGCV/WGISS



AVDC HDF file layout for ozonesondes



AVDC user support

AVDC provides direct investigator support for planning, access to data and sub-setting, data formulation/conversion tools, etc.

Tools and documentation on-line at:

☞ <http://avdc.gsfc.nasa.gov/Tools/>

☞ <http://avdc.gsfc.nasa.gov/Documentation/>

Data search pages (login pages):

☞ <http://avdc.gsfc.nasa.gov/Data/Search/>

Science team and Aura working groups documentation and presentations available at:

☞ <http://avdc.gsfc.nasa.gov/ST&WG/>



Satellite instrument field of views (FOV)

AVDC generates **validated** satellite instrument Field Of Views (FOV) predictions in support of Pls and campaigns

- 16-day Aura instrument FOV predictions for stations and campaigns (updated daily) <http://avdc.gsfc.nasa.gov/Data/FOV/index.html>

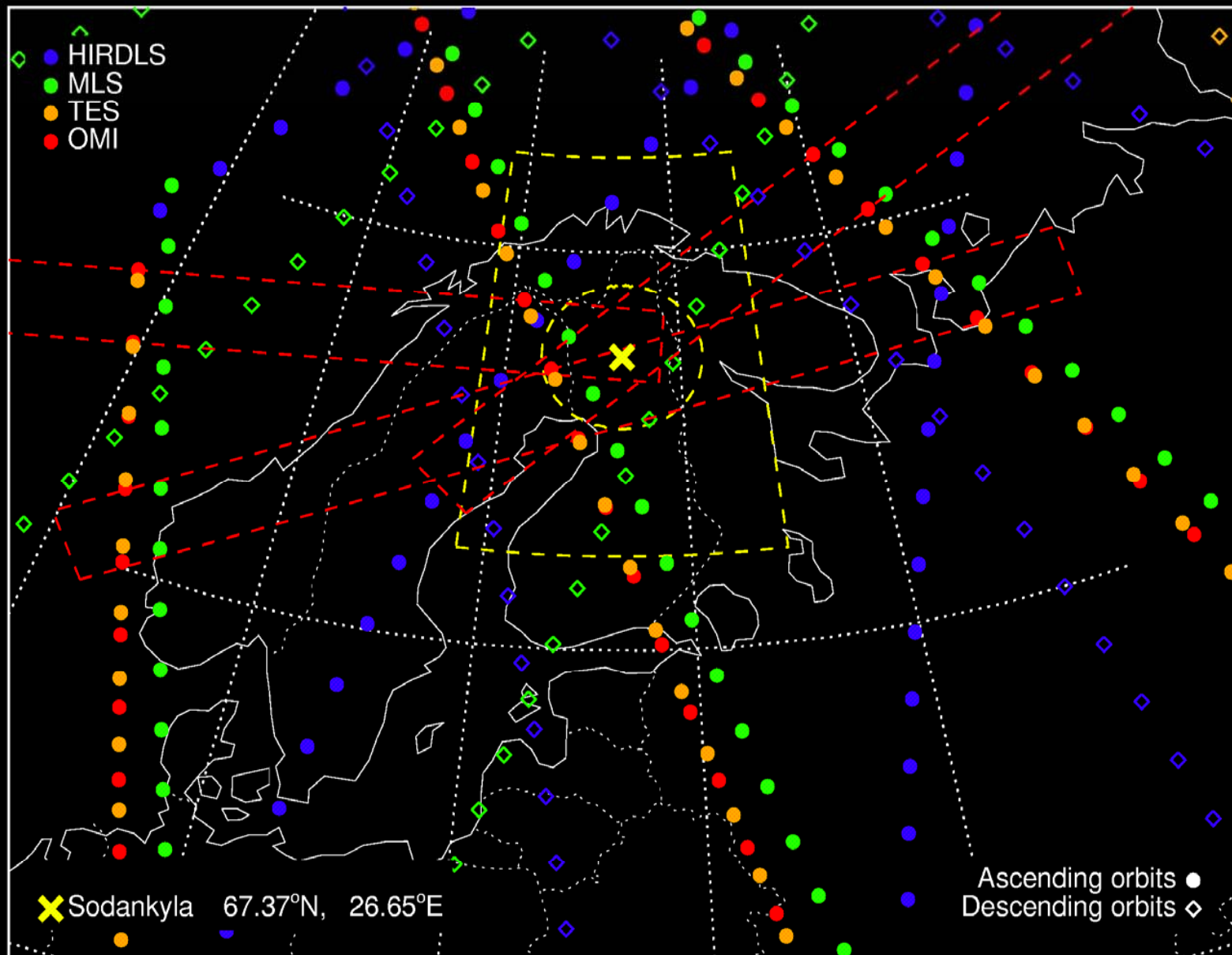
AVDC also stores “after the fact” instrument FOVs (from L2 data)

- http://avdc.gsfc.nasa.gov/Data/Search/avdc_overpass_search.php which provides temporal and geographic search and subsetting capabilities

AVDC can also generate Aqua, Terra, CALIPSO, NOAA-16,17,18 and Envisat FOVs for campaigns - **others instruments are easily added on a short turn-around**



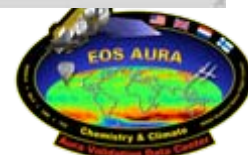
Aura FOV predictions: 20060331



Search for matching TES data

Search for actual TES
FOV coincidences with
the SAUNA LIDAR
measurements and the
ozonesonde launch of
the night of March 31,
2006 using the web
search interface

The screenshot shows a web browser window with the URL http://avdc.gsfc.nasa.gov/Data/Search/avdc_overpass_search.php. The page title is "AURA FOV COINCIDENCE SEARCH". On the left is a navigation menu with links: "Data", "Aura Data", "FOV Predictions", "Search Data", "Browse Data", and "Upload Data". The main content area has a "Data" header and a list of links: "Back to AVDC Data Search" and "Advanced AVDC Data Search (groundbased data only)". Below this is a section titled "Search the AVDC relational database for AURA FOV coincidences." with a sub-header "Select a LOCATION below:". A dropdown menu shows a list of locations: Singapore, Singapore; Skovorodino, Russian Federation; Socorro, NM, United States; Sodankylä, Finland; Sofia, Bulgaria; Sondrestrom, Greenland; and Songkhla, Thailand. Below the dropdown is a separator "OR". The next section is "Enter COORDINATES (latitude and longitude in decimal degrees):" with input fields for "Latitude:" (range -90°N to +90°N) and "Longitude:" (range -180°E to +180°E). The following section is "Define your Region of Interest (ROI) (latitude and longitude in decimal degrees):" with a note: "Note: Not applicable for OMI. OMI is swath-based and any swath/orbit including the point of interest indicated above will be included independent of Region of Interest settings." It includes input fields for "Latitude Range:" (0° to 5°) and "Longitude Range:" (0° to 8°). The next section is "Please enter minimum and maximum DATETIME (UTC):" with a table of input fields for Year, Month, Day, Hour, Minutes, and Seconds. The "Minimum:" row is set to 2006-03-30 22:00:00, and the "Maximum:" row is set to 2006-03-31 04:59:59. Below this is a section "Select ONE INSTRUMENT:" with radio buttons for HIRDLS, MLS, OMI, and TES (which is selected). At the bottom are "Submit Query" and "Reset" buttons.



L2/L3 sub-setting & co-location

AVDC has very fast turn-around for temporal and geographic sub-setting capabilities (typically less than 1 day per request)

<http://avdc.gsfc.nasa.gov/Data/Aura/>

Sub-setting is updated as L2 data becomes available:

All OMI products

- O₃: 531 stations (OMTO3, OMDOAO3)
- Aerosol: 313 stations, including all current Aeronet sites
- NO₂: 78 global, 40 CARB and 434 EPA sites
- UV: 123 sites (regional co-locations)
- SO₂: 58 sites

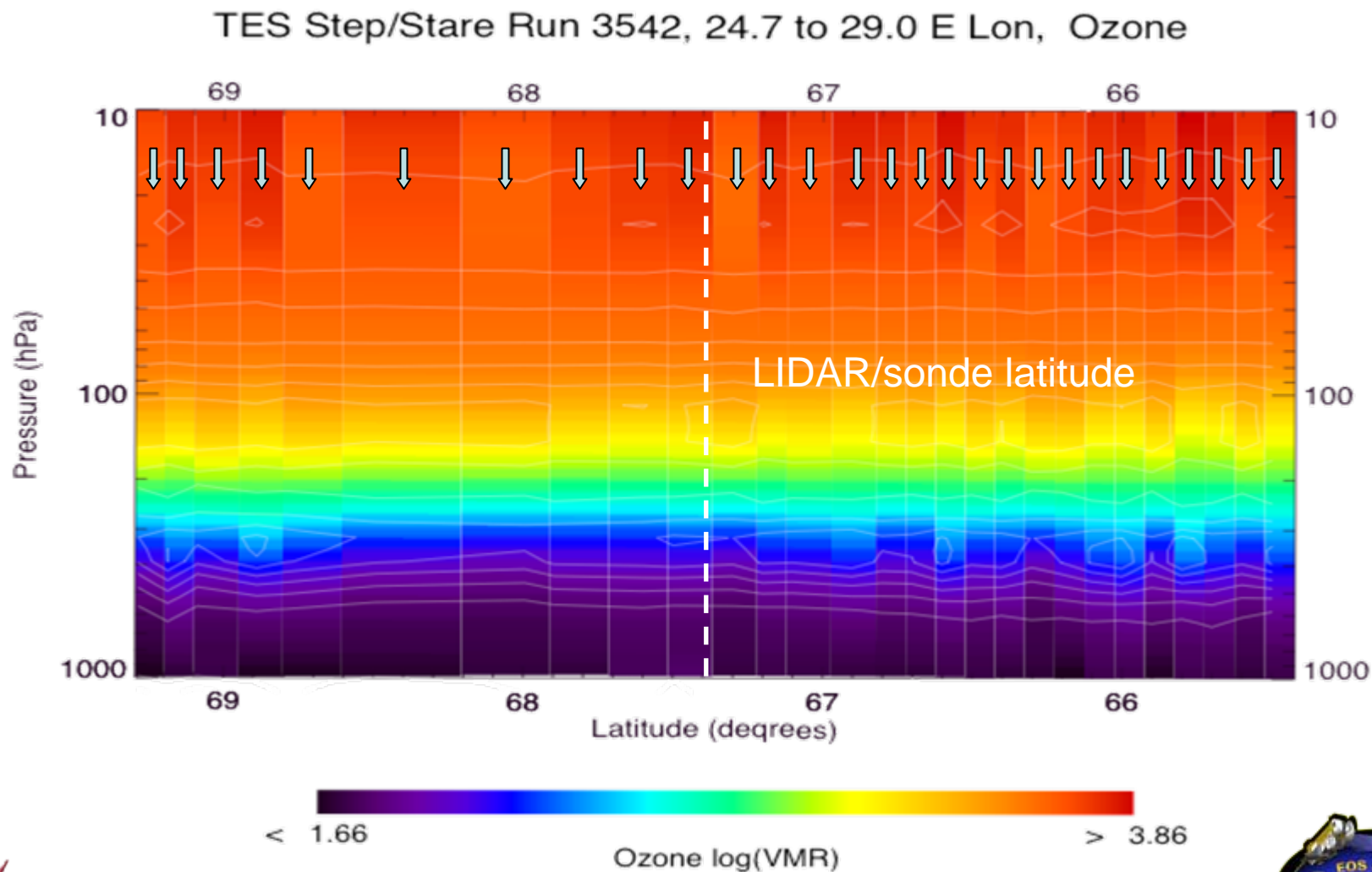
MLS, HIRDLS and TES

- O₃, T, H₂O at NDACC sites and other key profiling stations

AVDC coordinates sub-setting with L2 dataset PIs to ensure the best representativeness and quality



Co-located TES data for SAUNA



Supported campaigns since 2004

- NASA aircraft and large balloon campaigns
 - ▣ 2004 *Houston AVE, Ft. Sumner*
 - ▣ 2005 *PAVE, Kiruna, Ticosonde, Ft. Sumner*
 - ▣ 2006 *AVE Costa Rica, INTEx-B*
 - ▣ 2007 *TC4, Kiruna*
 - ▣ 2008 on *Arctas, Aura UAV, AVE-Guam*
- NASA funded SAUNA, WAVES, SHADOZ/IONS, and WFF ground-based activities (archives & active mission support)
- 2006 AMMA (NASA and EU contributions) A-Train FOV predictions and data subsets
- EU Bauru balloon campaigns (SCOUT-O₃ and ESABC)
- Contributing to WMO ground-based intercomparisons (coordinated by INM), NOAA AIRS validation (Ron Brown cruise), Eumetsat MetOp validation
- In the process of planning 3 CEOS cal/val activities through 2012



Additional/future activities □



Activity 1: Long-term validation

AVDC will:

- *Ensure that the long-term cal/val needs for Aura are met, and also support atmospheric constituent measurements from other NASA and non-NASA instruments*
- *Continue the collection of ground-based and sub-orbital campaign data*
- *Emphasize the **quality and completeness** (both availability and content) of the correlative datasets*
- *Support future missions such as Glory, OCO, NPP/NPOESS*



Activity 2: Expansion of non-US satellite datasets

AVDC to further expand non-US satellite atmospheric data collection at AVDC for validation and science - specifically datasets from Eumetsat, ESA, JAXA GOSAT, etc.



A feasibility study in collaboration with ESA to co-locate Aura MLS/HIRDLS with Envisat MIPAS is underway

- AVDC will use ESA's "Grid processing On Demand" (GPOD) computing resources at ESA/ESRIN

Activity 3: Merging data for science

The goal is to generate merged/co-located L2 data products from the A-Train and other satellite missions to help further scientific analysis

■ *A case study using **CALIPSO** and **MODIS** datasets as input for a research version of the **OMI** aerosol product. This experimental dataset coordinated with the OMI aerosol PI (O. Torres) will make use of the OMI observations to derive aerosols parameters by:*

- using the actual vertical distribution of the aerosols as given by CALIPSO
- and using the MODIS data for cloud screening purposes as well as for direct comparison of retrieved AOD to OMI results



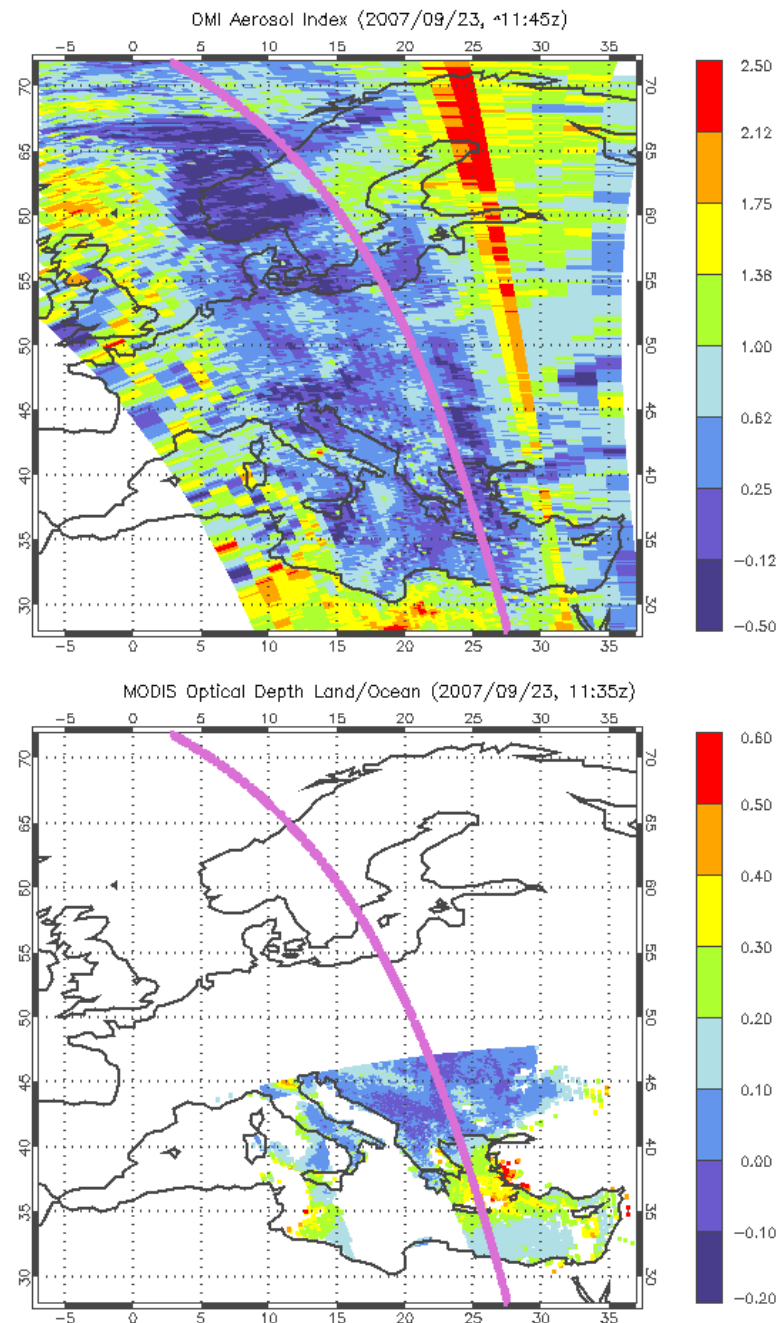
OMI/MODIS/Calipso

Here we co-locate both CALIPSO and MODIS to the actual OMI pixels - thus not losing any product information through averaging schemes

September 23, 2007

- *OMI Aerosol Index (AI, top)*
- *MODIS Aerosol Optical Thickness scene (bottom)*
- *CALIPSO (orchid)*

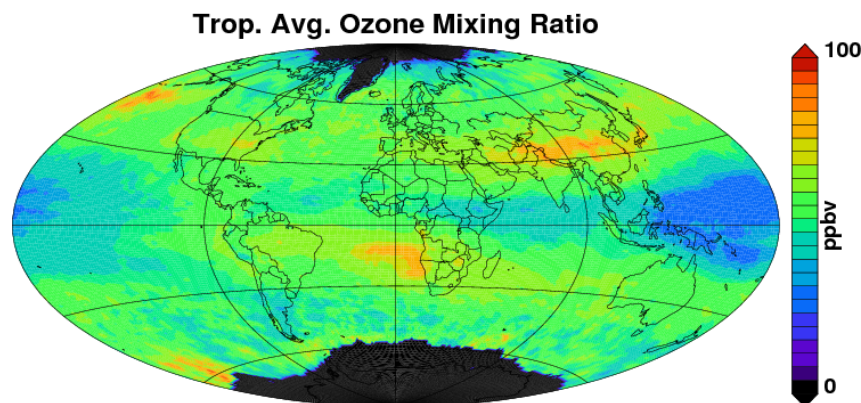
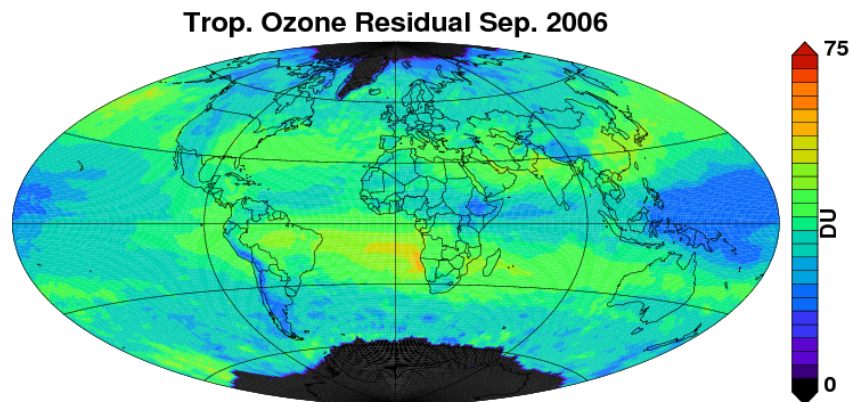
1-day global co-location takes ~7h in background processing with non-optimized code



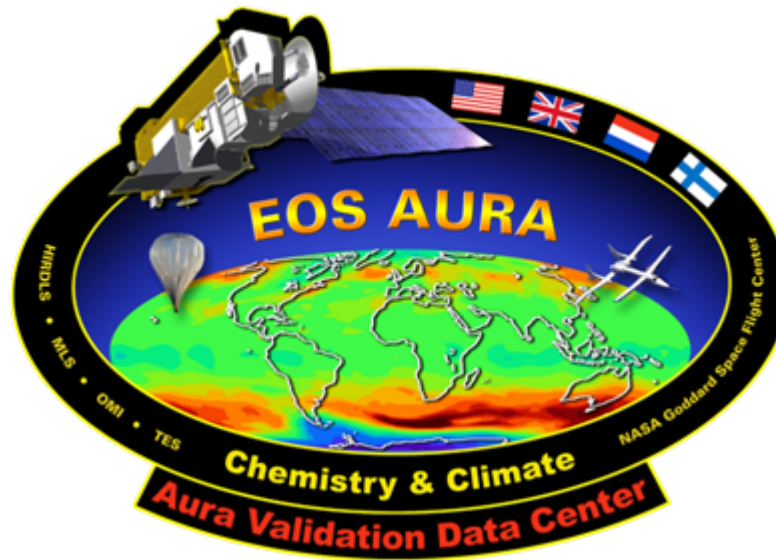
Activity 4: Experimental dataset production

AVDC is producing new or experimental L2 and L3 products using existing NASA and other satellite datasets

An example, in addition to the OMI NO_2 mapping shown previously, is the **Tropospheric Ozone Residual** (TOR, Schoeberl *et al.*, 2007) which is generated by merging the Aura MLS stratospheric ozone profiles and OMI total ozone products



<http://avdc.gsfc.nasa.gov/Data/Aura/Merged/TOR/>



Thank you

