What's NEW at the GES DISC: Evolution of data management and services for Aura mission and beyond

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2 Adnet Systems Inc.

Acknowledgment: Aura ST, SIPs, ESDIS EMS, GES DISC team

2016 Aura Science Team Meeting
Outline

• GES DISC world
• Aura data usage and trend
• Aura data users requests
• GES DISC update (before/after)
  – New Access method (ftp → http) with Earthdata Login System
  – New Website (DISC/Mirador → New Interface)
  – New Giovanni (Giovanni → Now Federated)
• GES DISC support beyond Aura Mission
  – Multi-sensor coincident data subsets
  – Level 2 support (Subsetter, Visualization)
  – Data List
The GES DISC ‘World’

- Advancing Technology
- Earth Science Data
- Earth Science Metadata
- Documentation
- Ingest, Process, Archive, Distribute, Steward Earth Science Data (on computers optimized for tasks)
- Data and Document Preservation
- Community Driven Data Access Capabilities
- User, Data, Science Support
- Value Added Products and Services
- Research
- Applications
- Outreach
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Aura Distribution by Instrument

Distribution presents the amount of data successfully distributed to user community.

<table>
<thead>
<tr>
<th>Mission</th>
<th>Instrument</th>
<th># Files</th>
<th>Volume (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aura</td>
<td>HIRDLS</td>
<td>18,922</td>
<td>0.92</td>
</tr>
<tr>
<td>Aura</td>
<td>MLS</td>
<td>3,420,094</td>
<td>25.34</td>
</tr>
<tr>
<td>Aura</td>
<td>OMI</td>
<td>11,634,182</td>
<td>164.48</td>
</tr>
<tr>
<td>Aura</td>
<td>TES</td>
<td>244,550</td>
<td>6.80</td>
</tr>
</tbody>
</table>

Aura Multi-Year Product Distribution Trend (Oct 2004 to July 2016)

User Geographical Distribution
# Aura MLS/OMI Data Processing Level Distribution

<table>
<thead>
<tr>
<th>Product Level</th>
<th>MLS_L1</th>
<th>MLS_L2</th>
<th>OMI_L1</th>
<th>OMI_L2</th>
<th>OMI_L3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Users</strong></td>
<td>1</td>
<td>253</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Volume (GB)</strong></td>
<td>4</td>
<td>11,260</td>
<td>19,238</td>
<td>70,805</td>
<td>9,127,010</td>
</tr>
<tr>
<td><strong>Files</strong></td>
<td>8</td>
<td>17,942</td>
<td>35</td>
<td>10,842</td>
<td>57,311</td>
</tr>
</tbody>
</table>

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Help Desk Request from Users

- **Find/Access/Download Data**
  - I do not know how to download…
  - Enhance tools/services/data recipe for better data search, data access, data download

- **Data Subsetting**
  - Improve ability and performance of data subsetting tool

- **Data Reading**
  - Keep data reader code updated, more data reading recipes

- **Documentation and Science Question**
  - Parameter unit, vertical layers …
  - Can we use OMI data for ...? Are OMI data better than ...?
  - Enhance metadata and online resources

- **Users help us**
  - Users find error in our website and code not working -> we make correction.

<table>
<thead>
<tr>
<th>Instrument</th>
<th># User Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aura</td>
<td>9</td>
</tr>
<tr>
<td>HIRDLS</td>
<td>7</td>
</tr>
<tr>
<td>MLS</td>
<td>53</td>
</tr>
<tr>
<td>OMI</td>
<td>283</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>352</strong></td>
</tr>
</tbody>
</table>

2007 May to 2016 Aug
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Transition to Earthdata Login

- GES DISC will replace anonymous FTP with HTTP download on October 3rd, 2016
- We have provided detail in alert message, banner, emails…
- Problems/Questions to GES DISC Help Desk (gsfc-help-disc@lists.nasa.gov)

IMPORTANT MESSAGE Jun 28, 2016  Access to GES DISC data will require all users to be registered with the Earthdata Login system

Starting August 1st, 2016, access to GES DISC data will require all users to be registered with the Earthdata Login system. Data will continue to be free of charge and accessible via HTTP. Access to data via FTP will no longer be available after October 3rd, 2016. Detailed instructions on how to register and receive authorization to access GES DISC data are provided here.

GES DISC Users who deploy scripting methods to list and download data in bulk via anonymous FTP are advised to review the How to Download Data Files from HTTP Service with wget recipe that provides examples of GNU wget commands for listing and downloading data via HTTP.
GES DISC New Web Interface
Giovanni: More Data, More Plots, Faster Results

Old Giovanni:
- 40 individual Portals

New Giovanni:
- Omnibus Portal (future)
- Point data (future)

Giovanni (V1/V2):
- Independent instances

Giovanni (V3):
- Harmonized data & inventory
- Separate instances
- Configurator

Giovanni (V4):
- Flexible infrastructure
- One Instance & Modular
- Fully interoperable
- URL-based
- Data types
  - L3 gridded
  - L2 swath/profiles
  - Point data (future)
Outline

• GES DISC world
• Aura data usage and trend
• Aura data users requests
• GES DISC update (before/after)
  – New Access method (ftp → http) with User Registration System
  – New Website (Mirador → Unified User Interface)
  – Giovanni (G3 → Giovanni, open source)

• GES DISC support beyond Aura Mission
  – A Train Data Depot (Multi-sensor coincident data subsets)
  – Level 2 support (Subsetter, Visualization)
  – Data List
A-Train Data Depot (ATDD) was supported by NASA ACCESS (Advancing Collaborative Connections in Earth System Science) program and now is on sustaining mode.

Started with CloudSat mission support with MODIS-CloudSat collocated subsets. Building upon the expertise, OMI, POLDER, and AIRS subsets were subsequently added in production, and distributed by ATDD.

The collocated subsets include MODIS/Aqua L1B and L2 atmospheric products, OMI/Aura L2 products, and Polder/Parasol L2 products (Table shows detail)

Archived On-line A-Train Subsets
- New Web  http://disc.sci.gsfc.nasa.gov/uui/datasets?keywords=a-train
- http://atrain.gesdisc.eosdis.nasa.gov/data/

MODIS/Aqua, Level 1B, radiances
- MAC021S*: 1-km radiances
- MAC02QS*: 250-m radiances

MODIS/Aqua, Level 2, atmospheric products
- MAC04S*: Aerosol Optical Depth Land and Ocean, Aerosol Type over Land, Angstrom Exponent, Mass Concentration, Fine Mode Fraction
- MAC05S*: Water Vapor IR and near IR retrievals
- MAC06S*: Cloud Top Parameters: Pressure, Temperature, Effective Emissivity, Spectral Forcing, Cloud Phase; Cloud Optical Parameters: Cloud Optical Thickness, Effective Particle Radius; Cirrus Detection: Cirrus Reflectance.
- MAC07S*: Temperature and Moisture (dew point temperature) profiles.
- MAC35S*: Cloud Mask: IR, NIR, and CO2 tests; Visible test at 250-m.

OMI/Aura, Level 2, Cloud Pressure, Ozone, and UV index
- OMLDO2_CPR: Cloud effective pressure based on O2-O2 absorption
- OMLDRR_CPR: Cloud effective pressure based on Raman scattering
- OMT03_CPR: Column amount O3, UV Aerosol Index, UV reflectivity.
- OMAERUV_CPR: UV Aerosol Index, Aerosol Absorption Optical Depth, Surface Albedo, UV Reflectivity.

POLDER/Parasol, Level 2, Radiation Budget processing
- PARASOLRB_CPR: Column Water Vapor, Cloud Pressure from O2 lines, Cloud Optical Thickness, Cloud Phase, Cloud Albedo, Clear Albedo.

*Available in 200- and 10-km swath widths. The rest are available (+/-100 km) only.
## Multi-Sensor Intercomparison

### Footprints of S5P TROPOMI, S-NPP OMPS, METOP-B GOME-2, Aura OMI, and Envisat Schiapachy

<table>
<thead>
<tr>
<th>Spectrometer</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-grating spectrometers with CCD detectors</td>
<td>Double monochromator with pre-disperser prism and four holographic gratings</td>
<td>4 grating spectrometers with their own optics and 2-D detectors</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP: 250-310</td>
<td></td>
<td>Band 1: 240-315</td>
<td>Band 1: 270-300</td>
</tr>
<tr>
<td>NM: 300-380</td>
<td></td>
<td>Band 2: 311-403</td>
<td>Band 2: 300-320</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spectral resolution (nm)</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td></td>
<td>Band 1: 0.24-0.29</td>
<td>Band 1 &amp; 2: 0.065</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Band 2: 0.26-0.28</td>
<td>Band 2: 0.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample interval (nm)</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.41</td>
<td></td>
<td>Band 1: 0.12</td>
<td>Band 1: 0.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Band 2: 0.12</td>
<td>Band 2 &amp; 3: 0.065</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Swath</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push broom 110°</td>
<td></td>
<td>Across track scanning</td>
<td>Push broom 2600km</td>
</tr>
<tr>
<td>GOME-2 band 1A pixel</td>
<td></td>
<td>METOP-A: 1920km &amp; 900R8NM nadir macropixel</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial Resolution</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NM: 50km x 50km</td>
<td></td>
<td>METOP-A: 40km x 80km &amp; 40km x 40km (after July 2013)</td>
<td>Band 1: 28x7km</td>
</tr>
<tr>
<td>NP: 250km x 250km</td>
<td></td>
<td>METOP-B: 40km x 80km</td>
<td>Band 2 &amp; 3: 7km x 7km</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L1B Data Format</th>
<th>OMPS</th>
<th>GOME-2</th>
<th>TROPOMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDF5</td>
<td></td>
<td>EPS-native format</td>
<td>netCDF-4</td>
</tr>
</tbody>
</table>

Source: [http://www.tropomi.eu/](http://www.tropomi.eu/)
Data Quality Level 2 Visualizer

NASA L2 Data Quality Visualization

MAP LAYERS
- MODIS
  - Terra Corrected Reflectance (True Color)
  - Aqua Corrected Reflectance (True Color)
- OMI
  - OMAERUV
    - Absorption AOD 388nm (no QA)
    - Absorption AOD 388nm (QA)
    - Absorption AOD 500nm (no QA)
    - Absorption AOD 500nm (QA)
  - AOD 388nm (no QA)
  - AOD 388nm (QA)
  - AOD 500nm (no QA)
  - AOD 500nm (QA)
- OMAERO
- OMSO2
- OMTQ3
- OMDQA03
- World Background
Summary

GES DISC is user driven data service center

- Maintain active archive of datasets and enhance information services by developing tools and services for users
  - Applications Support: Earthdata Login, New Website, Subsetting, Giovanni, Data Recipe/Cookbook, OPeNDAP, …
  - Dataset documentation support (User Guides, Readme, FileSpec, DIF, …)

- Engage the user community in their data access, data usability and information/services needs.
  - Conference & Science Team participation, outreach.
  - Help Desk/User Support.
  - Develop and test recipes, and support tools for working with GES DISC data.

- Web content support, Social Media, User Forum, news articles, version release information, and data services updates, FAQ.

- Support for legacy missions & document preservation
Operational Services/Tools

- **Giovanni** – Data Discovery, Visualization and Exploration
- **Mirador** – Data Search and access
- **Simple Subset Wizard** – GES DISC led, cross DAAC effort to provide subsetting capabilities
- **Data Recipes**
- **OpenDAP**
- **GrADS Data Server**
- **Open Geospatial Consortium (OGC) Web Map Service (WMS)**
- **Data provided in various formats** (HDF, netCDF, ASCII, kmz, others)
- **MAPSS** – Provides multi-sensor aerosol analysis centered around AERONET sites
- **Data Quality Screening** – Allows users to filter data on Quality
- **NEESPI (Northern Eurasia), MAIRS (Monsoon Asia), and A-Train Data Depot (along the A-Train track)** – Provides multi-instrument heterogeneous data access for a given region
- **Data Stewardship**