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)

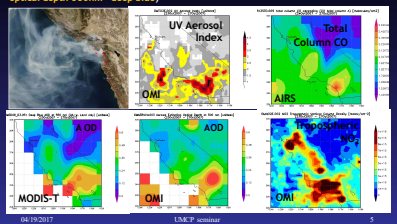
Satellite Data at GES DISC

- 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, …
- ACOS(2009.04 - 2013.05): CO2
- OCO-2 (2014-present): CO2
- UARS (1991-2005): upper atmospheric trace gases, …
- SORCE (2003-2011): Solar Irradiance

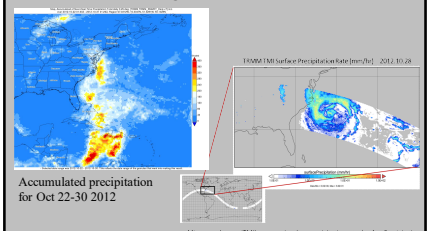
Viewing Aerosol Data on California's Wildfire

23-27 October 2007

Data from NASA's Aura OMI (Tropospheric NO_2 , UV Aerosol Index and aerosol extinction optical depth), Aqua AIRS (Total Column CO), and Terra MODIS (aerosol optical depth 550nm - deep blue)

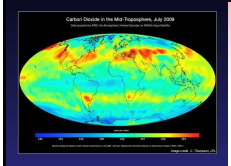


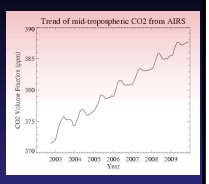
Hurricane Sandy Precipitation from TRMM



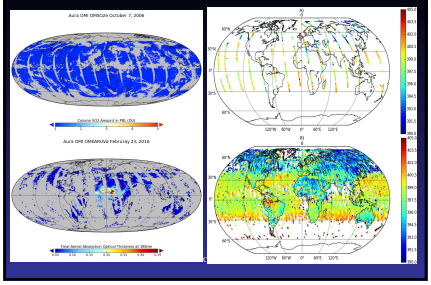
Accumulated precipitation for Oct 22-30 2012

Greenhouse Gases



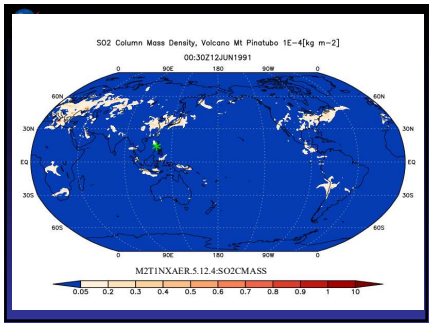


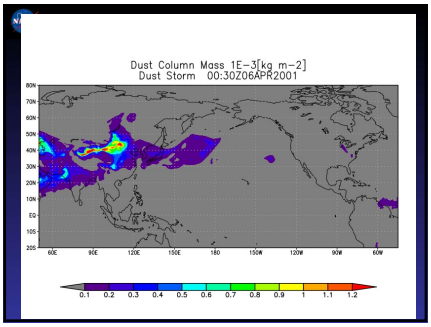
Example of Gaps in Satellite Data



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
- NOBM (1998-2007): Ocean biogeochemical Assimilation Model





Products from MEaSUREs: ESDR

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.

- Reprocessing and Goddard Satellite-based **Surface Turbulent Fluxes** (GSSTF) Data Set for Global Water and Energy Cycle Research (1987-2008)
- Creating a Long Term Multi-Sensor **Ozone** Data Record (1970-2014)
- Consistent Long-Term **Aerosol** Data Records over Land and Ocean from SeaWIFS (1979-2010)
- Global **Ozone Chemistry and Related trace gas** Data Records for the Stratosphere (1979-2012)
- Earth Surface and **Atmosphere Reflectivity** Since 1979 from Multiple Satellites (TOMS, SBUV, SBUV-2, OMI, SeaWIFS, NPP, and NPOESS) (1978-2012)
- A 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

Earth Science Missions

https://science.nasa.gov

Past (36) | Operating (28) | Future (24)

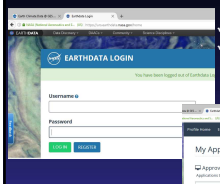
NASA Data Centers

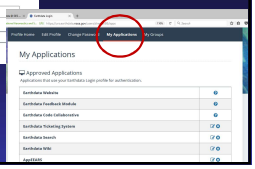
- ✓Register with Earthdata system
- ✓Data are free, most data are unrestricted
- ✓Data citation is encouraged

Courtesy: https://earthdata.nasa.gov

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:

- **HTTPS**: Direct access
- **Data Search System**: Search and download
- **Data Subsetter**: parameter and spatial subsetter

Visualization Services:

- **Giovanni** : Online Data Visualization and Analysis

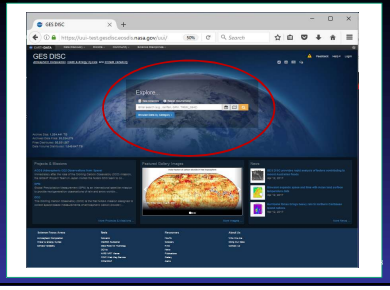
Interoperable Services:

- **OPeNDAP** : Open-source Project for a Network Data Access Protocol
- **GDS** : GrADS Data Server
- **OGC /WMS** : Open Geospatial Consortium /Web Map Service

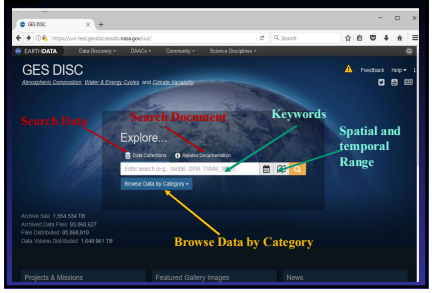
Online Helps:

- **FAQ:** short description of frequently asked questions
- **Data How-To: (Recipes)** Detailed examples on How to access and work with data

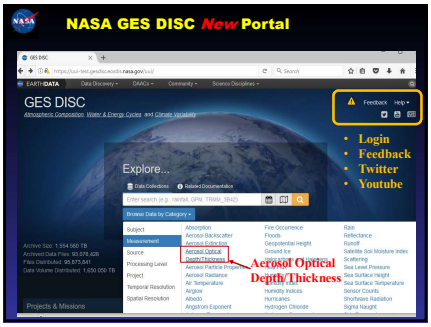
NASA GES DISC *New* Portal



NASA GES DISC *New* Portal

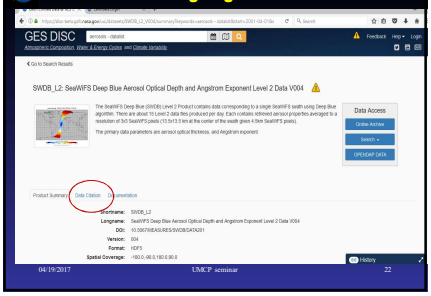


NASA GES DISC *New* Portal

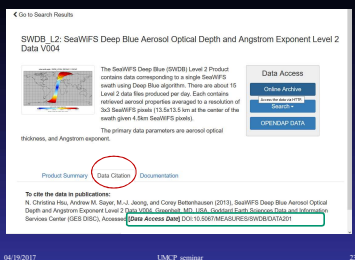


NASA GES DISC *New* Portal

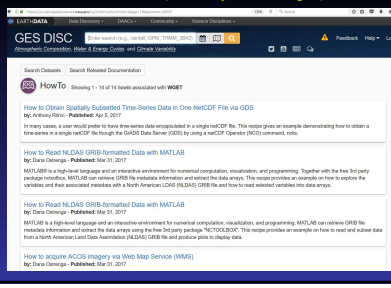
Product Landing Page



Data Citation and DOI



Data How-To (formally data recipes)



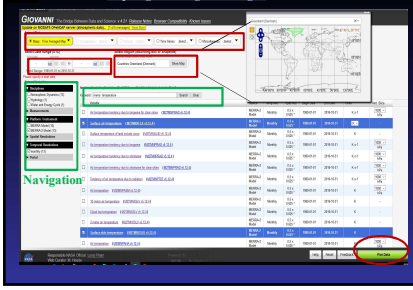
- **Giovanni: online data exploration tool**

Geospatial Interactive Online Visualization ANd aNalysis Infrastructure (Giovanni)

https://giovanni.gsfc.nasa.gov

- ✓ 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



Giovanni Features

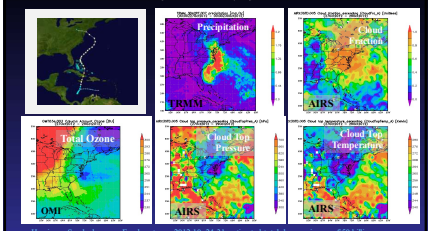
Single Parameter :
- Lat–Lon map of time-averaged data
- Time-series of area-averaged data
- Hovmöller diagram/cross section map
- Histogram
- Vertical profile, cross-section map
- Zonal mean
- Animations of Lat–Lon map over time
- Climatology & Anomaly analysis

Multi-parameters:
- Scatter plots with regression statistics
- Temporal correlation maps
- Lat–Lon map overlain with 2nd parameter contour plot
- Time-series differences
- Lat–Lon map differences
- Regridding (for different spatial resolutions)

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

Signatures of Hurricane Sandy from Giovanni

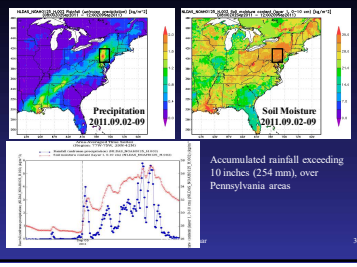
2012 October 27-29



Hurricane Sandy, know as Frankenstorm, 2012.10. 24-31, estimated total damage is more $50 billion

NLDAS Reveals Soil Moisture Change with Giovanni

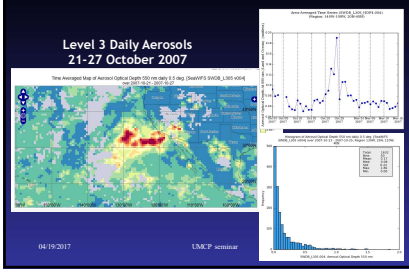
Tropical Storm Lee , Sep 2011



Accumulated rainfall exceeding 10 inches (254 mm), over Pennsylvania areas

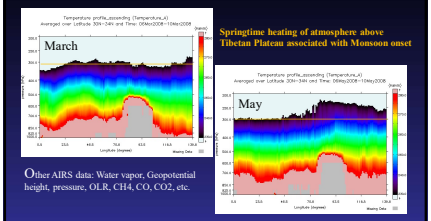
SeaWiFS Deep Blue Aerosols during California's Wildfire with Giovanni

Level 3 Daily Aerosols
21-27 October 2007



View AIRS Temperature Profile with Giovanni

Cross Section averaged for 30°N-34°N

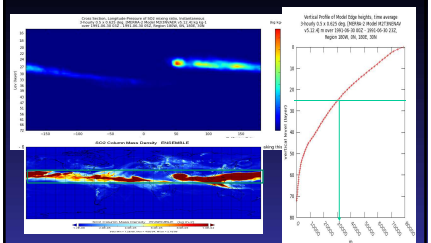


Springtime heating of atmosphere above Tibetan Plateau associated with Monsoon onset

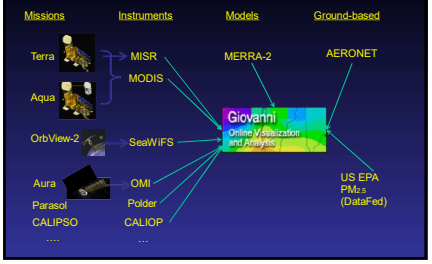
Other AIRS data: Water vapor, Geopotential height, pressure, OLR, CH4, CO, CO2, etc.

View MERRA-2 SO2 Profile with Giovanni

On 1991.06.30 After Volcano Mt Pinatubo

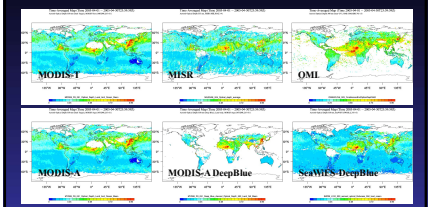


Example: Comprehensive Multi-Sensor Data Environment for Aerosol Studies



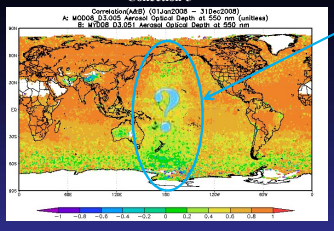
Inter-comparisons of Aerosols

April 1-30 2005 averaged daily aerosols from MODIS, MISR, OMI, and SeaWiFS at 550 nm, and OMI at 500nm

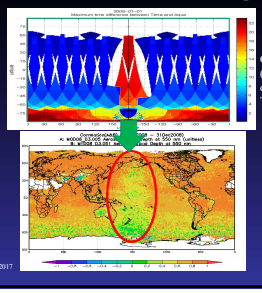


Correlations of Daily MODIS Terra and Aqua Aerosols

Collection-5



Artifact in AOD Correlation Explained!



Observation Time (local time) differences between Terra and Aqua

Dataday definition in Level 3 Aerosols

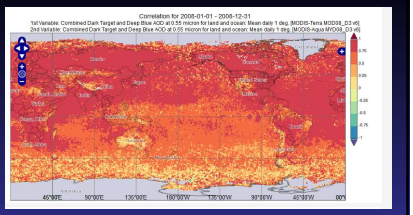
Level 3 gridded data are easy to use by modelers, application users, climate scientists… but also easy to get wrong conclusions….

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

Collection-6

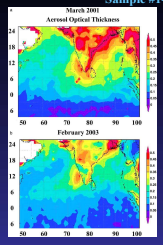


Recommendation to use Giovanni:

read carefully documents about data, retrieval algorithm, and data quality, …

Published Paper using Giovanni:

Sample #1- Regional Aerosol Study

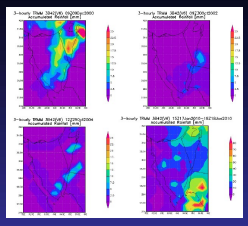


V. Vinoj, … Y. J. Kaufman, 2004, Radiative forcing by aerosols over the Bay of Bengal region derivedfrom shipborne, island-based, and satellite (Moderate-Resolution Imaging Spectroradiometer) observations . JGR, 109, DOI: 10.1029/2003JD004329

Figure 9. Regional distribution of aerosol optical depth (550 nm) during (a) March 2001 and (b) February 2003 (http://lake.nascom.nasa.gov/movas).

Published Paper using Giovanni:

Sample #2: Flash Flood Early Warning System

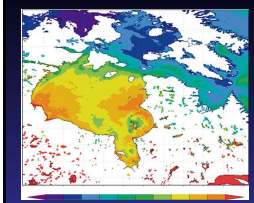


Cools, et al. (2012). An early warning system for flash floods in hyper - arid Egypt. Natural Hazards and Earth System Sciences, 12, 443-457.

Fig. 7. Selection of 3-hourly rainfall estimates from TRMM for the events in December 2000, October 2002, October 2004, and January 2010. Images have been extracted with NASA's Giovanni (http://giovanni.gsfc.nasa.gov)

Published Paper using Giovanni:

Sample #3: Climate Change and Arctic SST

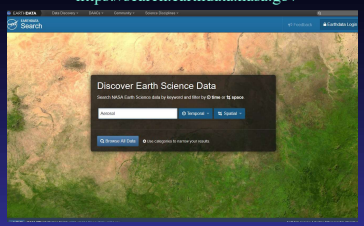


Stewart, D.B. and Barber, D.G. (2010). The ocean-sea ice-atmosphere system of the Hudson Bay Complex. In A Little Less Arctic, S. H. Ferguson, L.L. Loseto, and M.L. Mallory, Eds., Springer, Netherlands, 1-38

Fig. 8 Summer (July–September) sea surface temperature in 2006 (Prepared using the Giovanni online data system, developed and maintained by the NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC).

NASA Earth Science Data Search

https://search.earthdata.nasa.gov



Relevant Resources

- ✓ NASA EOS Data and Information System (https://earthdata.nasa.gov)
  - user-resources/outreach-products : list of NASA products
  - user-resources/sensing-our-planet : case studies of use remote sensing data
- ✓ Applied remote sensing training: https://arset.gsfc.nasa.gov/
- ✓ WorldView (https://worldview.earthdata.nasa.gov)
- ✓ NASA's Earth Observatory http://earthobservatory.nasa.gov/
- ✓ NASA's Visible Earth http://visibleearth.nasa.gov/
- ✓ NASA Earth Observations http://neo.sci.gsfc.nasa.gov/Search.html
- ✓ Near Real-Time data and imagery: https://earthdata.nasa.gov/earth-observation-data/near-real-time

Thanks

https://disc.sci.gsfc.nasa.gov

Question & Feedback:
gsfc-help-disc@lists.nasa.gov

Examples of Mission poster

March 2014 - present

September 2014 - present