The Diverse Data, User Driven Services and the Power of Giovanni at NASA GES DISC

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Outlines

• Overview of remote sensing and model data at GES DISC
• Overview of data services at GES DISC
  – Registration with NASA data system
  – Searching and downloading data
• Giovanni: online data exploration tool
• NASA Earth Data and Information System

Data Products at GES DISC

• Satellite Observation
• Model Outputs
• Earth System Data Records (ESDR)

Satellite Data at GES DISC

• AIRS (2002.08 – 2016.09): temperature, pressure, humidity, geopotential height, ...
• TRMM (1997.12 – 2015.06): precipitation
• GPM (2014.03 - ): precipitation
• TOMS (1978 – 2011): ozone
• AURA (OMI, MLS, HIRDLS, 2004.10 - ): ozone, aerosols, NO2, SO2, water vapor
• AIRS (2002.08 – 2016.09): CO, CO2, CH4, ...
• ACS (2009.04 - 2013.05): CO2
• OC3 (2014-present): CO2
• UARS (1991-2005): upper atmospheric trace gases, ...
• SORCE (2003-2011): solar irradiance

Greenhouse Gases

Example of Gaps in Satellite Data

Model Data at GES DISC

• MERRA (1979-2015): atmosphere reanalysis
• MERRA-2 (1980 – present): atmosphere reanalysis
• GLDAS (1979-present): Global land data assimilation
• NLDAS (1979-present): North American land data assimilation
• NOAA (1988-2007): Ocean biogeochemical Assimilation Model
An ESDR (Earth System Data Records) is defined as a unified and coherent set of observations of a given parameter of the Earth system, which is optimized to meet specific requirements for addressing science questions.

- Creating a Long-Term Multi-Sensor Ozone State Data Record (1979-2014)
- Consistent Long-Term Aerosol Data Records over Land and Ocean from SeaWiFS (1979-2013)
- Global Ozone Chemistry and Related Trace gases Data Records for the Stratosphere (1979-2012)
- Earth Surface and Atmosphere Reflectivity since 1978 from Multiple Satellites (TOMS, SBUV, SBUV-2, OMI, SeaWIFS, NPP, and NPOESS) (1978-2012)
- Multi-Sensor Water Vapor Climate Data Record Using Cloud Classification (2006-2012)
- Multi-Decadal Sulfur Dioxide Climatology from Satellite Instruments
- Globally Merged, Reconciled and Gridded Observations of Near-Surface Atmospheric and Land Surface Properties

Over view of data services at GES DISC
- Registration with NASA data system
- Searching and downloading data

Past (36)

Earth Science Missions
https://science.nasa.gov

Future (24)

NASA Data Centers

- Register with Earthdata system
- Data are free, most data are unrestricted
- Data citation is encouraged

Registration to NASA Data System
https://urs.earthdata.nasa.gov/

- Register with Earthdata system
- Add data access applications, e.g. "NASA GESDISC DATA ARCHIVE"

Data Services at GES DISC

- Data downloading Services:
  - Data Search System: Search and Download Data Subsets: gridded and spatial subsets

Visualization Services
- Giovanni: Online Data Visualization and Analysis

Interoperable Services:
- OGC/WMS: Open Geospatial Consortium / Web Map Service
- OGC/WMTS: Open Geospatial Consortium / Web Map Tile Service
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Data How-To: (Recipes) Detailed examples on how to access and work with data

Products from MEaSUREs: ESDR

For ESDR (Earth System Data Records) to be useful and valuable, it is essential to understand its underlying science operation.

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Giovanni: online data exploration tool

- With a few mouse clicks, obtain information easily on the atmosphere, ocean and land around the world.
- No need to learn data formats to retrieve & process data.
- Try various parameter combinations measured by different instruments.
- All the statistical analyses are done via a regular Web browser.

https://giovanni.gsfc.nasa.gov

Geospatial Interactive Online Visualization And Analysis Infrastructure (Giovanni)
**Giovanni Features**

**Single Parameter:**
- Lat–Lon map of time-averaged data
- Time-series of area-averaged data
- Cross-section map
- Contour map
- Time-series of Lat–Lon map over time

**Multi-parameters:**
- Scatter plots with regression statistics
- Time-series of cross-section data
- Cross-section differences
- Time-series differences
- Time-series of Lat–Lon differences
- Interpolating for different spatial resolutions

**Output Features:**
- Data: ASCII, netCDF
- Image: PNG, GeoTIFF, KMZ
- Provides WMS and WCS to other Web servers to get maps or data from Giovanni

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**Signatures of Hurricane Sandy from Giovanni**

2012 October 27-29

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**NLCD Reveals Soil Moisture Change with Giovanni**

Tropical Storm Lee, Sep 2011

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**SeaWIFS Deep Blue Aerosols during California’s Wildfire with Giovanni**

Level 3 Daily Aerosols
21-27 October 2007

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**View AIRS Temperature Profile with Giovanni**

March

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**View MERRA-2 SO2 Profile with Giovanni**

On 1991.06.30 After Volcano Mt Pinatubo

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**Example: Comprehensive Multi-Sensor Data Environment for Aerosol Studies**

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**Inter-comparisons of Aerosols**

April 1-30 2005 averaged daily aerosols from MODIS, MISR, OMI, and SeaWiFS at 555 nm, and OMI at 500 nm
Artifact in AOD Correlation Explained!

**Dataday definition in Level 3 Aerosols**

Level 3 gridded data are easy to use by modelers, application users, climate scientists... but also easy to get wrong conclusions.... Level 3 daily products are generated by binning Level 2 data belonging to one day onto a certain spatial grid according to a Dataday definition:

1. UTC (00:00-24:00Z) : MODIS-Atmospheric (V5)
2. Local Time: MISR, MODIS-ocean, AIRS, OMI, TOMS, SeaWIFS

**Correlations of Daily MODIS Terra and Aqua Aerosols**

**Recommendation to use Giovanni:**
read carefully documents about data, retrieval algorithm, and data quality, ...

**Published Paper using Giovanni:**

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**Published Paper using Giovanni:**

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**Published Paper using Giovanni:**

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**Relevant Resources**

- NASA EOS Data and Information System (https://earthdata.nasa.gov)
  - User Resources/Outreach Products: list of NASA products
  - User Resources/Sensor Use Plans: case studies of use remote sensing data
- Applied remote sensing training: https://edc.usgs.gov/eatr/ground
- WorldView (https://worldview.earthdata.nasa.gov)
- NASA’s Earth Observatory: https://earthobservatory.nasa.gov
- NASA’s Visible Earth: https://visibleearth.nasa.gov
- NASA Earth Observations: https://earthdata.nasa.gov/earth-observatories
- Near Real-Time data and imagery: https://earthdata.nasa.gov/earth-observatories/near-real-time