



Giovanni: **The Bridge Between Data and Science**

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Giovanni Team**

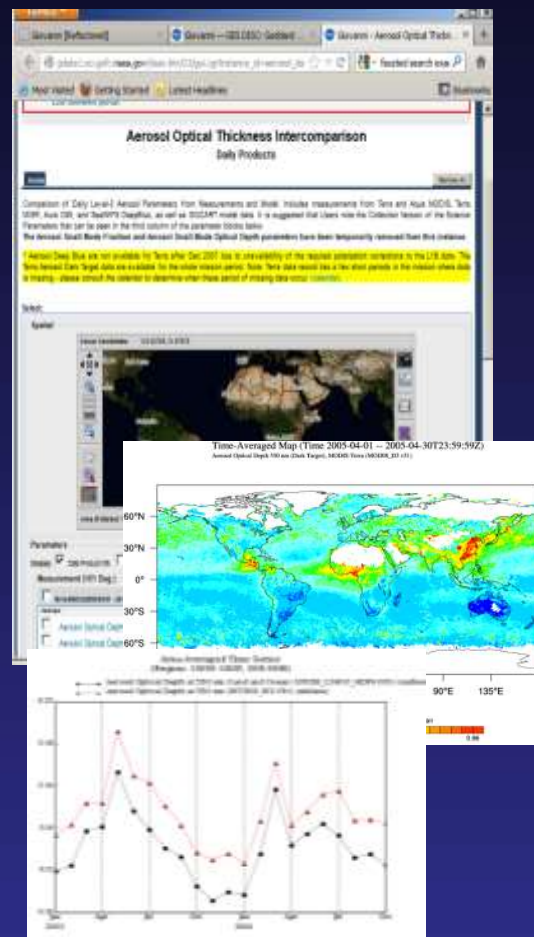
**NASA Goddard Earth Sciences Data and
Information Services Center**

<http://giovanni.gsfc.nasa.gov/>



Goddard Interactive Online Visualization ANd aNalysis Infrastructure (Giovanni)

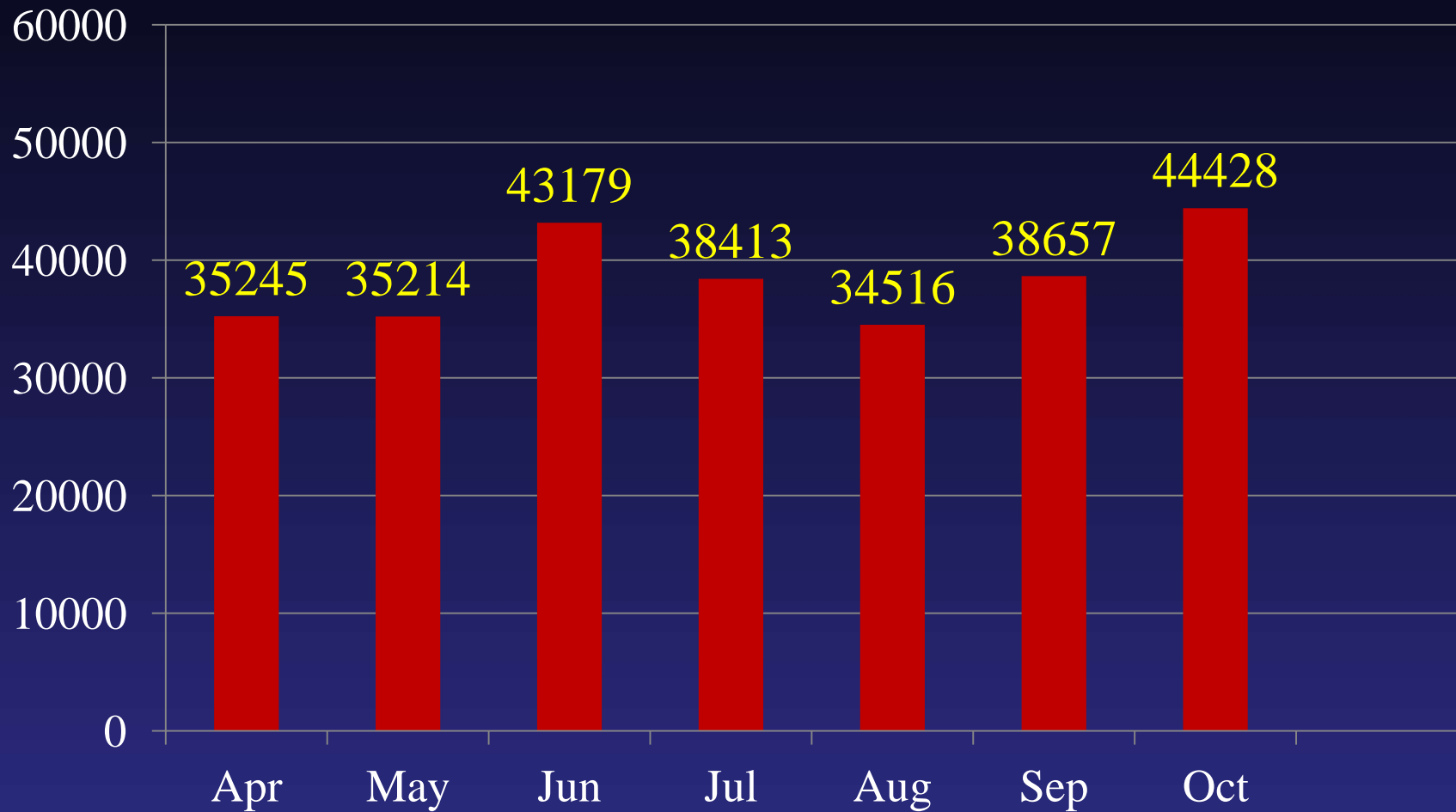
<http://giovanni.gsfc.nasa.gov>



- With a few mouse clicks, obtaining 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 analysis is done via a regular web browser.



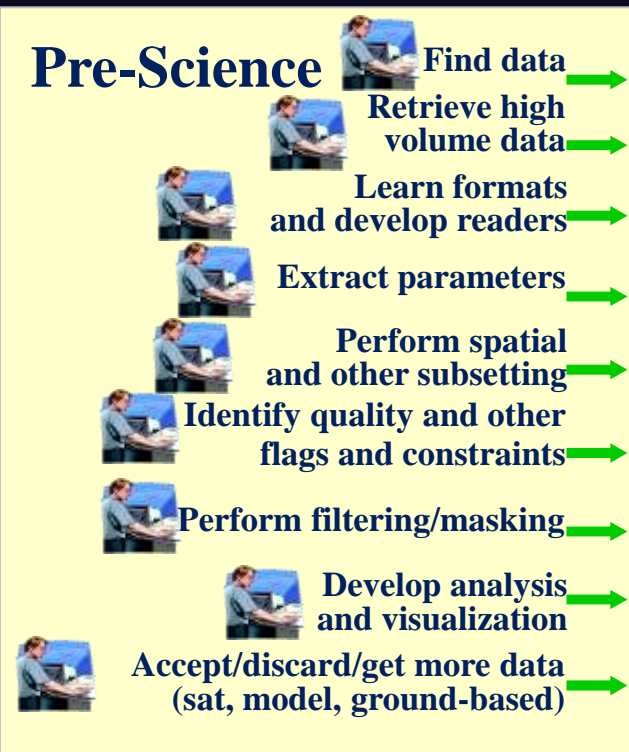
Monthly Plots Generated with Giovanni in last 7 months (Apr-Oct 2012)



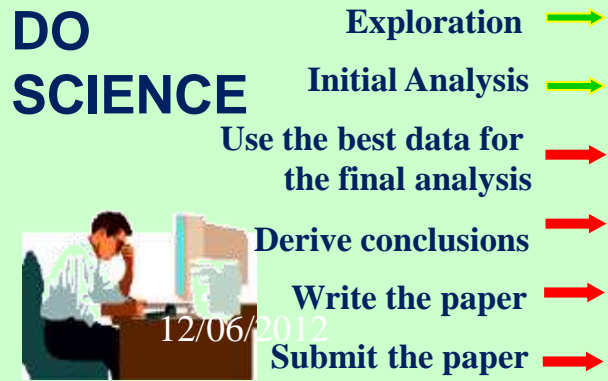
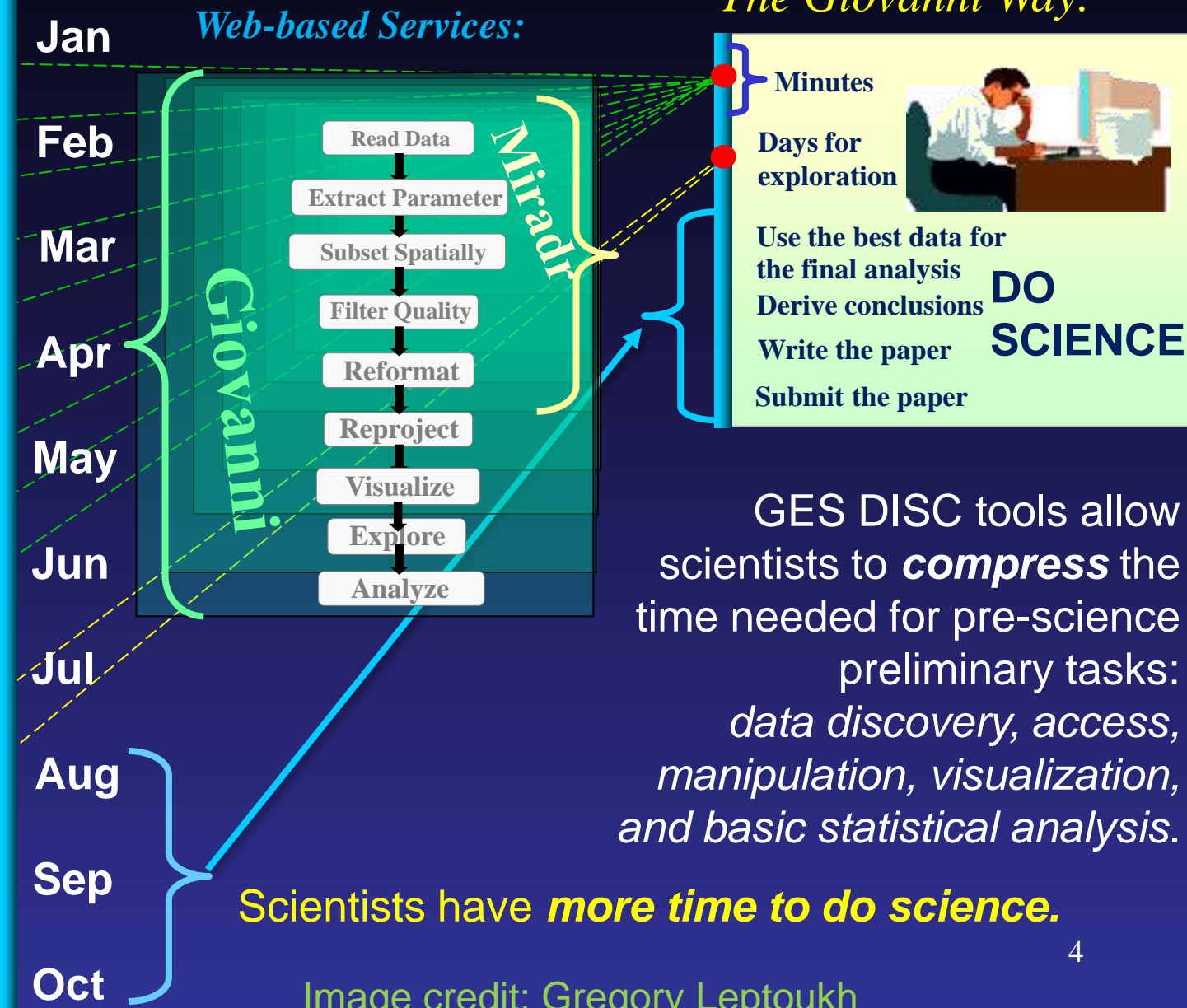


Giovanni Allows Scientists to Concentrate on the *Science*

The Old Way:



The Giovanni Way:





Giovanni Features

Single Parameter :

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

Multi-parameters:

- Scatter plots with regression statistics
- Temporal correlation maps
- Lat–Lon map overlain of time-averaged
- Time-series differences
- Lat–Lon map differences
- Regridding if different spatial resolution

Other Features:

- Output: ASCII, HDF, netCDF for data; png and kmz for images
- Input: HDF, NetCDF, GRIB
- Input data from local and remote systems: FTP, HTTP, OPeNDAP, WCS, and GDS.
- Provides WMS and WCS to other web server to get maps or data from Giovanni



Giovanni now

- 40+ customized **Giovanni portals** serving various missions and projects
- 1600+ geophysical parameters/variables from satellites and models

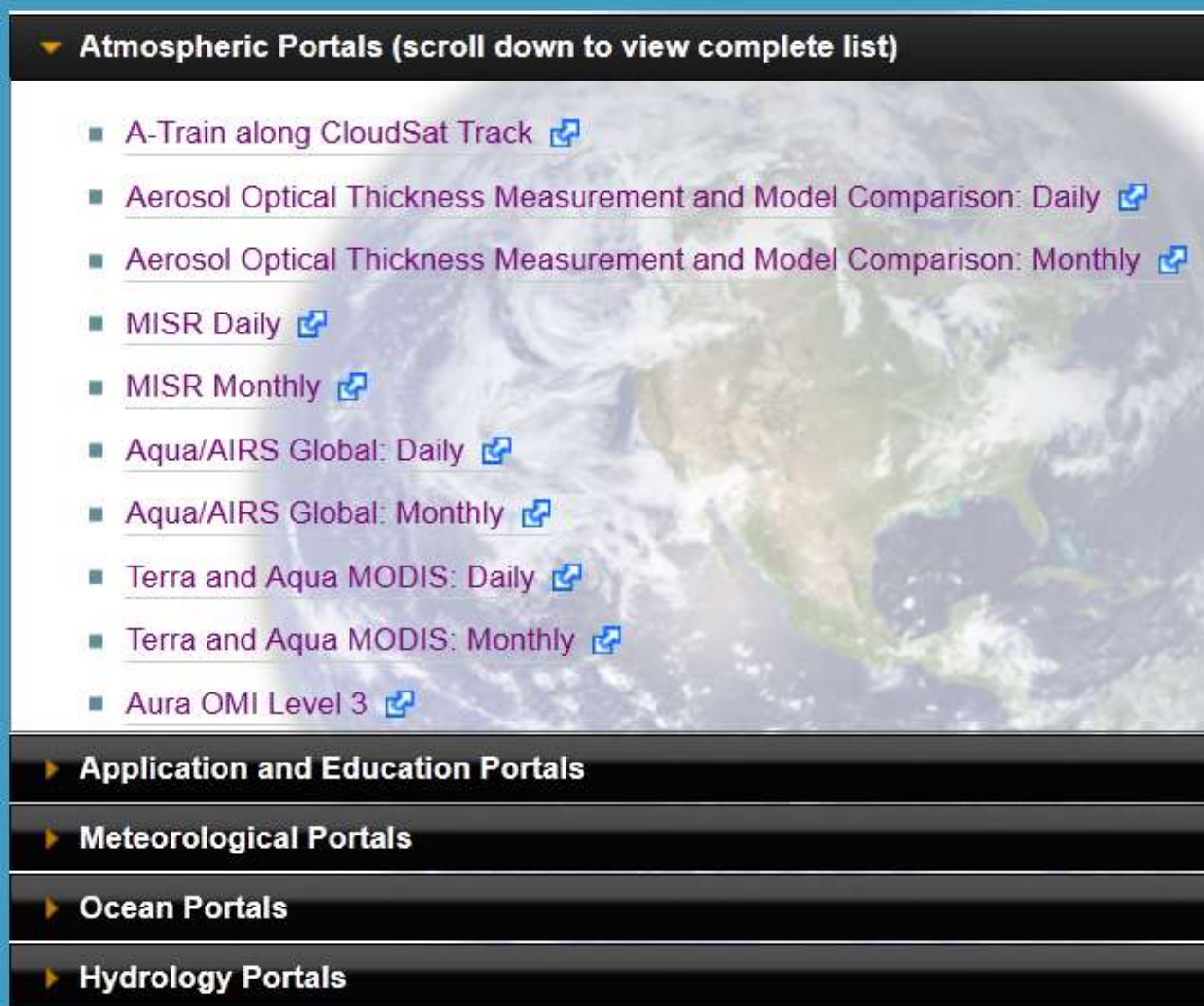
➤ Atmospheric Portals

➤ Application and Education Portals











➤ Meteorological Portals

➤ Ocean Portals

➤ Hydrology Portals



▼ Atmospheric Portals (scroll down to view complete list)

- [A-Train along CloudSat Track](#) 
- [Aerosol Optical Thickness Measurement and Model Comparison: Daily](#) 
- [Aerosol Optical Thickness Measurement and Model Comparison: Monthly](#) 
- [MISR Daily](#) 
- [MISR Monthly](#) 
- [Aqua/AIRS Global: Daily](#) 
- [Aqua/AIRS Global: Monthly](#) 
- [Terra and Aqua MODIS: Daily](#) 
- [Terra and Aqua MODIS: Monthly](#) 
- [Aura OMI Level 3](#) 

▶ Application and Education Portals

▶ Meteorological Portals

▶ Ocean Portals

▶ Hydrology Portals



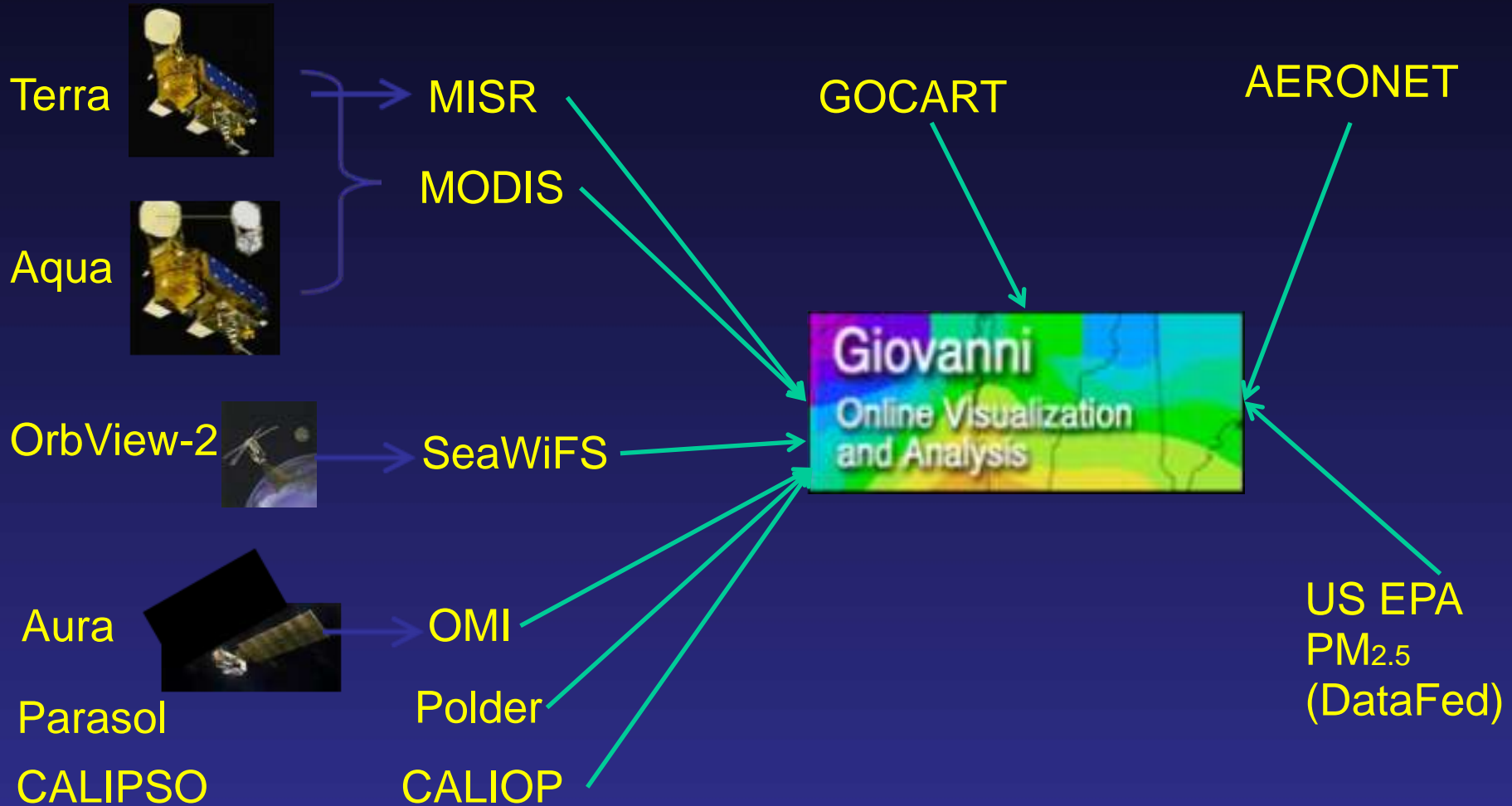
Example: Comprehensive Multi-Sensor Data Environment for Aerosol Studies

Missions

Instruments

Models

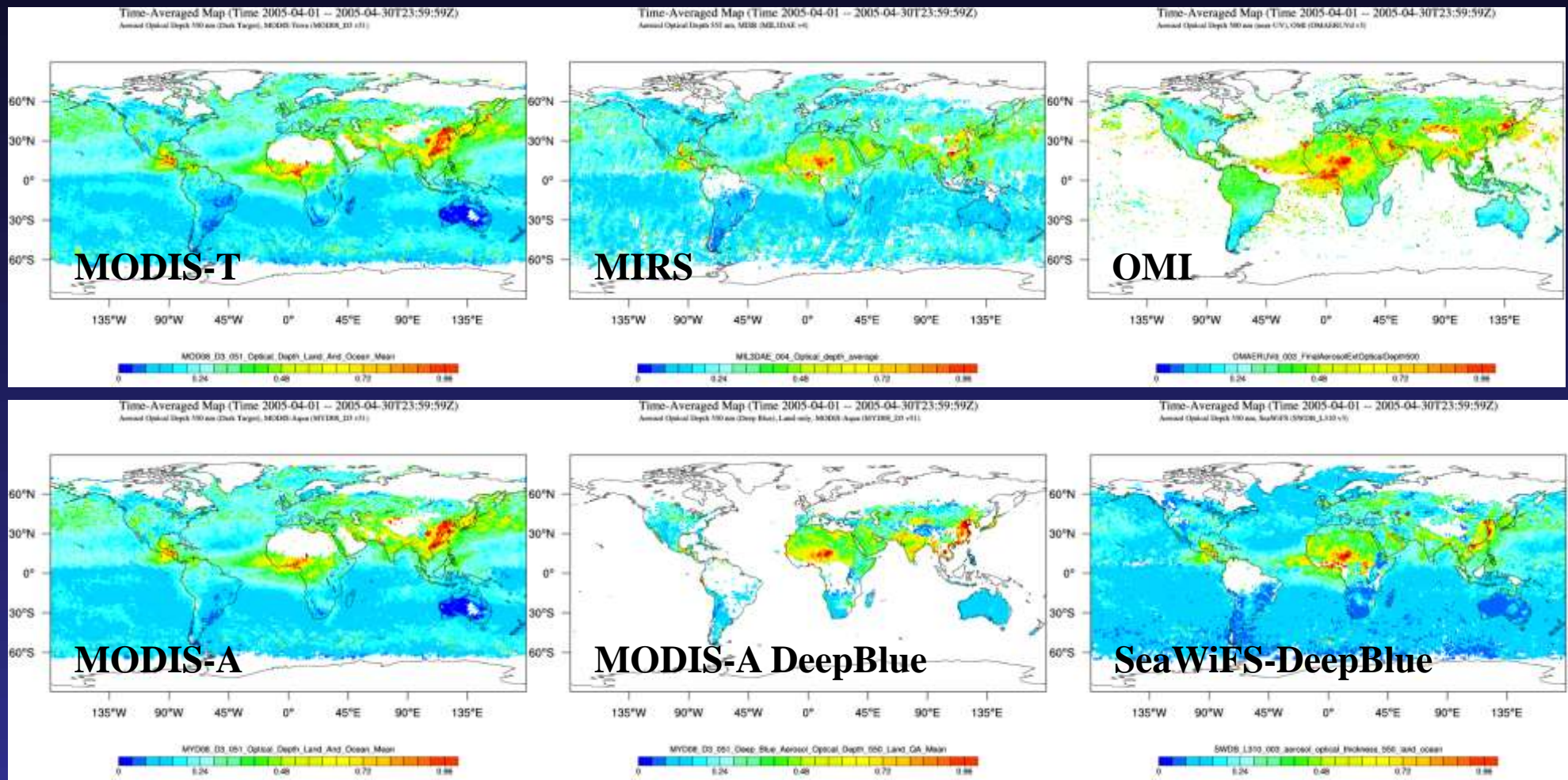
Ground-based





Inter-comparisons of Aerosols

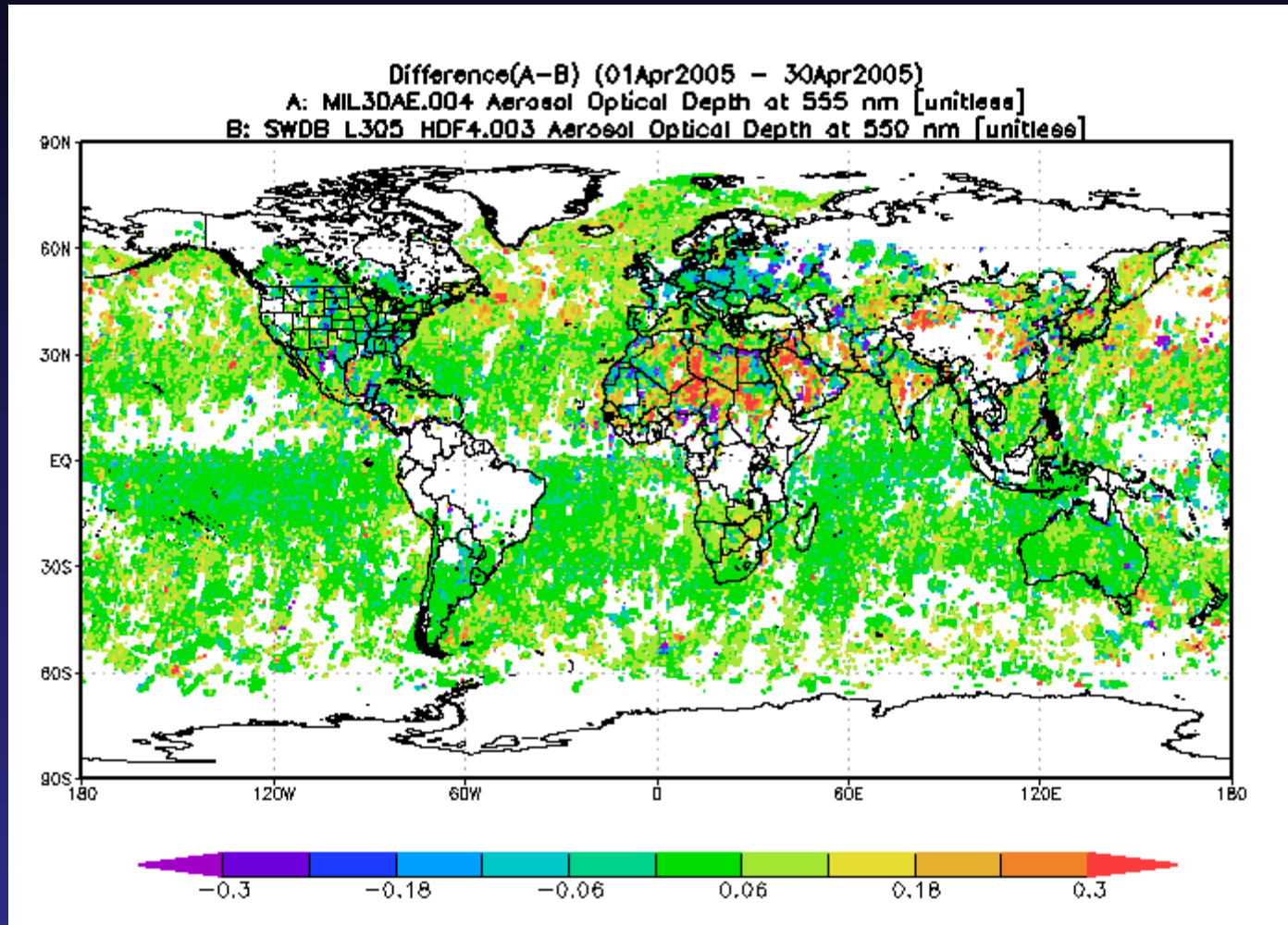
Apr 1-30 2005 averaged daily aerosols from MODIS, MISR, OMI, and SeaWiFS at 550 nm, and OMI at 500nm





Spatial Pattern of Differences

Averaged daily aerosol optical depth difference between
SeaWiFS DeepBlue and MISR (Apr 1-30 2005)

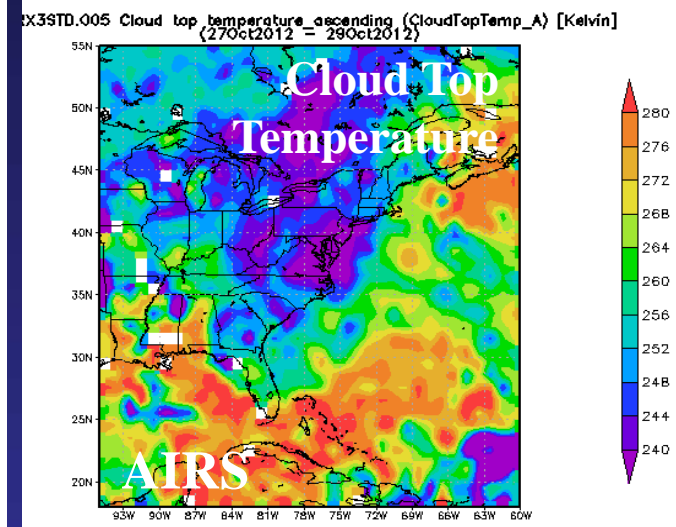
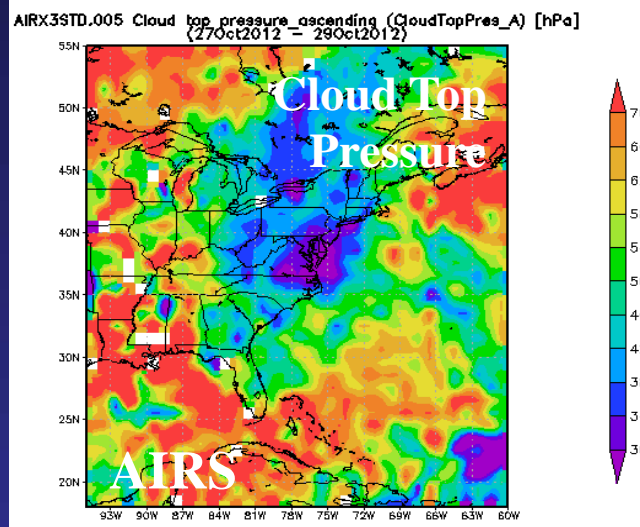
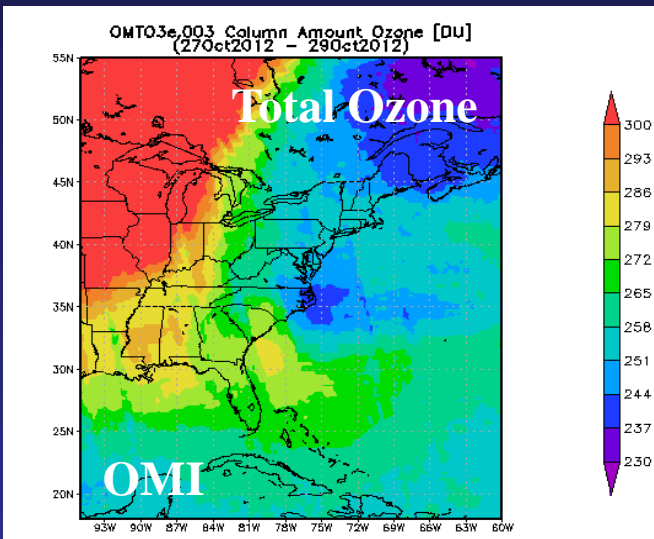
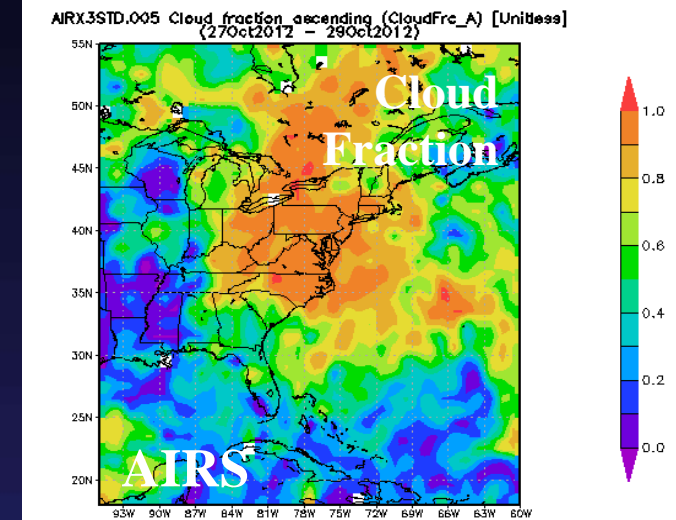
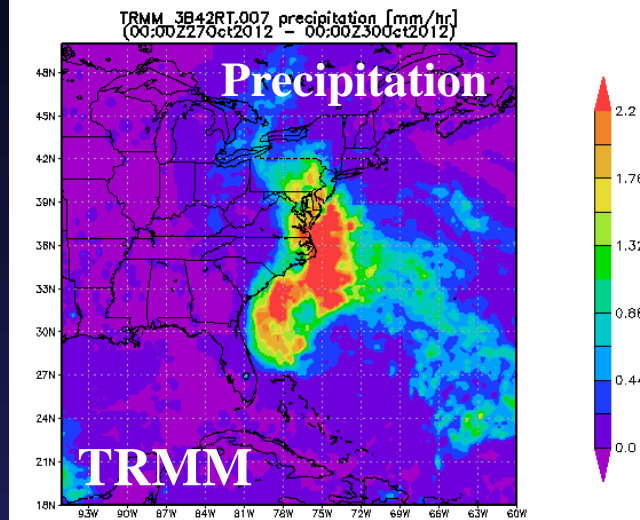




Signatures of Hurricane Sandy

2012 Oct. 27-29

Data are NASA Satellite Observations from TRMM, AIRS, and OMI



12/06/2012

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

10



California's Wildfire



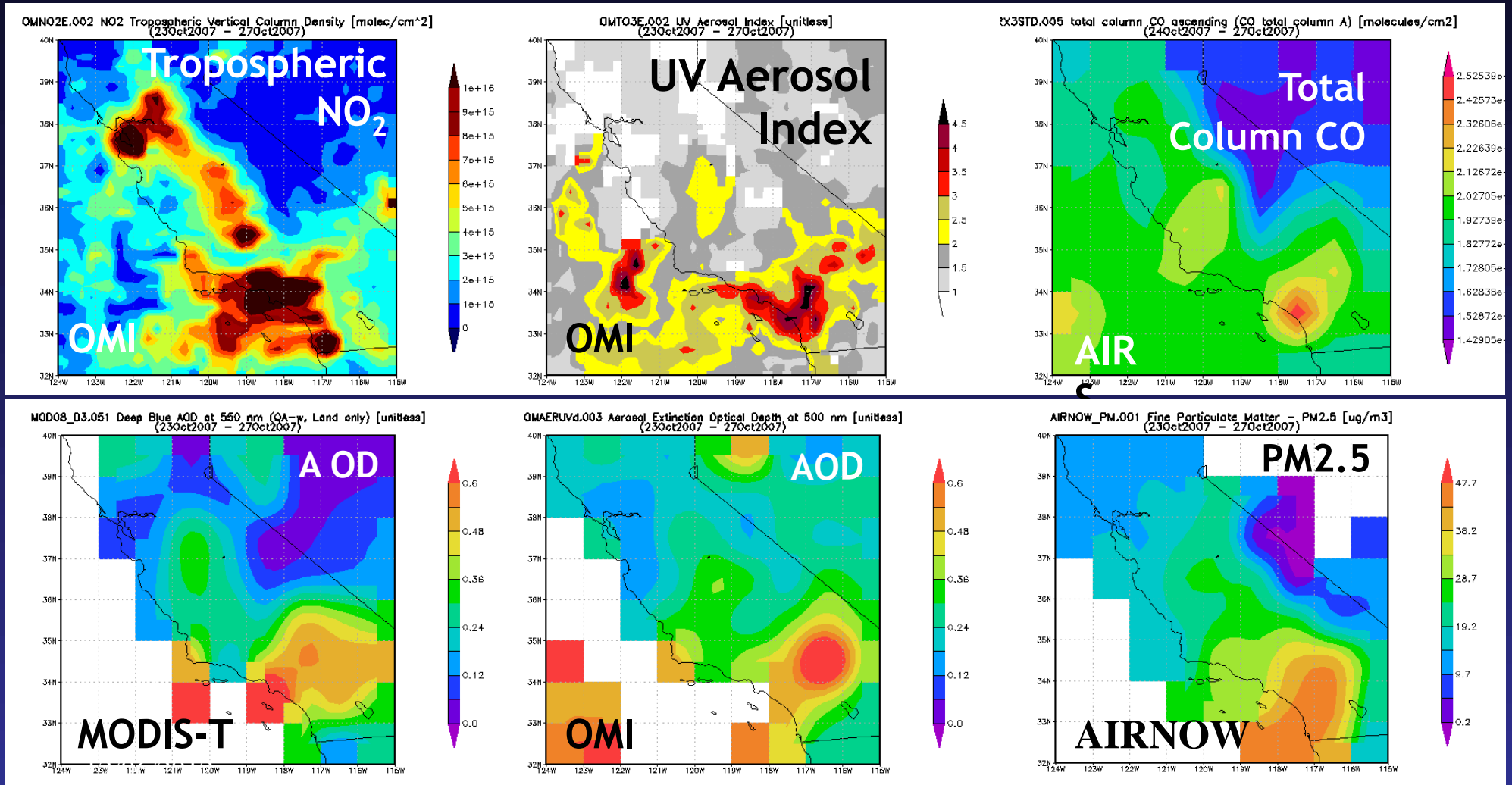
Smoke from California fire observed from MODIS-Aqua on Oct 24 2007 20:45UTC. Image credit: NASA EOSDIS Rapid Response image gallery.



California's Wildfire Visualization

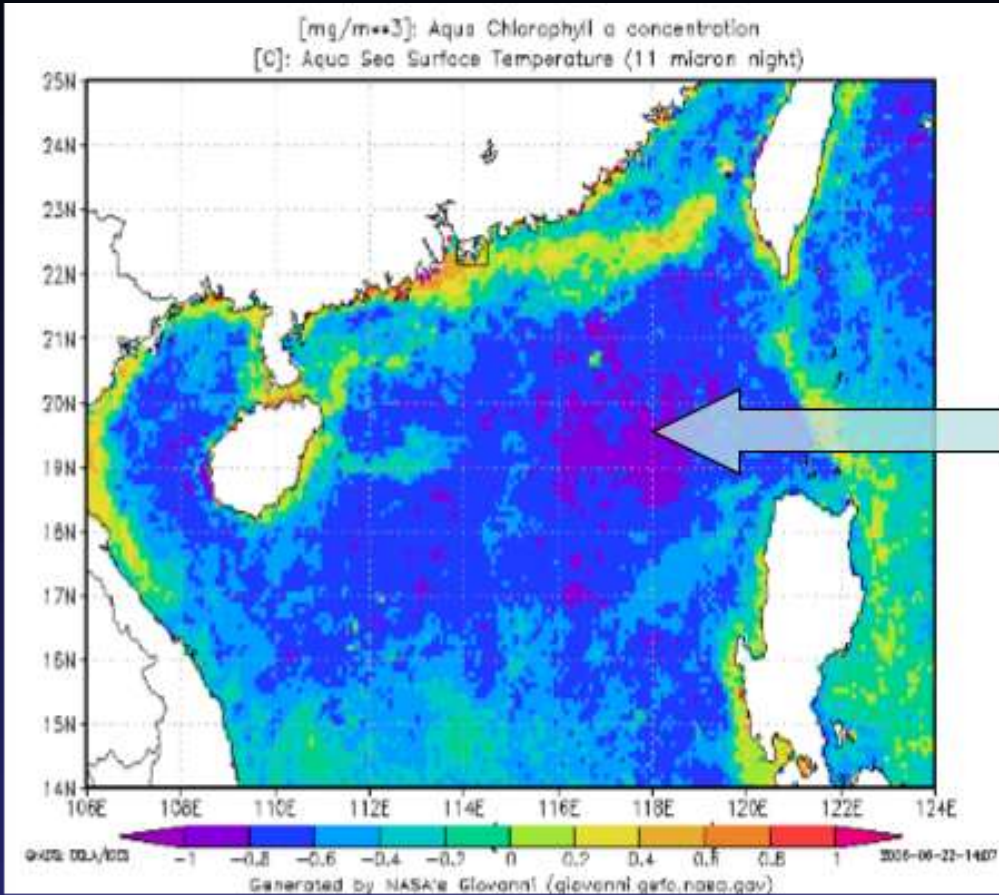
23-27 October 2007

Data from NASA's Aura OMI (Tropospheric NO₂, UV Aerosol Index and aerosol extinction optical depth), Aqua AIRS (Total Column CO), Terra MODIS (aerosol optical depth 550nm - deep blue), and AIRNOW (PM2.5 from ground measurement)

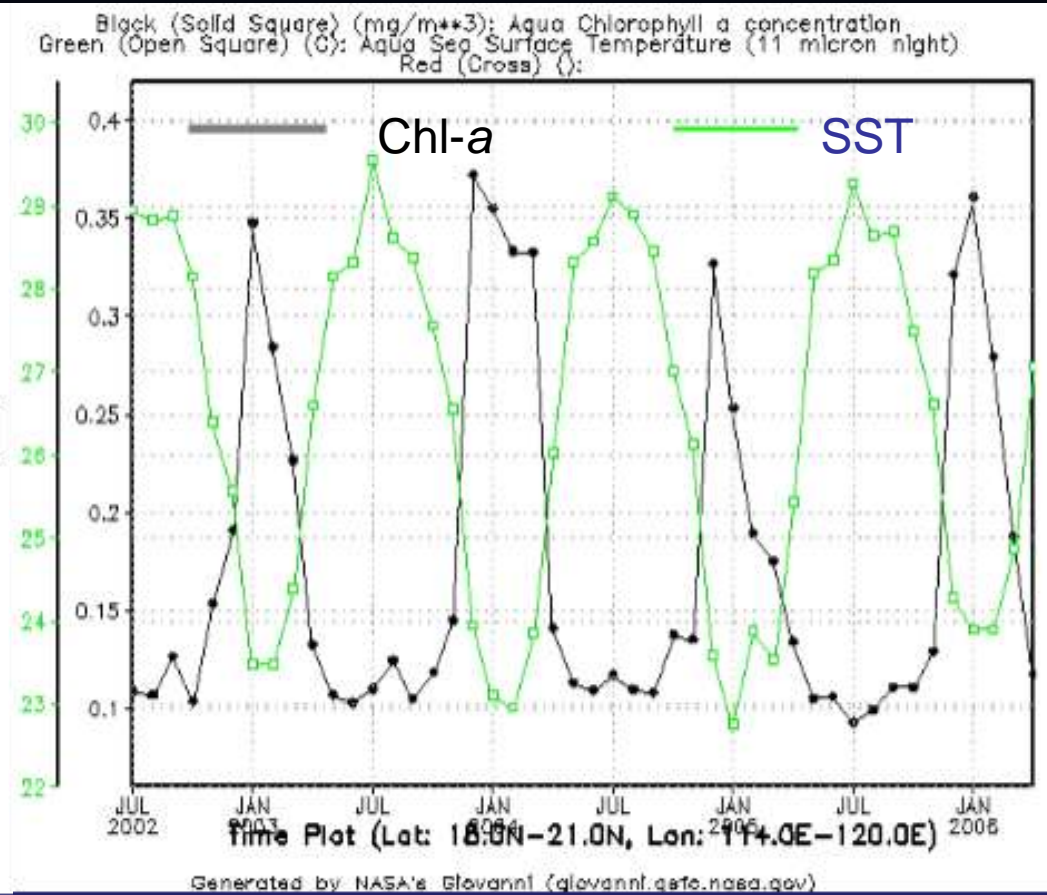




Correlations between Chlorophyll-a and SST in the northern East China Sea using MODIS-Aqua



Temporal correlation map



Time-series

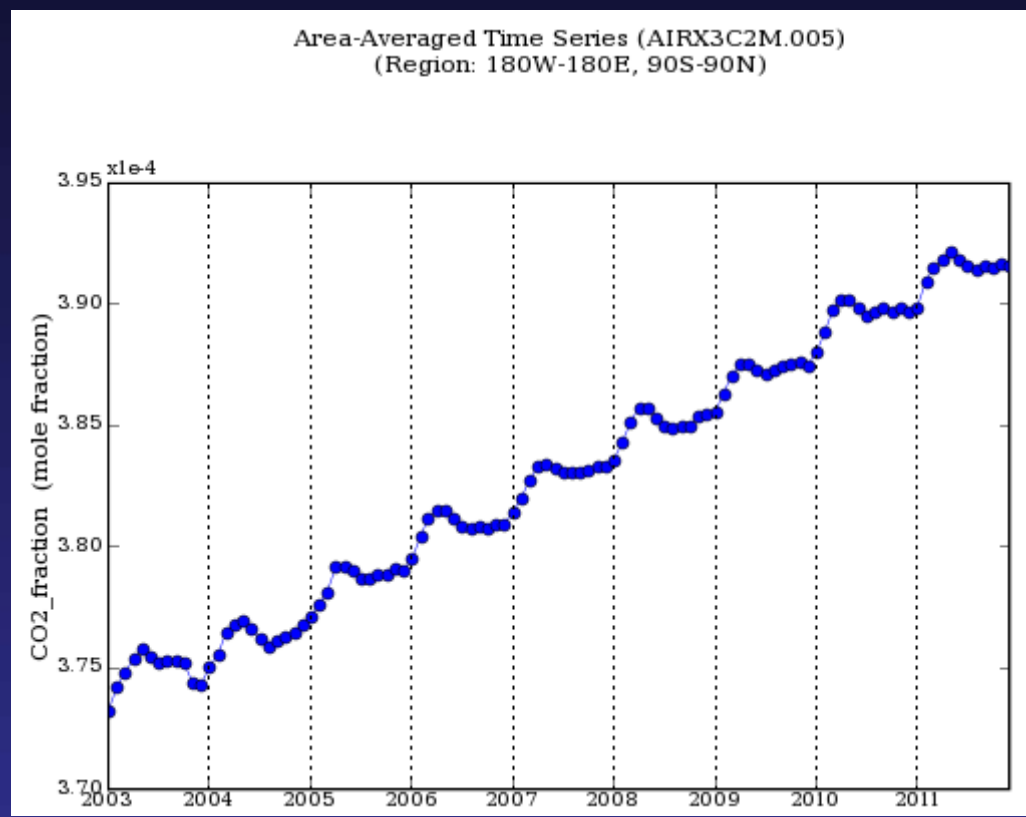
Case-1 waters with nutrient-rich cold water due to upwelling are well identified by strong negative correlation between chlorophyll and sea surface temperature. In Case 2 coastal waters nutrients are carried in by warm water from river and runoff therefore resulting in positive correlation between chl and SST.



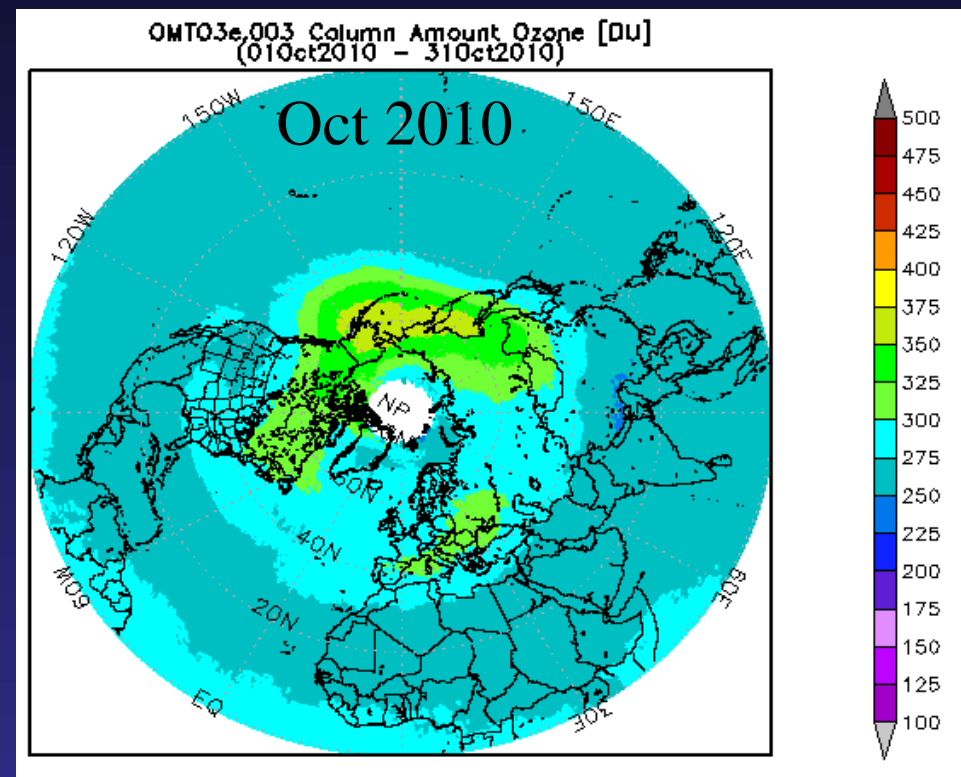
Greenhouse Gases Data in Giovanni

H₂O (AIRS/Aqua, MODIS, MERRA), CO₂ (AIRS/Aqua),
CH₄ (AIRS/Aqua, TES, UARS), O₃ (OMI/Aura, TES/Aura, UARS, TOMS),
N₂O (MLS/Aura)

Global CO₂ from AIRS



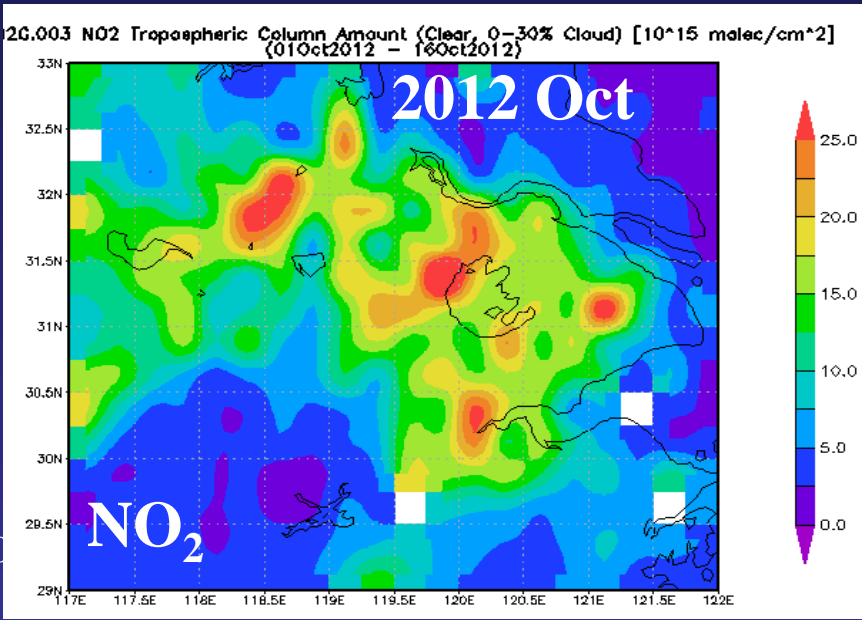
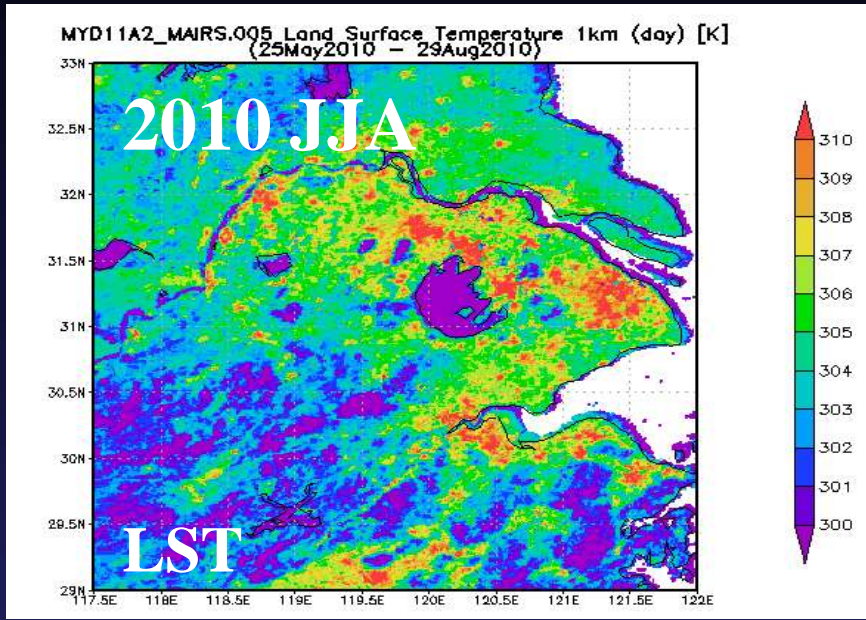
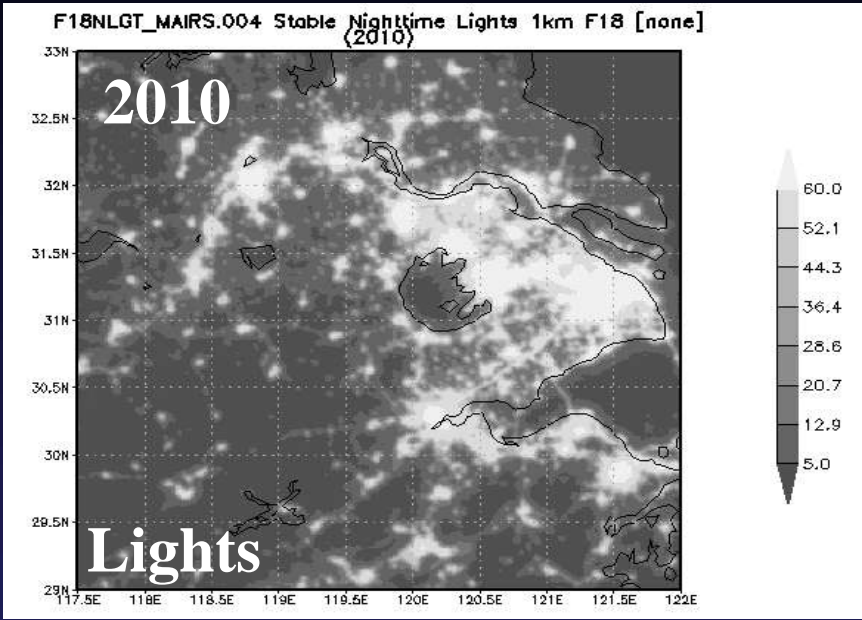
N. Hemisphere O₃ from OMI





Studying Urbanization and Air Quality

Yangtze River Delta region, Eastern China



Data in Giovanni:

- Nightlight (DMSP/OLS)
- LST (MODIS)
- NDVI (MODIS)
- NO₂ (OMI/Aura)
- SO₂ (OMI/Aura)



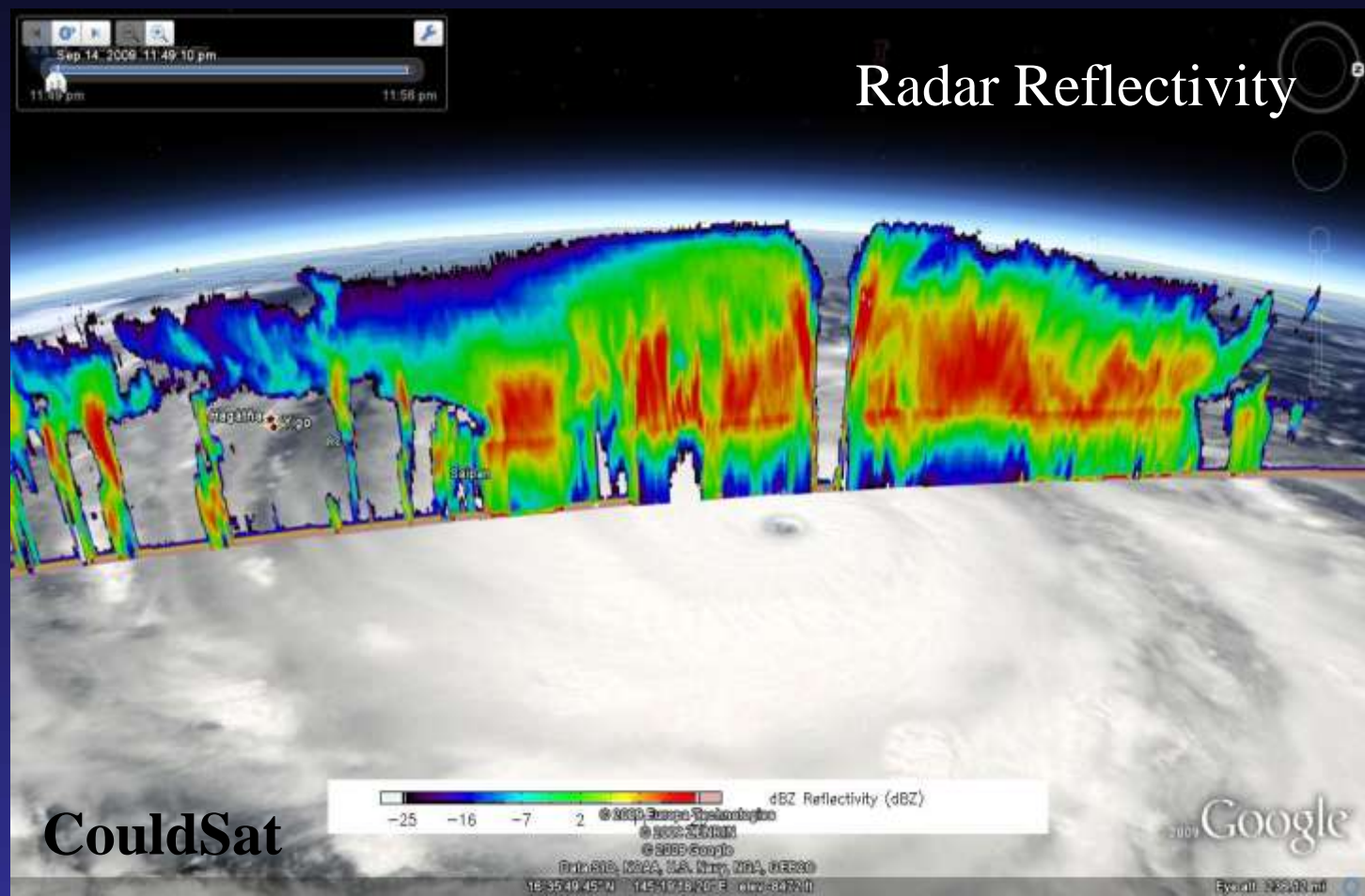


Viewing Cloud Properties Along CloudSat Track in Giovanni A-train

Typhoon Choi-Wan (2009.09.15)

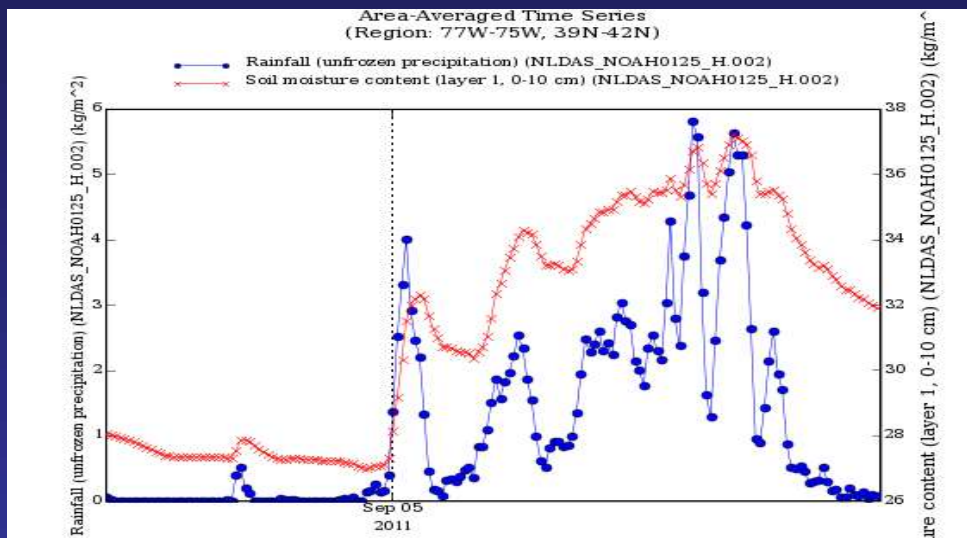
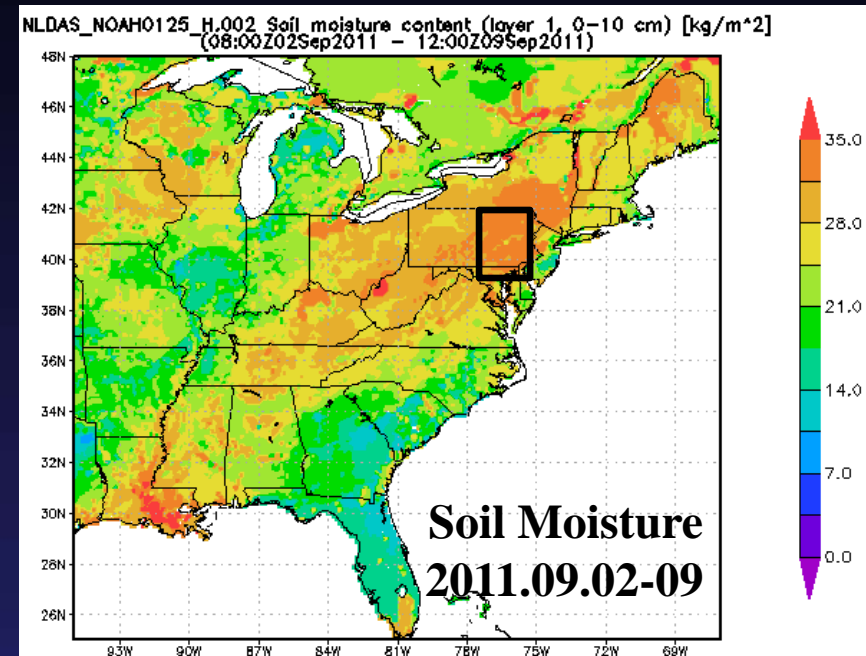
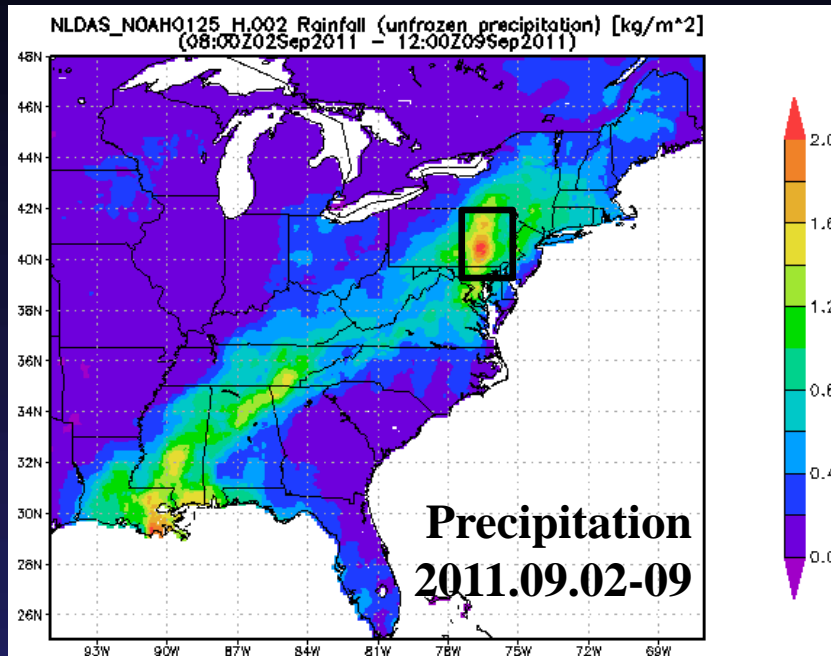
Sensors:
 CloudSat
 MODIS
 AIRS
 MLS
 CALIPSO
 AMSR-E
 OMI

Models:
 MERRA
 ECMWF





NLDAS Model Reveals Soil Moisture Change Tropical Storm Lee , Sep 2011



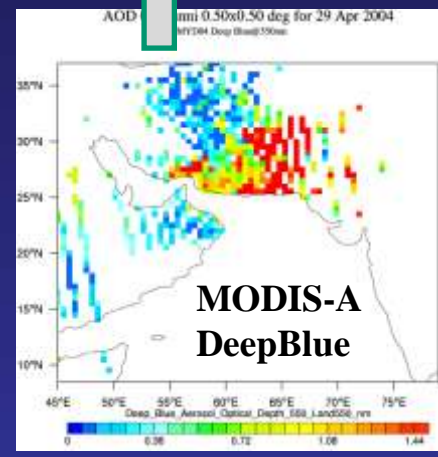
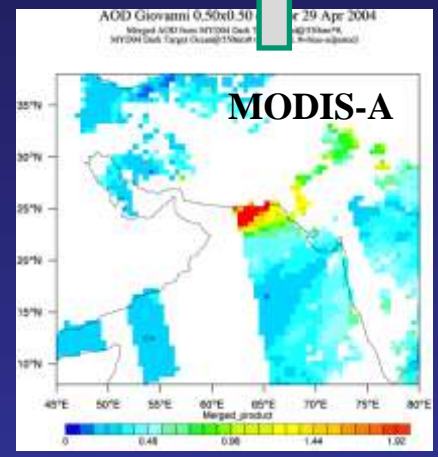
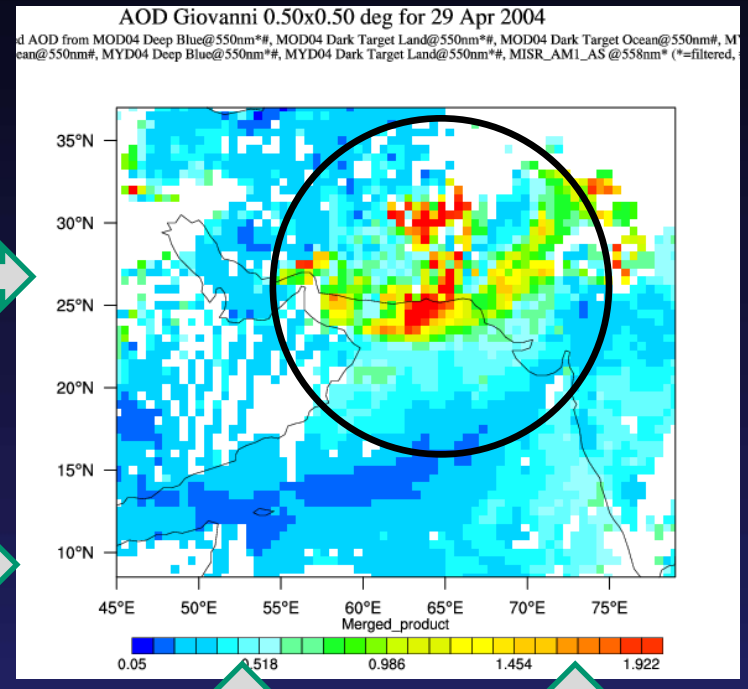
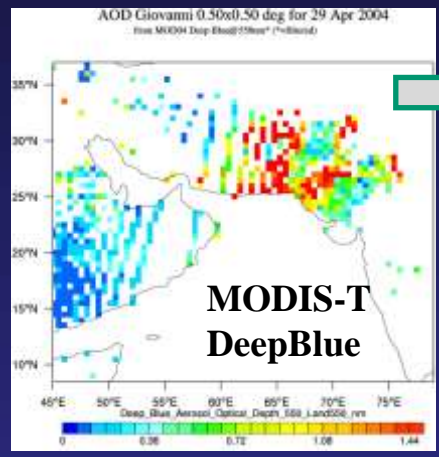
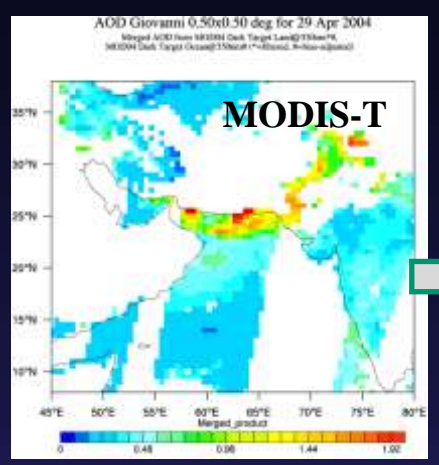
Assimilation Model Data in Giovanni:

- MERRA: atmospheric
- GLDAS: global land
- NLDAS: N. America land
- GOCART: aerosol
- NOBM: ocean color



Giovanni Aerostat: Aerosols Comparison and Merging

April 29 2004

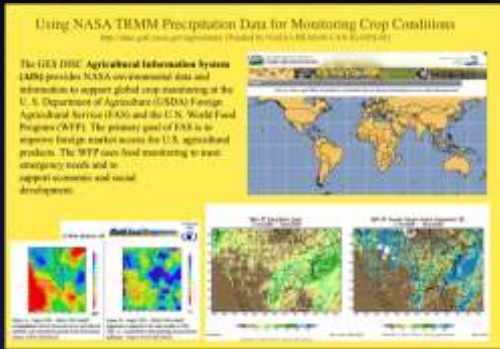


Options:

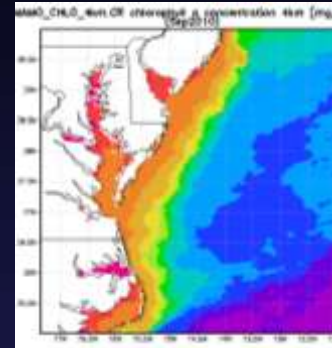
- QA filtering
 - Bias adjustment
- bases on AERONET



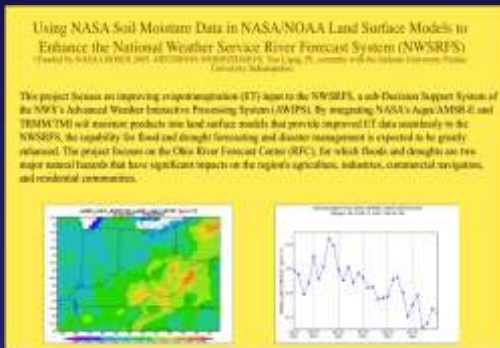
Giovanni Applications Projects



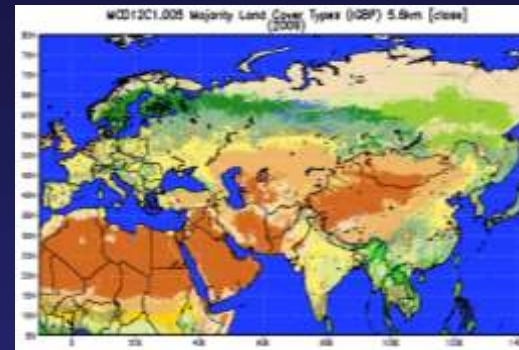
TRMM precipitation data for Monitoring Crop Conditions



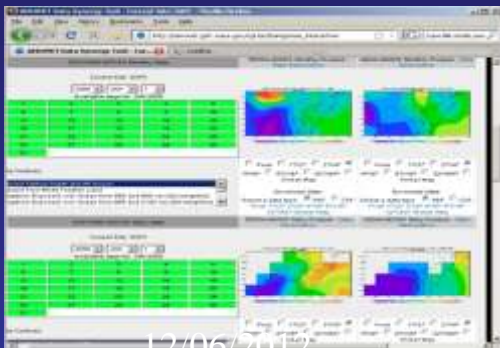
Ocean color data to monitoring water quality



Soil Moisture data to enhance NWSRFS



Land data to support NEESPI/MAIRS



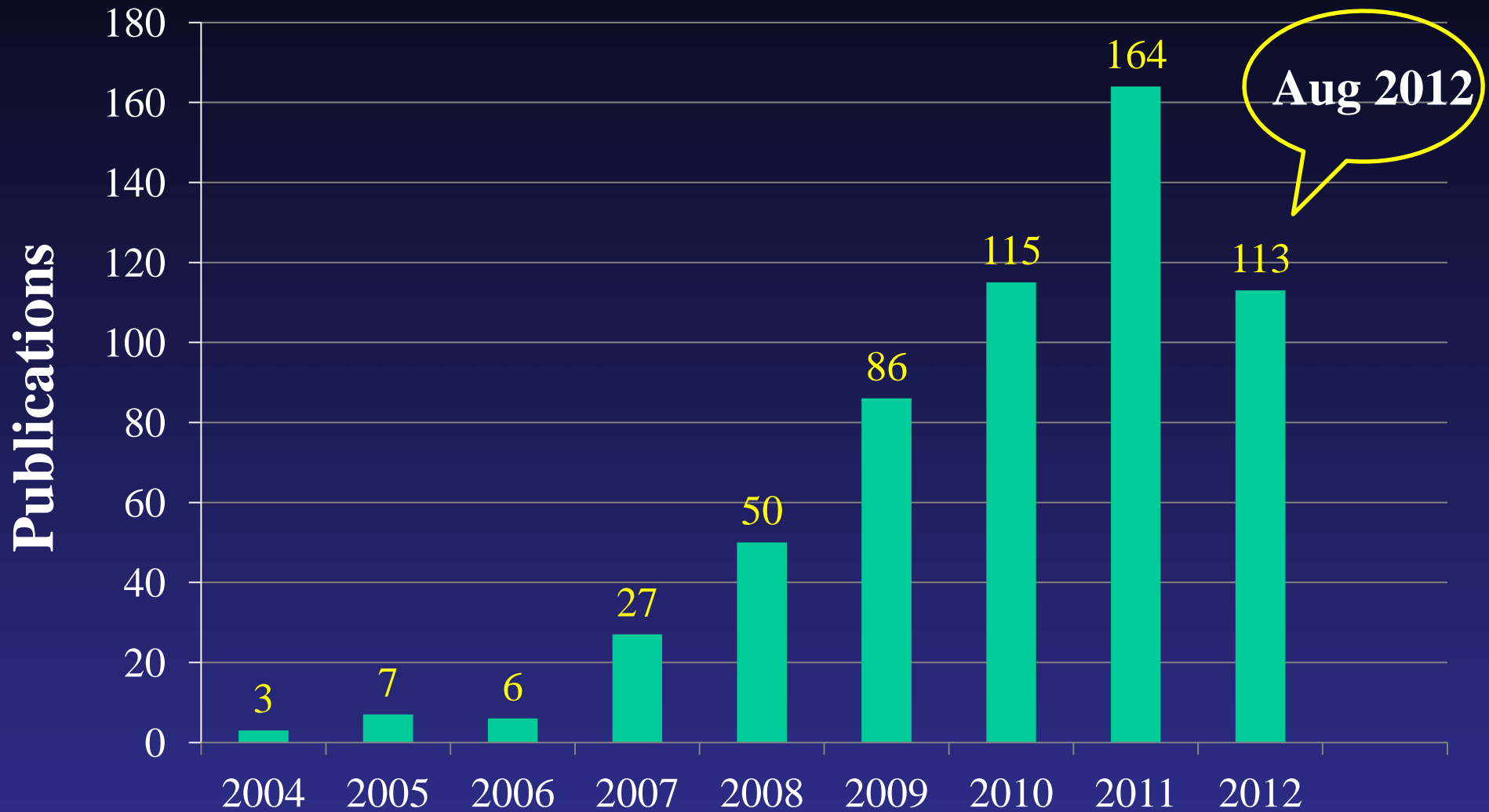
Aerosol data in AERONET data synergy tool



Data in Giovanni to support Climate Change Education



Peer-reviewed publications using and acknowledging Giovanni (as of Aug, 2012)





Science Quality of Giovanni Results

- Giovanni operates mostly on the standard data products
- Giovanni results are the same as produced using the standard data out-side of Giovanni
- We implement Science Team recommendations
- We provide (some) warnings and caveats
- We perform sensitivity studies together with scientists in the corresponding fields
- Provide “Product Lineage” showing processing steps
- Provide links to product document

**If any question regarding data and results, please send e-mail to
GES DISC help desk: gsfc-help-disc@lists.nasa.gov**



Evolving from G3 to G4

Challenges to Giovanni:

- Improve performance
- Demand more data and functionalities
- Difficult to find an interested variable

Giovanni-3

- Harmonized data & inventory
- Separate portals
- 2005 -

Agile Giovanni (G4)

- Omnibus (all-in-one) portal
- Faceted variable navigation
- Faster services
- Interactive plotting
- Better documentation
- 2012 -



Next Giovanni: "Omnibus" portal

Firefox

Giovanni [Refactored] x Giovanni - A-Train Data Collocated Along ... x

giovanni.gsfc.nasa.gov/giovanni/

Most Visited Getting Started Latest Headlines

NASA Earth Data Data Discovery Data Centers Community Science Disciplines Search EOSDIS

Giovanni The Bridge Between Data and Science

v 4.0 (Beta) [Release Notes](#) [Browser Compatibility](#) [Known Issues](#)

Select Plot

[Lat-Lon Map](#) [Scatter Plot](#) [Time Series](#)

[Interactive Scatter Plot](#) [Correlation Map](#)

Select Date Range (UTC)

Format: YYYY-MM-DD.

to

Valid Range: 1997-09-03 to 2012-11-20

Select Bounding Box

Format: West,South,East,North.

Select Variables

Measurements

- Angstrom Exponent (0)
- Component Aerosol Optical Depth (2)
- Pixel Counts (0)
- Total Aerosol Optical Depth (3)

Instruments

- GoCART Model (9)
- MISR (4)
- MODIS (6)
- OMI (4)
- SEAWIFS (24)

Platforms

- Aqua (0)
- Aura (4)
- GoCART Model (0)

Number of matching Variables: 5 of 60

Please select at least 1 variable

Keyword:

	Variable Name	Resolution	Begin Date	End Date
<input type="checkbox"/>	Aerosol Optical Depth 555 nm, MISR (MIL3DAE v4)	0.5 x 0.5 deg.	2000-02-25	2012-02-29
<input type="checkbox"/>	Aerosol Absorption Optical Depth 388 nm (near-UV), OMI (OMAERUVd v3)	1 x 1 deg.	2004-10-01	2012-10-17
<input type="checkbox"/>	Aerosol Absorption Optical Depth 500 nm (near-UV), OMI (OMAERUVd v3)	1 x 1 deg.	2004-10-01	2012-10-17
<input type="checkbox"/>	Aerosol Optical Depth 388 nm (near-UV), OMI (OMAERUVd v3)	1 x 1 deg.	2004-10-01	2012-10-17
<input type="checkbox"/>	Aerosol Optical Depth 500 nm (near-UV), OMI (OMAERUVd v3)	1 x 1 deg.	2004-10-01	2012-10-17

Total Variable(s) included in Plot: 0

Bookmark Selections

Keyword search

Faceted Search

show # variables in a facet

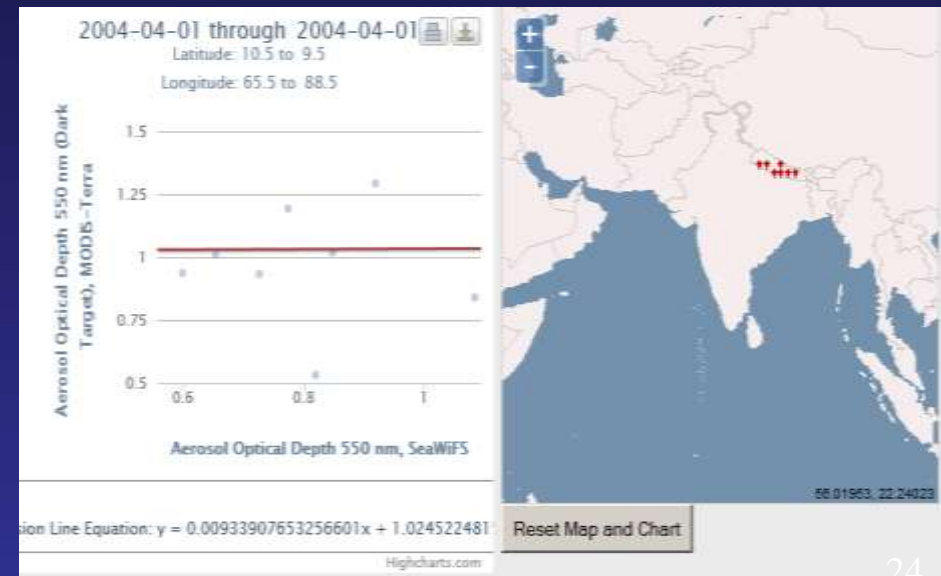
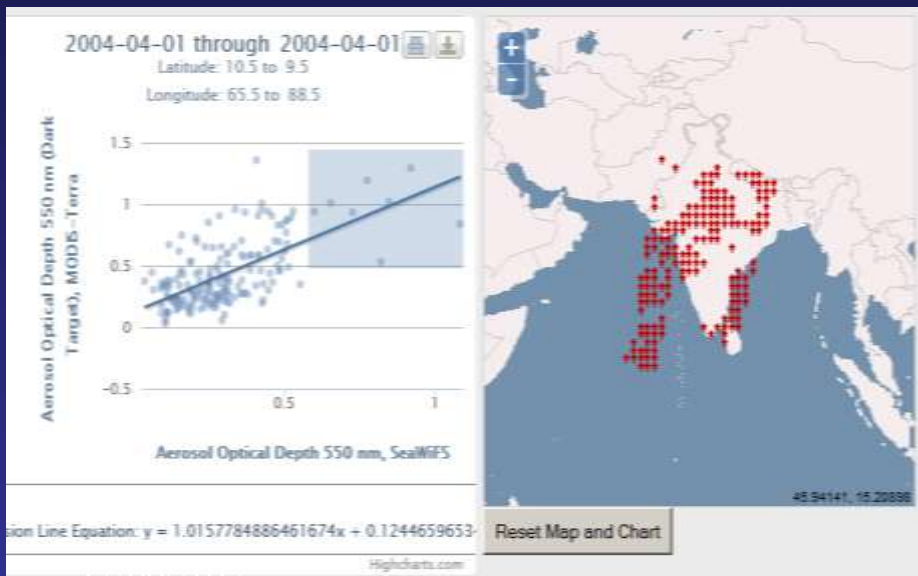
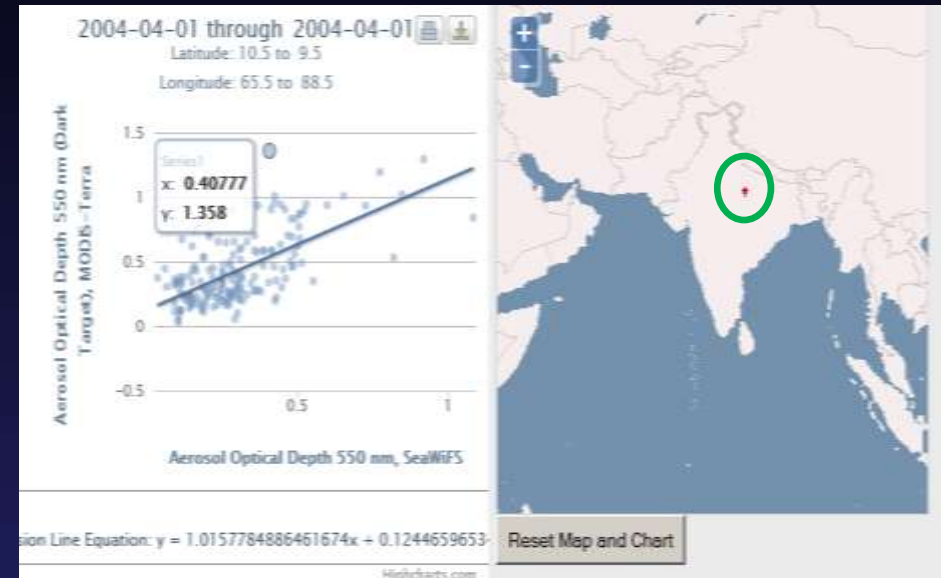
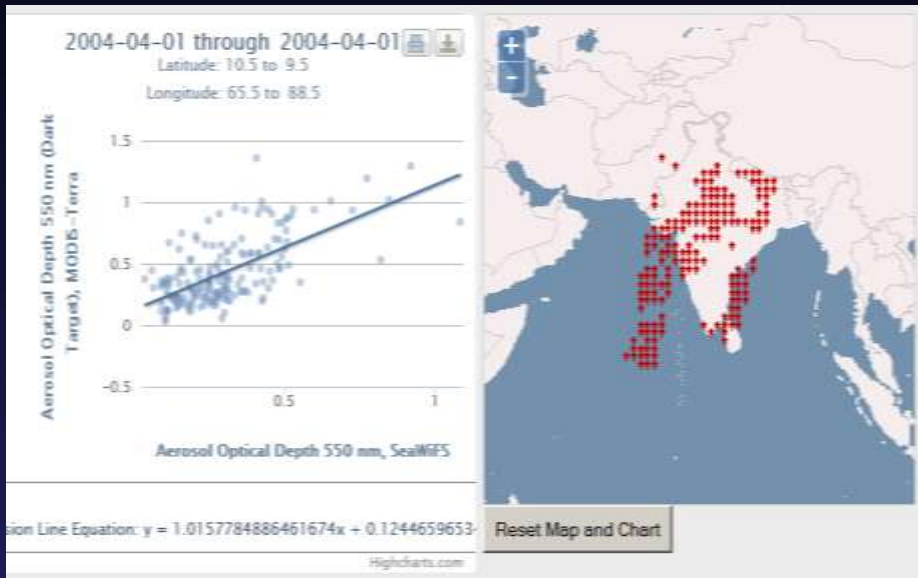


40+ G3 Portals



New Features: Interactive Scatter Plot

Comparison of Aerosols from SeaWiFS (Deep Blue) and MODIS-Terra (Dark Target) on 2004.04.01





Summary

- **Giovanni has many faces:**
 - Access large amount of satellite, model and ground-based data from multiple archives
 - Supports science, applications, and education
 - Supports various formats
 - Makes working with data easy
 - Is a tool to help explore and understand the data,
Not a data producer
- **System Characteristics:**
 - Uses interoperability standards
 - Supports standard data formats
 - Acts as a server and a client



Animation: Total Precipitable Water from MERRA (Hurricane Sandy Oct 25-30 2012)

