Multi-Instrument Tools and Services to Access NASA Earth Science Data from the GSFC Earth Sciences Data and Information Services Center (GES DISC)

http://disc.gsfc.nasa.gov/

March 30, 2010

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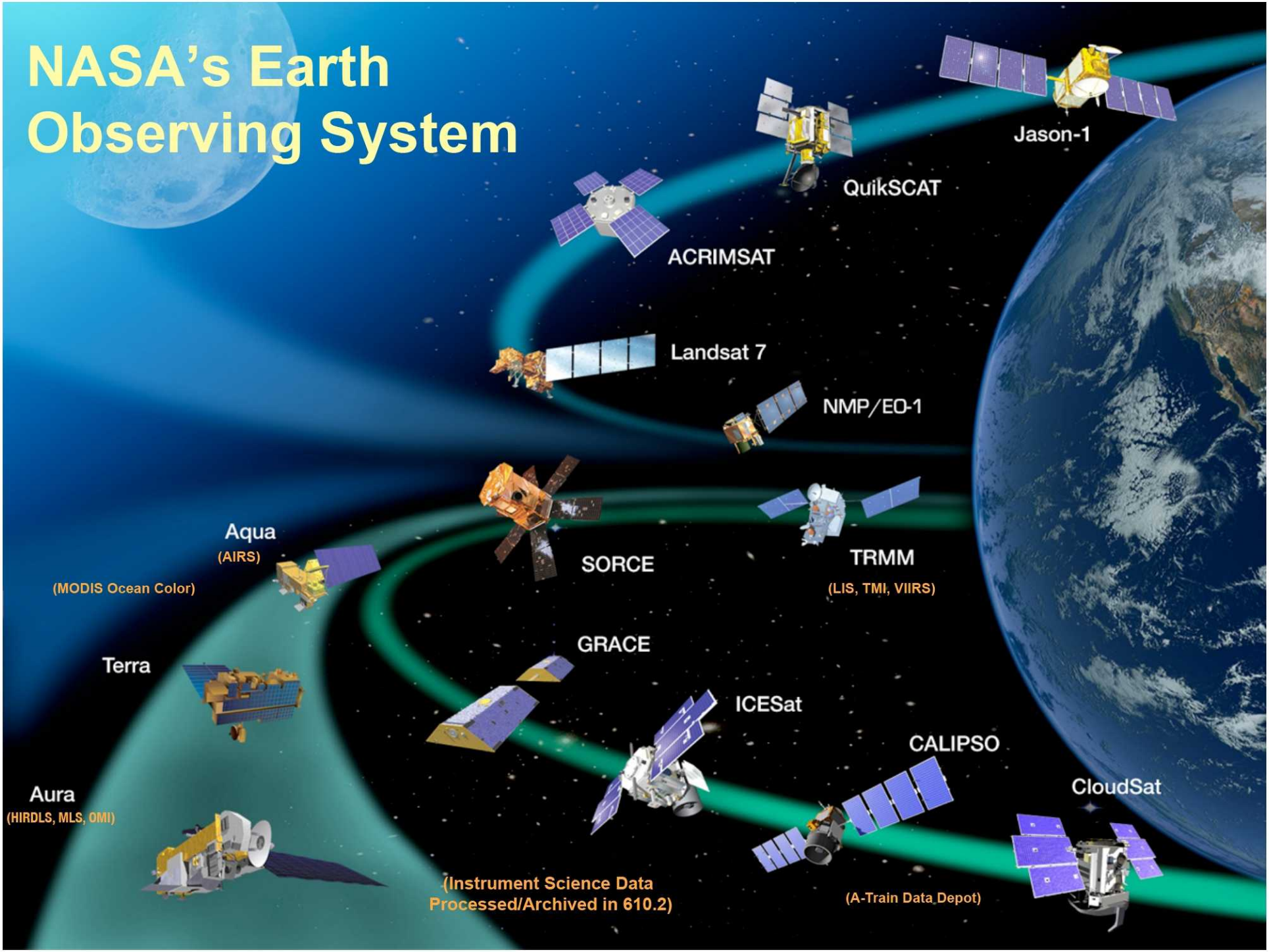
With contributions from:
ESDIS Project

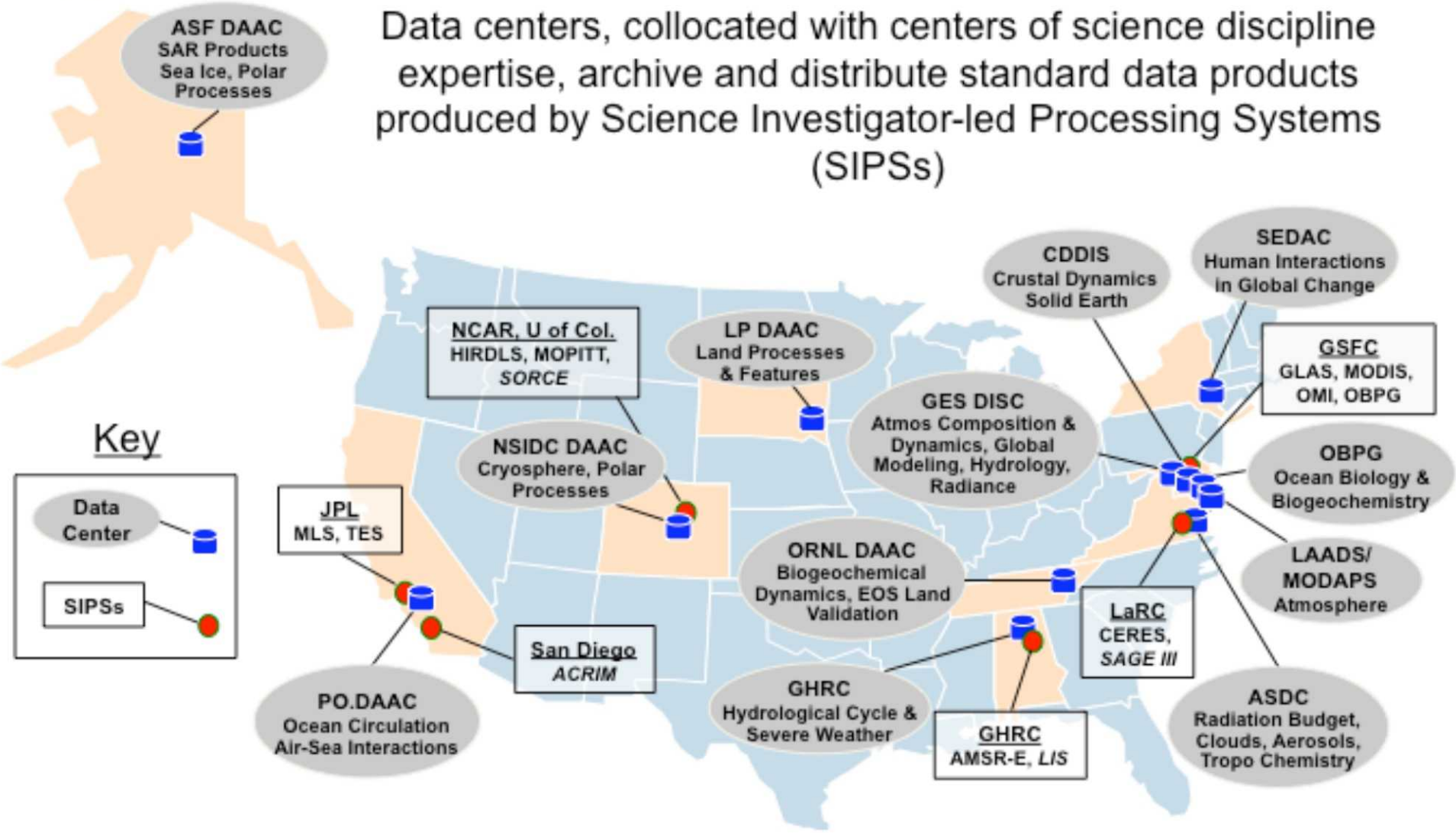
Presentation Purpose

- Describe multi-instrument tools and services that facilitate access and usability of NASA Earth science data at Goddard Space Flight Center (GSFC)


NASA's Earth Observing System
Jason-1
QuikSCAT
ACRIMSAT
Landsat 7
NMP/EO-1
SORCE
TRMM
(LIS, TMI, VIIRS)
Aqua
(AIRS)
(MODIS Ocean Color)
GRACE
Terra
ICESat
CALIPSO
CloudSat
Aura
(HIRDLS, MLS, OMI)
(Instrument Science Data Processed/Archived in 610.2)
(A-Train Data Depot)

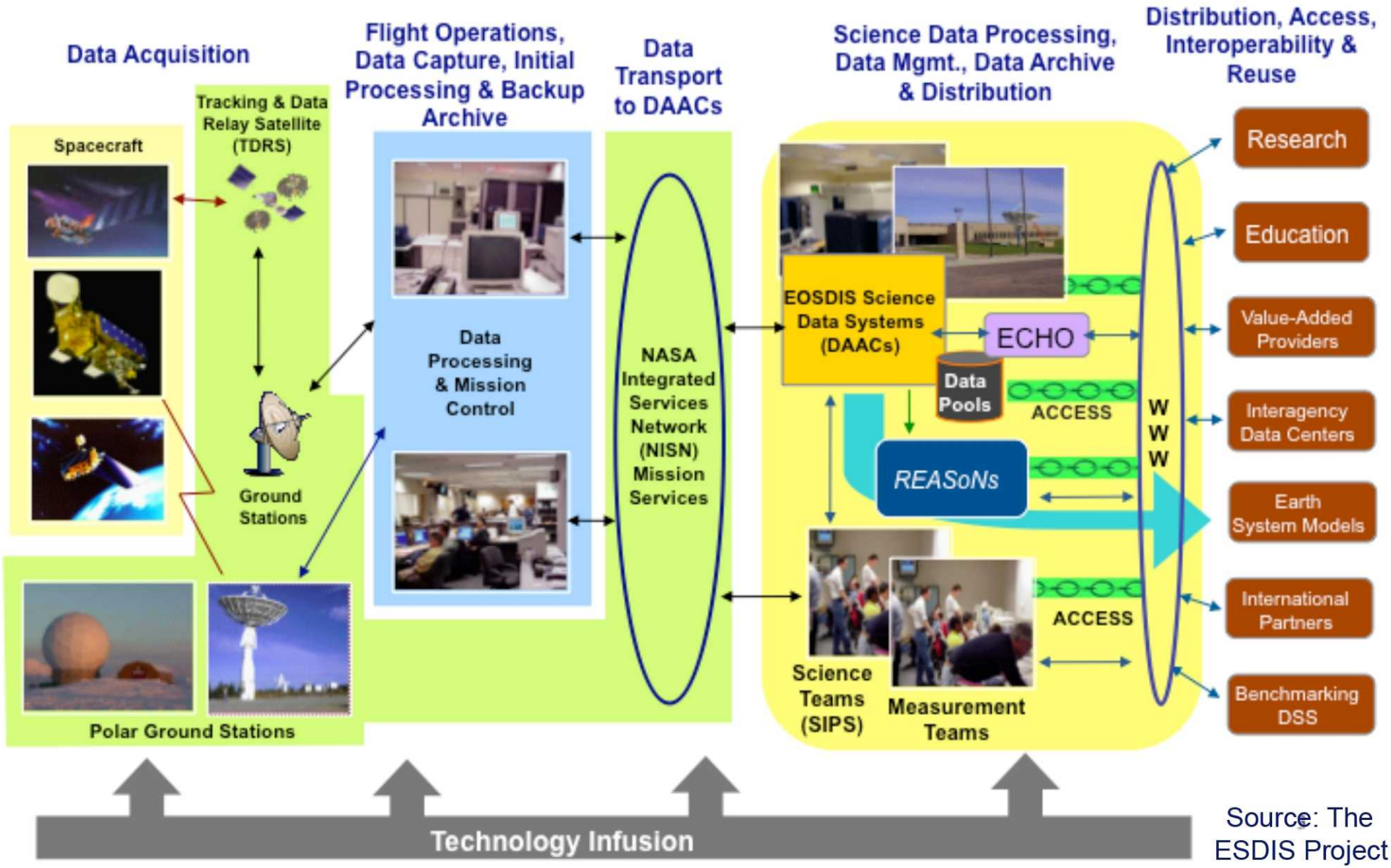
EOSDIS Facilities

Data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by Science Investigator-led Processing Systems (SIPSs)



EOSDIS – Earth Observing System Data and Information System

EOSDIS System Architecture



Source: The ESDIS Project

Definitions

- **Data Center** - Ingests, processes, archives, distributes, and manages data acquired from remote sensing instruments. Data "has no significance beyond its existence" *
- **Information Center** - Ingests, processes, archives, distributes, and manages value-added data products, and value-added data processes. "Data that has been given meaning by way of relational connection" *
- **Knowledge Center** (not yet) - "Knowledge is the appropriate collection of information, such that its intent is to be useful" *
- **Data and Information Services Center** - Provides tools that further the use and usefulness of data and information

Each further enables researchers to do their work

* G.Bellinger, et al, "Data, Information, Knowledge, and Wisdom, 2004

GSFC Earth Science Data and Information Services Center (GES DISC) Mission

The GES DISCs mission is to maximize NASA's investment benefit by providing data and services that enable people to fully realize the scientific and educational potential of global climate data.

In Short...

The GES DAACs mission is to:

ENABLE EARTH SCIENCE, APPLICATIONS, and EDUCATION

Summary of Expertise

- **Software engineering** - *In-house expertise and experience that understands the best advanced technologies to further mature data management system usability and efficiency*
- **Science data management expertise** – *Doctorate-level scientists in interdisciplinary Earth sciences who collaborate with researchers to develop sophisticated Web-based tools to facilitate comprehensive information management, access, analysis and visualization*
- **Mission Support** - *In-house expertise who understands the requirements for costing and sizing information management systems for new or existing missions*
- **Operational active archive and distribution system with complete user services** - *8 X5 (24 X 7 on call) staff that understands the importance of, and ensures, continuous data ingest, processing, archive and distribution*

Missions Supported

Atmospheric Composition

- Total Ozone Mapping Spectrometer (TOMS)
- Upper Atmosphere Research Satellite (UARS)
- Solar Radiation and Climate Experiment (SORCE)
- Aura: Ozone Monitoring Instrument (OMI), High Resolution Dynamics Infrared Sounder (HIRDLS), Microwave Limb Sounder (MLS)
- *Soon*: GLORY: Aerosol Polarimetry Sensor (APS), Total Irradiance Monitor (TIM), Cloud Camera

Atmospheric Dynamics

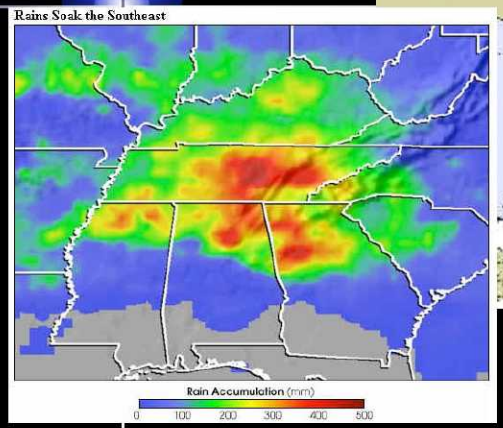
- TIROS Operational Vertical Sounder (TOVS)
- Aqua Atmospheric Infrared Sounder (AIRS)

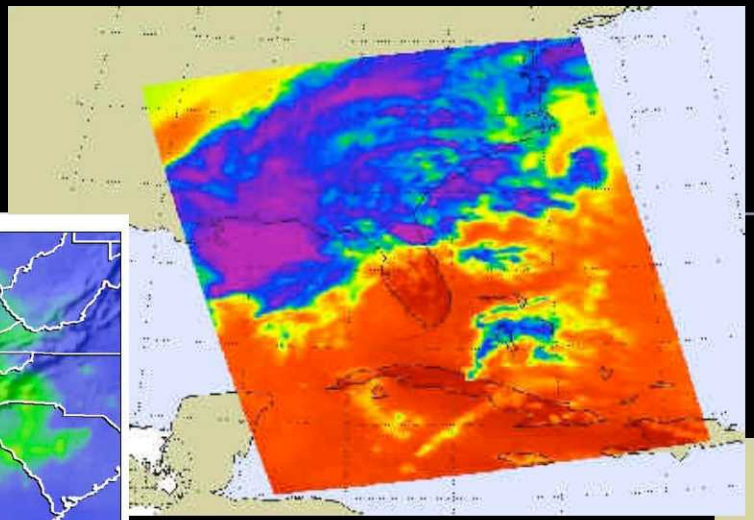
Modeling

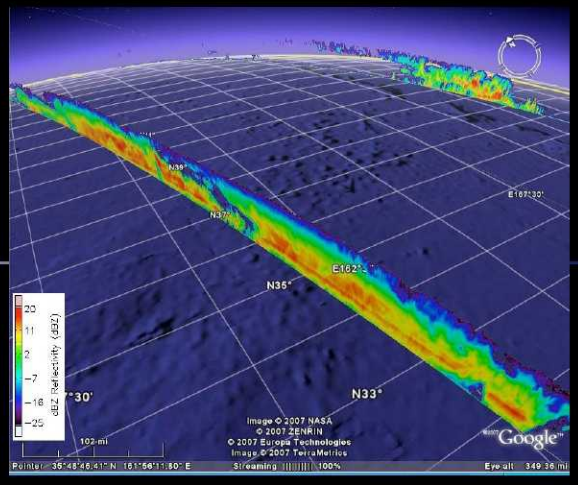
- Data Assimilation Office (DAO), Global Modeling Assimilation Office (GMAO) – 30 year Merra dataset
- Land Data Assimilation System (LDAS)

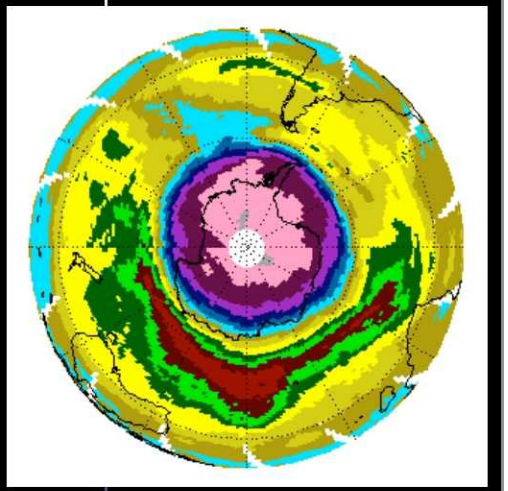
Precipitation

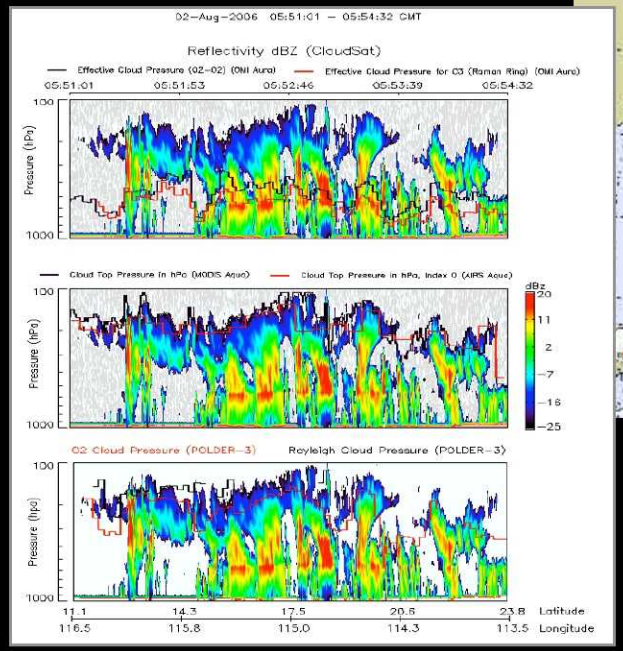
- Tropical Rainfall Measuring Mission (TRMM)
- Hydrology Data Collections

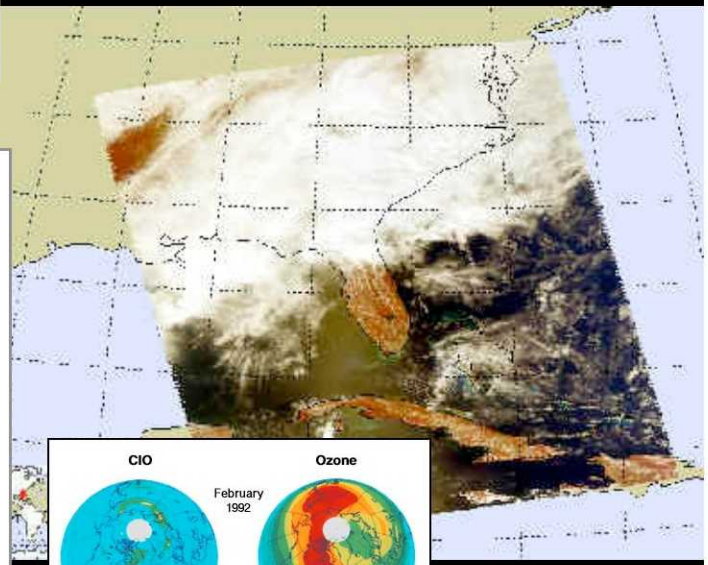

Rains Soak the Southeast
Rain Accumulation (mm)
0
100
200
300
400
500

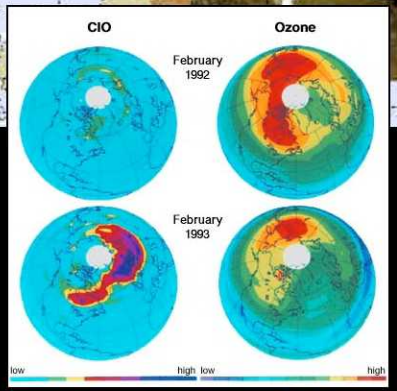



N35°
N33°
Image © 2007 NASA
© 2007 ZENRIN
© 2007 Europa Technologies
Image © 2007 TerraMetrics
Google




02-Aug-2006 05:51:01 - 05:54:32 GMT
Reflectivity dBZ (CloudSat)
Effective Cloud Pressure (02-02) (OMI Aura)
Effective Cloud Pressure for O3 (Raman Ring) (OMI Aura)
05:51:01
05:51:53
05:52:46
05:53:39
05:54:32
Pressure (hPa)
100
1000
Cloud Top Pressure in hPa (MODIS Aqua)
Cloud Top Pressure in hPa, Index 0 (AIRS Aqua)
dBz
20
11
2
-7
-16
-25
O2 Cloud Pressure (POLDER-3)
Rayleigh Cloud Pressure (POLDER-3)
11.1
14.3
17.5
20.6
23.8
Latitude
116.5
115.8
115.0
114.3
113.5
Longitude



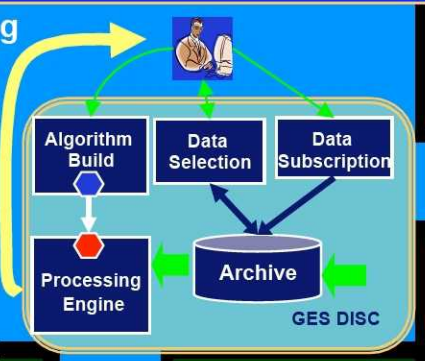

ClO
Ozone
February
1992
February
1993
low
high
low
high

Core Technology Components

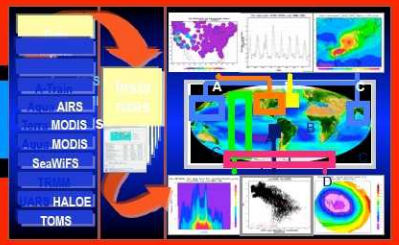
User Community

Science Investigators/Partners

Data Mining



Giovanni: Data Visualization and Analysis



http://giovanni.gsfc.nasa.gov

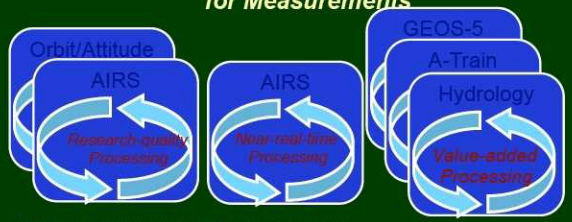
- Data from multiple sensors
- Single- and multi-parameter statistics
- Multiple output formats & protocols
- Data lineage support (in development)

Data & Information Web Portals

- Community and project based portals
- Tailored to the users being served

Data Processing with *S4PM*

Simple, Scalable, Script-based Science Processor for Measurements

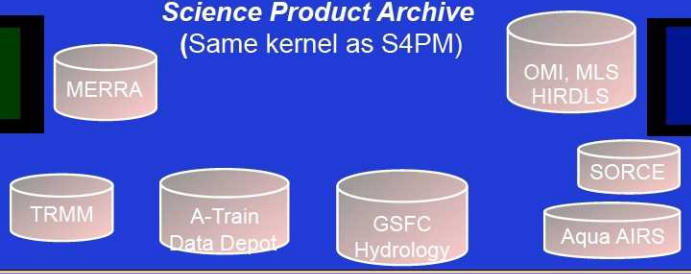


http://s4pm.sci.gsfc.nasa.gov

Data Archive and Distribution with *S4PA*

Simple, Scalable, Script-based, Science Product Archive

(Same kernel as S4PM)



Mirador Data Search

Science Teams

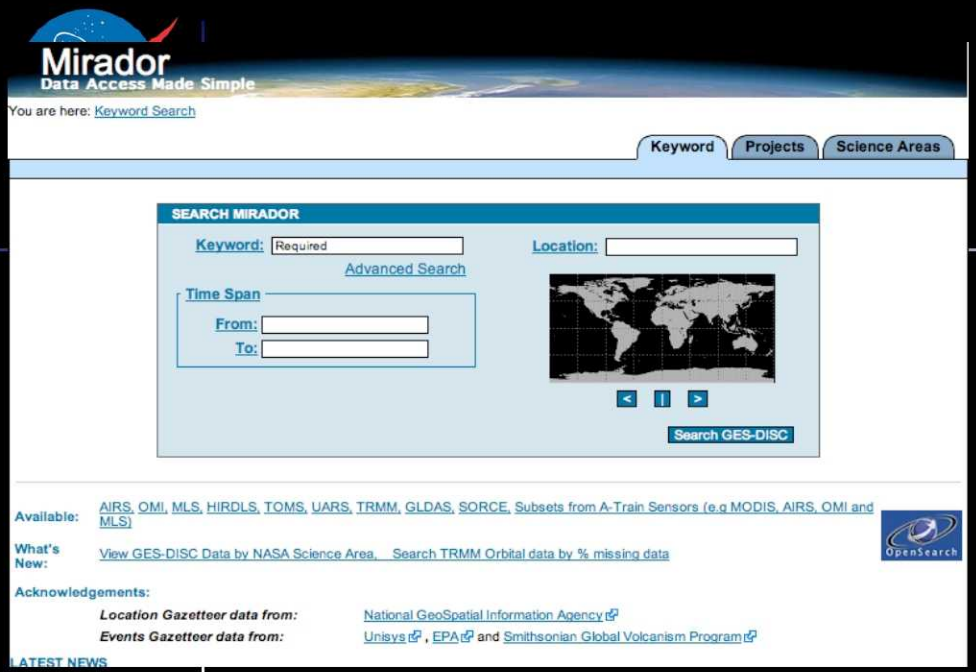
User Community

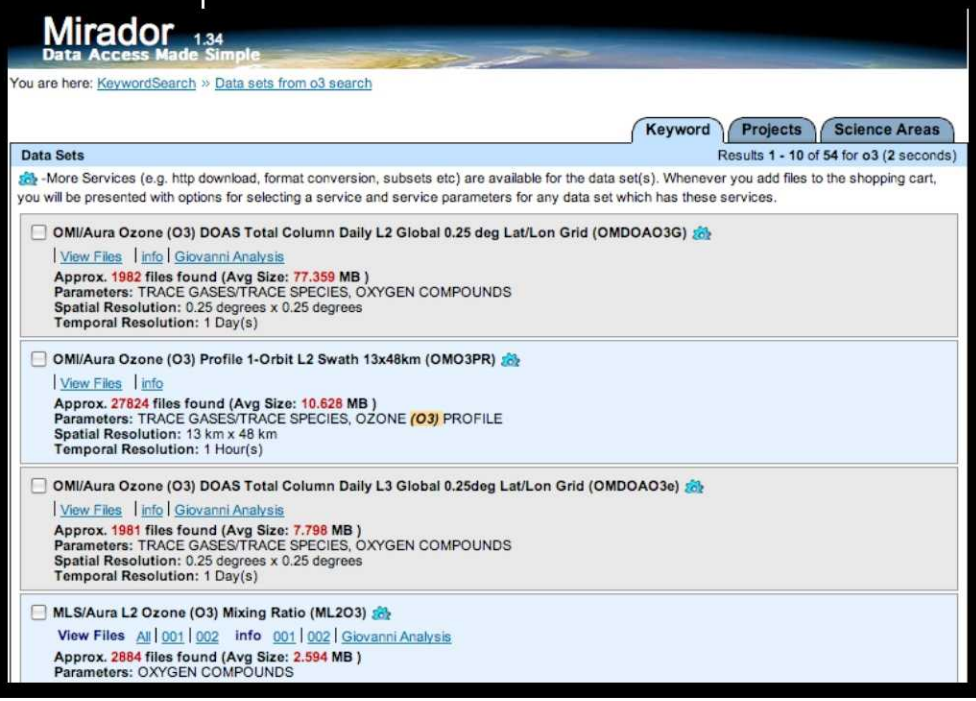
Multi-Instrument Tools and Services at the GES DISC

- Mirador Data Search
- Giovanni Data Exploration
- Multi-Instrument Data Exploration
- Google Earth™
- Data Merging
- Applications

Mirador Data Search

http://mirador.gsfc.nasa.gov





Mirador Data Search

- Based on Google
- Fast, easy to use
- Gazetteers for places and events
- Can support portals
- Also available as Web Service

Mirador Projects and Science Areas Tabs

Mirador
Data Access Made Simple

You are here: Project

Keyword | Projects | Science Areas

A-Train | AIRS | GLDAS | GOCART | HIRDLS | LIMS | MERRA | MLS | MSU | NEESPI | NLDAS | OMI | SORCE | SSBUV | TOMS | TOVS | TRMM | UARS

Project	Description	Start Year	End Year
A-Train	Collocated with CloudSat subsets of MODIS/Aqua, AMSR-E/Aqua, OMI/Aura, and POLDER/PARASOL.	2004	2010
AIRS	The Atmospheric Infrared Sounder (AIRS) is a facility instrument aboard the second Earth Observing System (EOS) polar-orbiting platform, EOS Aqua. In combination with the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB), AIRS constitutes an innovative atmospheric sounding group of visible, infrared, and microwave sensors. Global coverage will be obtained twice daily (day and night) on a 1:30pm sun synchronous orbit from a 705-km altitude. For processing convenience, the data is divided into 6-minute files for Level 1 and 2 data. more info	2002	2010
GLDAS	The Global Land Data Assimilation System (GLDAS) is generating a series of land surface state (e.g., soil moisture and surface temperature) and flux (e.g., evaporation and sensible heat flux) products simulated by four land surface models (CLM, Mosaic, Noah and VIC). Current data holdings include a set of 1.0 degree resolution data products from the four models, covering 1979 to the present; and a 0.25 degree data product from the Noah model, covering 2000 to the present.	1979	2010
GOCART	The Goddard Chemistry Aerosol Radiation and Transport (GOCART) model simulates major tropospheric aerosol components, including sulfate, dust, black carbon (BC), organic carbon (OC), and sea-salt aerosols. The following is a brief description of the model. The GOCART model uses the assimilated meteorological fields of the Goddard Earth Observing System Data Assimilation System (GEOS DAS), generated by the Goddard Global Modeling and Assimilation Office. The model has a horizontal resolution of 2 deg latitude by 2.5 deg longitude or 1 deg by 1 deg, and 20-55 vertical sigma layers (depending on the version of GEOS DAS).	2000	2007
HIRDLS	The High Resolution Dynamics Limb Sounder (HIRDLS) aboard the EOS Aura spacecraft (launched July 15, 2004) measures infrared emissions in 21 channels ranging from 6.12 to 17.76 microns. These measurements are used to derive vertical profiles of Ozone, HNO3, Water Vapor, Methane, N2O, NO2, N2O5, CFC11, CFC12, aerosols, and	2005	2008

Designed for simple and quick data access

Mirador
Data Access Made Simple

You are here: Science Areas

Keyword | Projects | Science Areas

Science Areas

Atmospheric Composition Atmospheric Composition is focused on the composition of Earth's atmosphere in relation to climate prediction, solar effects, ground emissions and time.	Aerosols, High Energy Particles, Trace Gases
Carbon Cycle and Ecosystems This Focus Area deals with the cycling of carbon in reservoirs and ecosystems as it changes naturally, is changed by humans, and is affected by climate change.	Land Biomass, Trace Gases
Climate Variability and Change NASA's role in climate variability study is centered around providing the global scale observational data sets on oceans and ice, their forcings, and the interactions with the entire Earth system.	Aerosols, Atmospheric Height, Atmospheric Radiation, Atmospheric Temperature, Clouds, Rain, Snow/Ice, Surface Radiation, Trace Gases, Wind
Earth Surface and Interior The goal of the Earth Surface and Interior focus area is to assess, mitigate and forecast the natural hazards that affect society, including earthquakes, landslides, coastal and interior erosion, floods and volcanic eruptions.	Rain, Snow/Ice, Soil, Terrestrial Water, Trace Gases
Water and Energy Cycles Through water and energy cycle research we can improve hurricane prediction, quantify tropical rainfall and eventually begin to balance the water budget at global and regional scales.	Atmospheric Radiation, Clouds, Heat Flux, Land Height, Precipitation, Rain, Snow/Ice, Soil, Surface Radiation, Terrestrial Water

Mirador Features

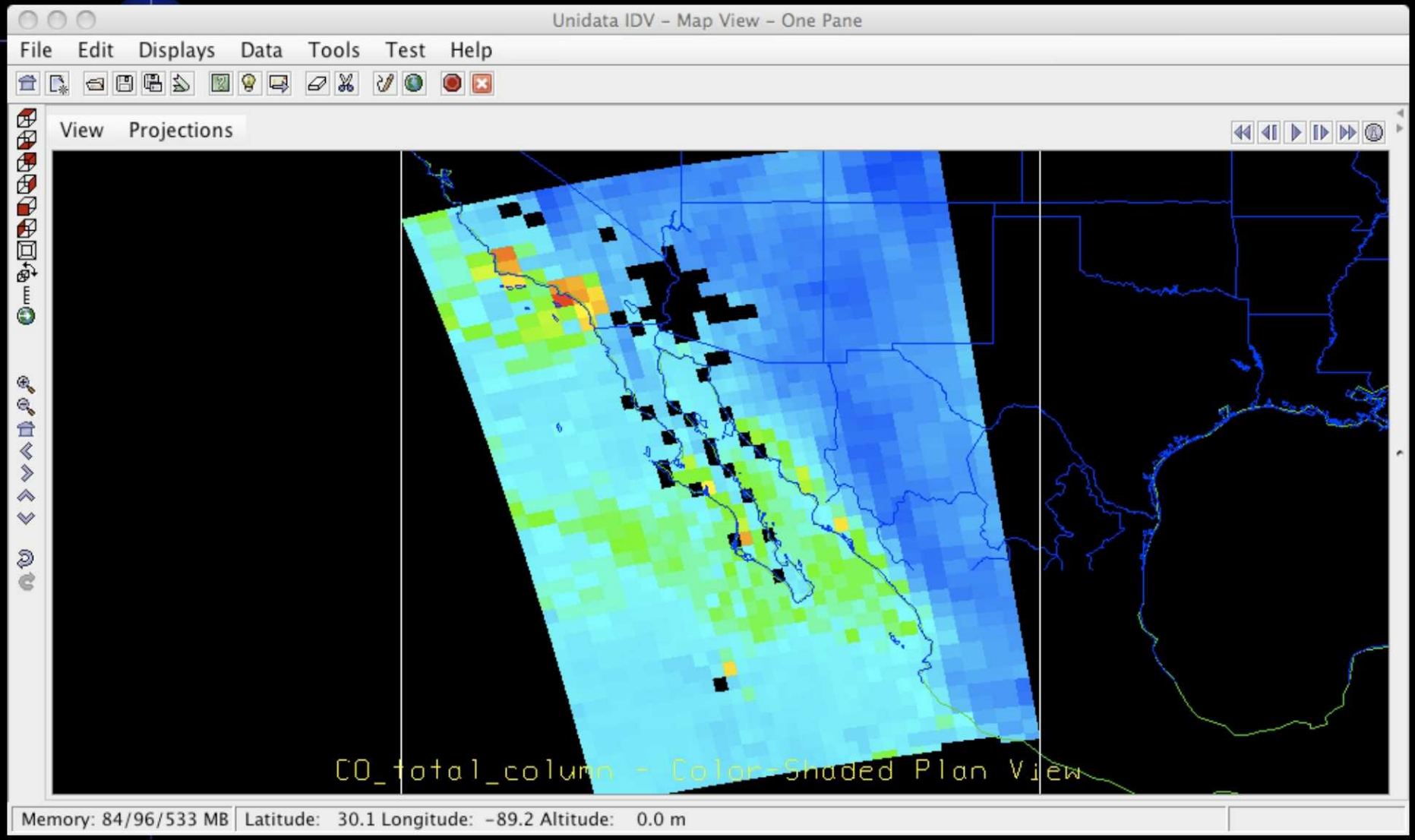
- Space-time hit estimator for datasets
- Search by location name
- Search on geophysical event (e.g. Hurricane Katrina)
- Data availability calendars (Projects Tab only)
- Descriptive filenames
- Multiple batch download methods
  - Java downloader application
  - URL List
  - DownThemAll
  - FTP script
- Orbit number search (TRMM only)

Mirador Access to Services

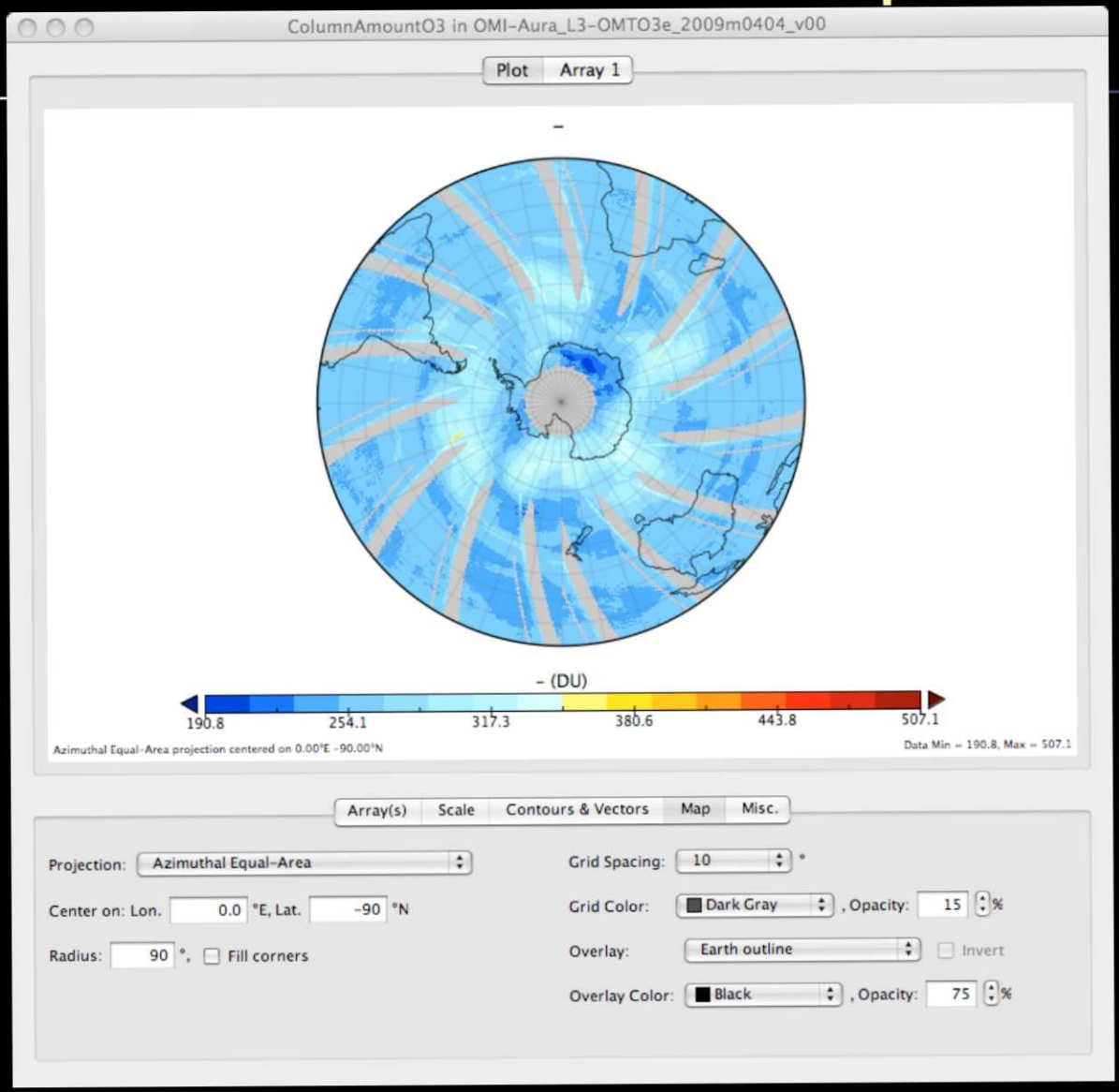
- KML - points to WMS in many cases*
- OPeNDAP - data access / transfer framework*
- Subsetting*
- NetCDF format conversion*

*Access provided through Mirador

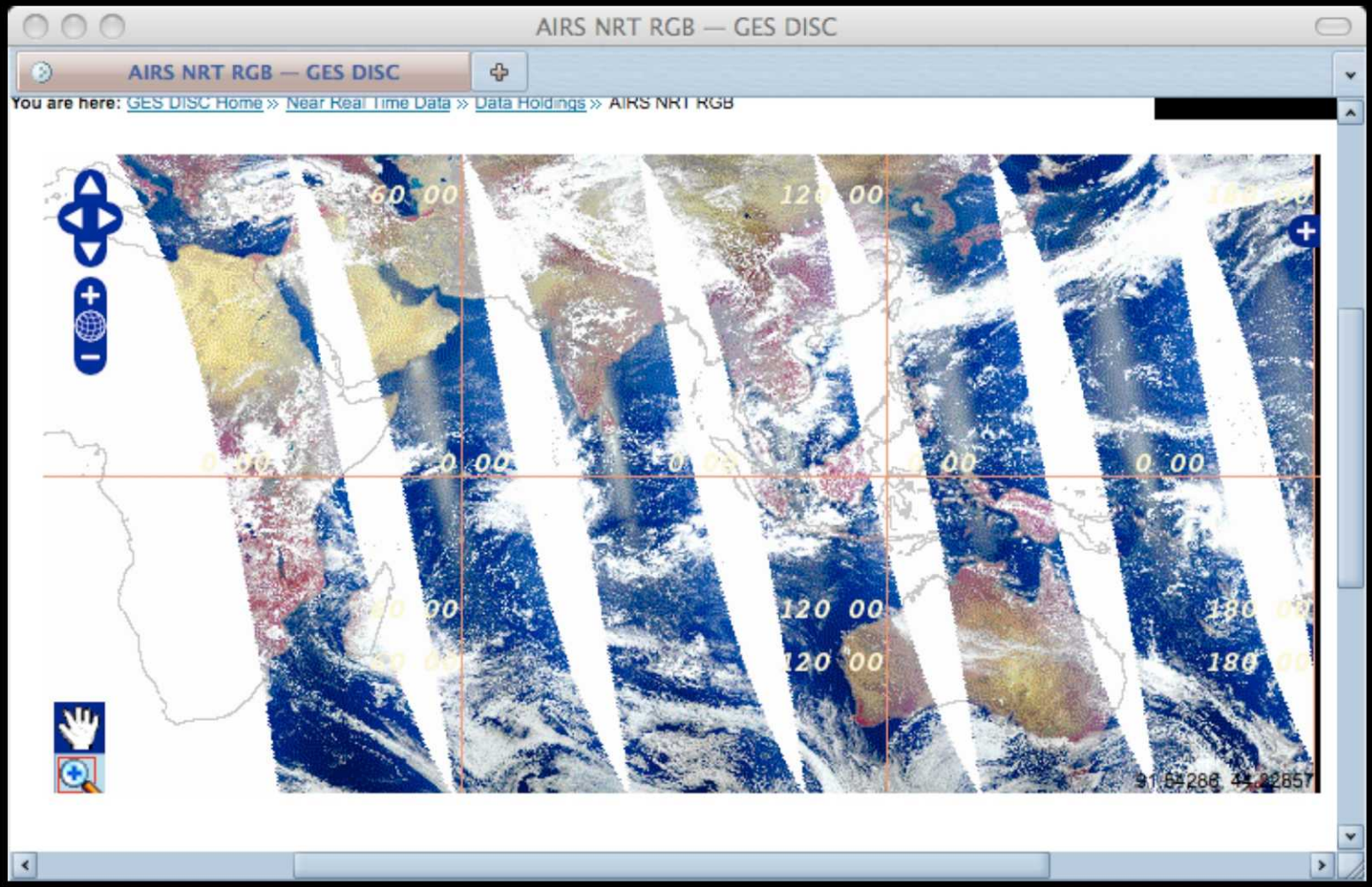
NetCDF Conversion



OPeNDAP Example



WMS Example


AIRS NRT RGB — GES DISC
AIRS NRT RGB — GES DISC
You are here: GES DISC Home » Near Real Time Data » Data Holdings » AIRS NRT RGB

Giovanni

Goddard **I**nteractive **O**nline **V**isualization **AN**d a**N**alysis Infrastructure

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

About Giovanni

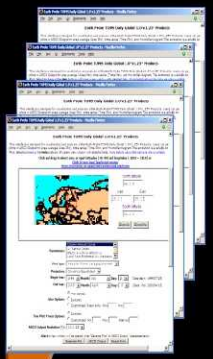
- Provides a simple and easy way to explore, visualize, analyze, and access vast amounts of Earth science remote sensing and model data.
- Is a Web-based application.
- Supported by NASA EOSDIS and several NASA-funded projects.

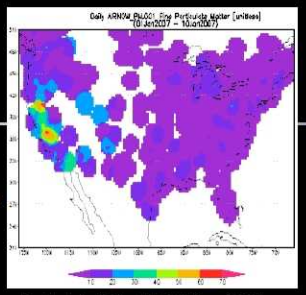
Grand view

Data Inputs

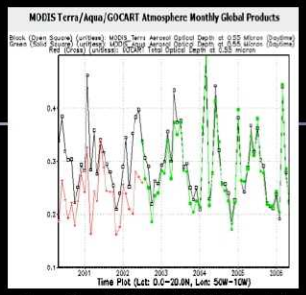
- AIRS
- MODIS
- MISR
- Parasol
- CloudSat
- CALIOP
- TOMS
- OMI
- MLS
- HIRDLS
- HALOE
- TRMM
- AMSR-E
- SeaWiFS
- Models
- and more…

Giovanni Instances

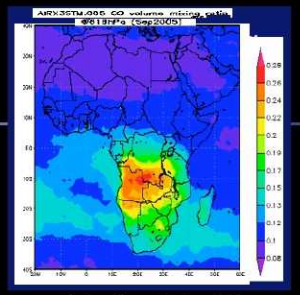




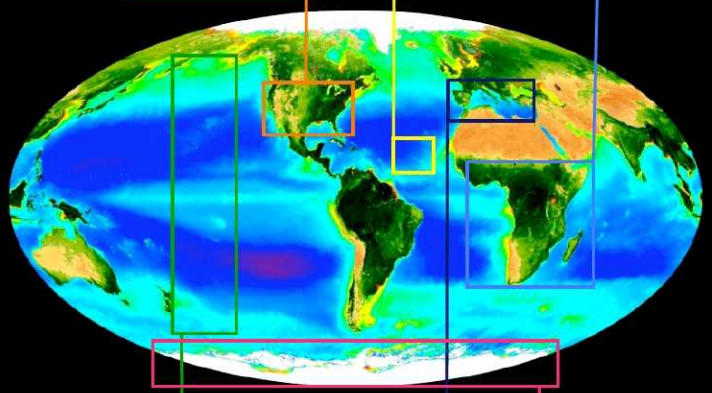
Particulate Matter (PM 2.5) from AIRNow

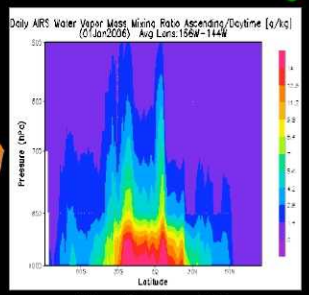


Aerosol from MODIS and GOCART model

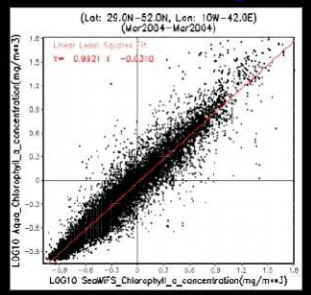


Carbon Monoxide from AIRS

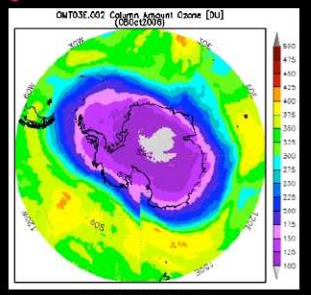




Water Vapor from AIRS



MODIS vs SeaWIFS Chlorophyll



Ozone Hole from OMI

Giovanni Allows Scientists to Concentrate on the *Science*

The Old Way:

Pre-Science

- Find data
- Retrieve high volume data
- Learn formats and develop readers
- Extract parameters
- Perform spatial and other subsetting
- Identify quality and other flags and constraints
- Perform filtering/masking
- Develop analysis and visualization
- Accept/discard/get more data (sat, model, ground-based)

DO SCIENCE

- Exploration
- Initial Analysis
- Use the best data for the final analysis
- Derive conclusions
- Write the paper
- Submit the paper

Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

Web-based Services:

The Giovanni Way:

- Minutes
- Days for exploration

- Use the best data for the final analysis
- Derive conclusions
- Write the paper
- Submit the paper

DO SCIENCE

Giovanni and other web-based tools allow scientists to ***compress*** the time needed for pre-science preliminary tasks:
data discovery, access, manipulation, visualization, and basic statistical analysis.

Scientists have ***more time to do science!***

Giovanni Now

- Almost 30 customized Giovanni portals
- Thousands of geophysical parameters
- Data from:
  - ~20 space-based instruments
  - ~50 models
  - EPA and Aeronet stations
- Multiple visualization and statistical analysis functionalities including data intercomparison
- Data lineage
- Subsetted data downloads in multiple formats

Capabilities

One-parameter:

- **Area plot** – averaged or accumulated over any data period for any rectangular area (various map projections)
- **Time plot** – time series averaged over any rectangular area
- **Hovmöller plots** –longitude-time or latitude-time cross sections
- **Image animation** – for area plot
- **Vertical profiles**
- **Vertical cross-sections, zonal means**
- **Download in ASCII, netCDF, HDF, KMZ format**
- **Lineage/provenance**

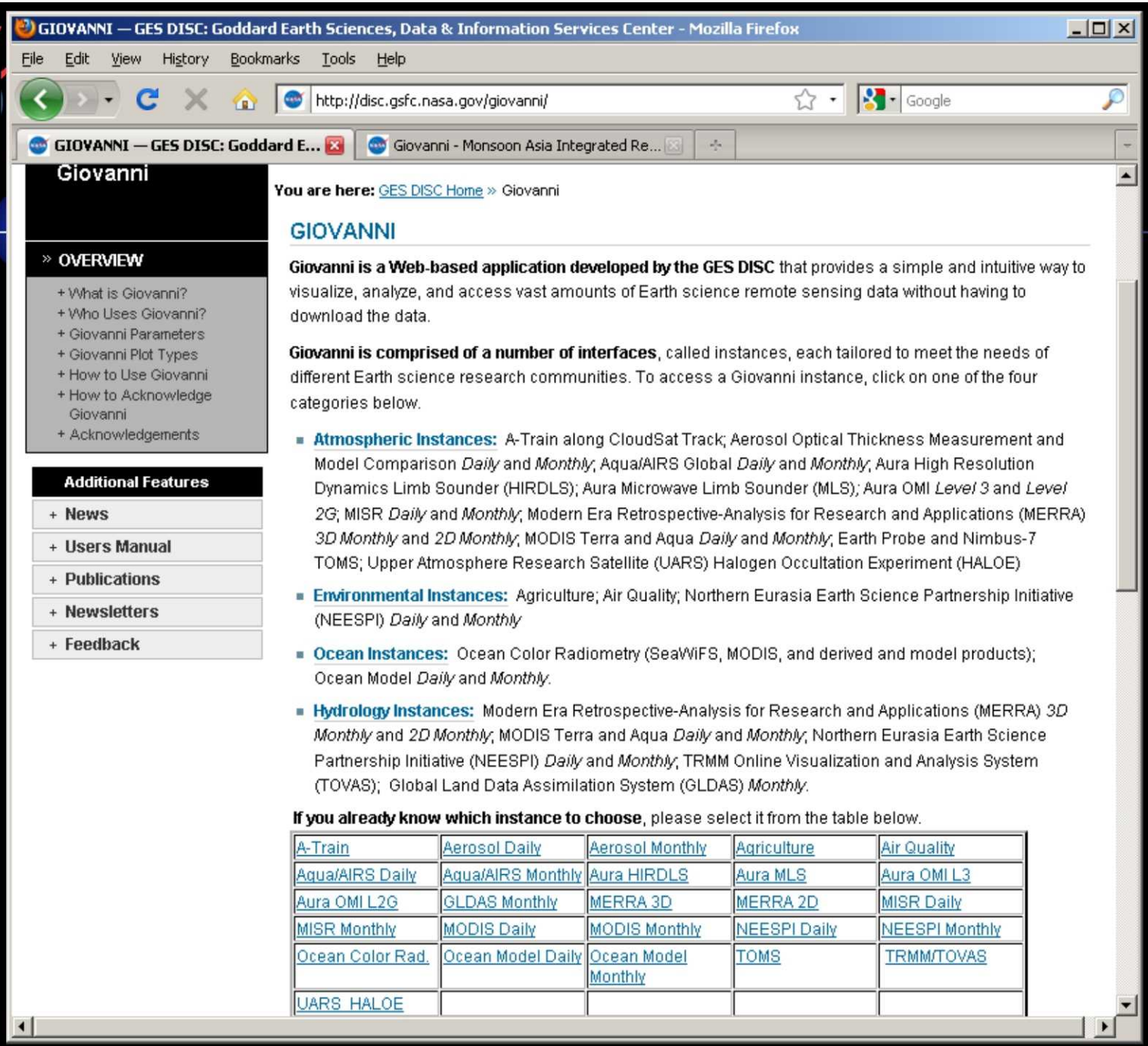
Multi-parameter/Multi-sensor

- **Area plot** - geographical intercomparison between two parameters
- **Time plot** - an X-Y time series plot of several parameters
- **Scatter plot of parameters in selected area and time period**
- **Scatter plot of area averaged parameters**
- **Temporal correlation map**
- **Temporal correlation of area averaged parameters**
- **Difference plots**
- **Anomaly plots**
- **Acquiring parameter and spatial subsets** in a batch mode through Giovanni

Giovanni Features

- Uses only a **Web browser**
- **Accesses data from multiple sensors, models and ground-based** measurements from **one place**
- **No need** to **learn** multiple **data formats**
- **No need** to **write** various **data readers**
- **No need** to **download large amounts** of data.
- Data from **multiple sources** are already **quality** screened and **harmonized**
- Obtain **customized data and analyses** with only a **few mouse clicks**

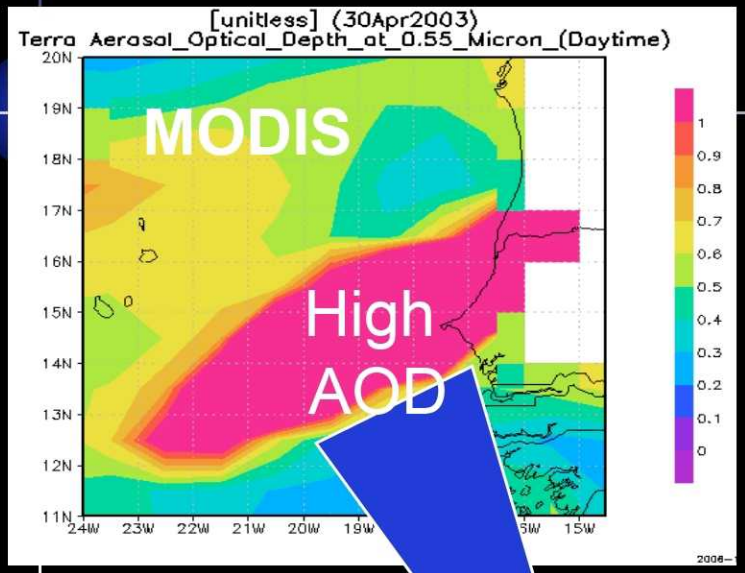
Caution: *Giovanni is a data exploration tool!*

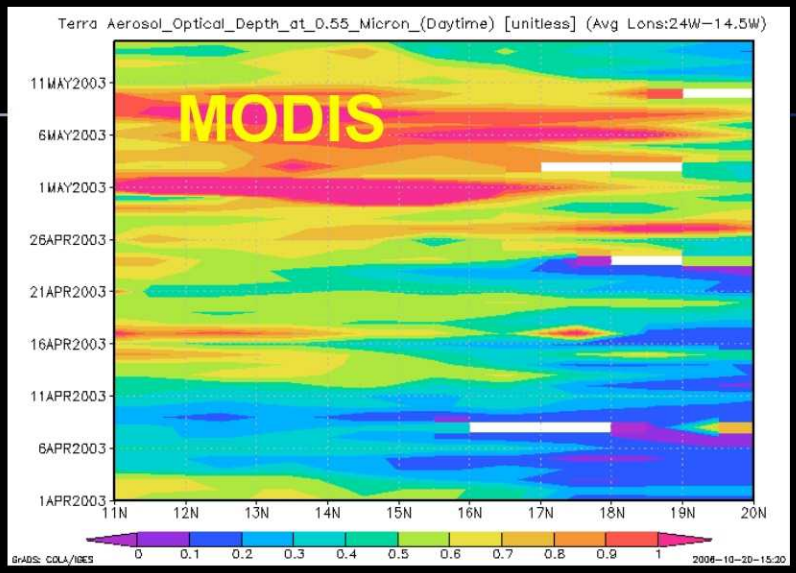


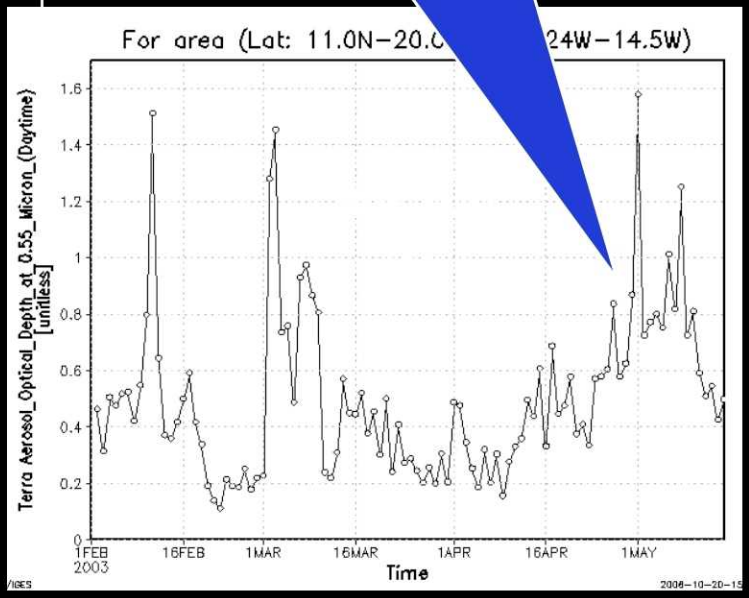
http://giovanni.gsfc.nasa.gov/

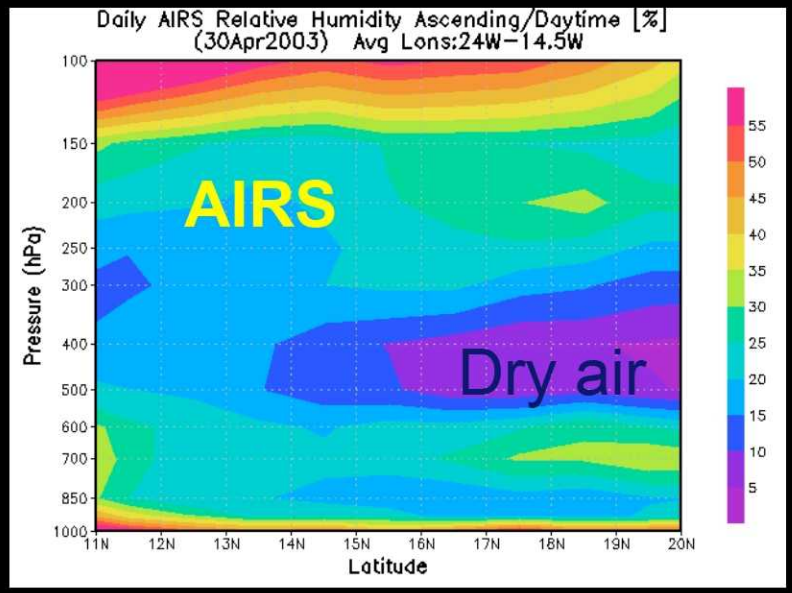
28

Tracking dust storm



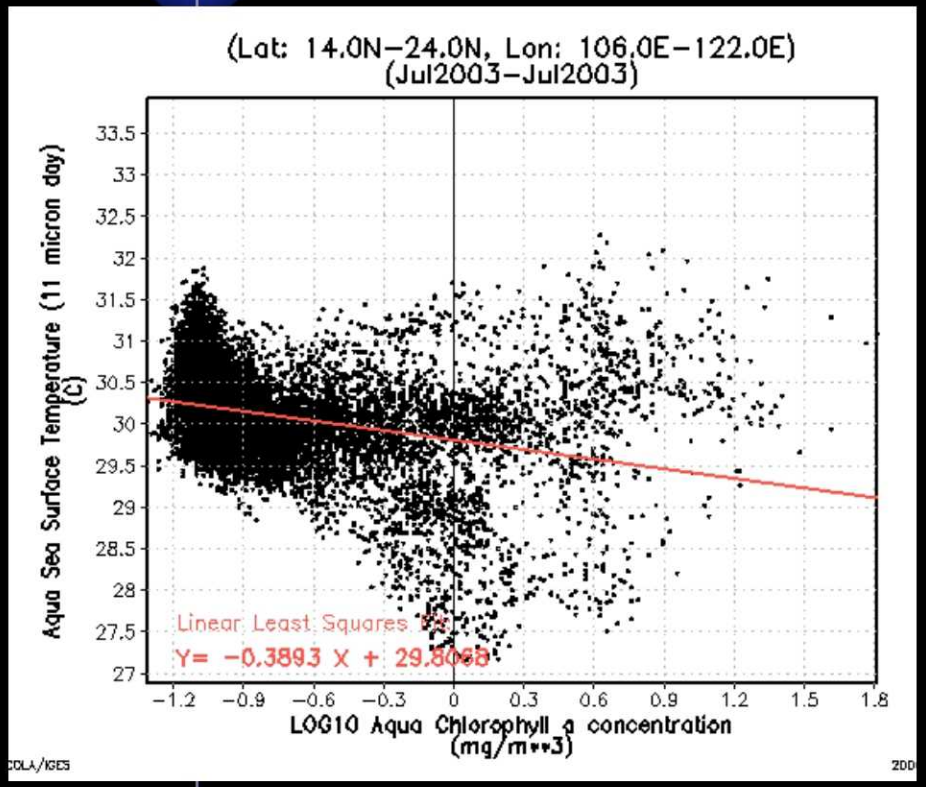




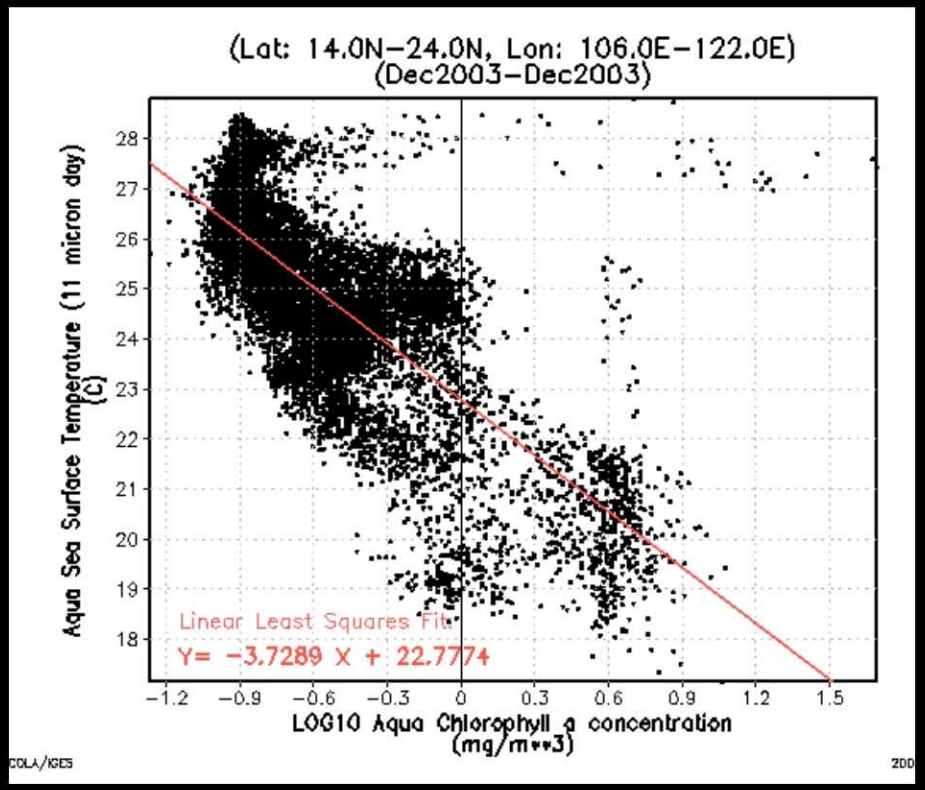


Multi-Parameter Scatter Plots

July 2003

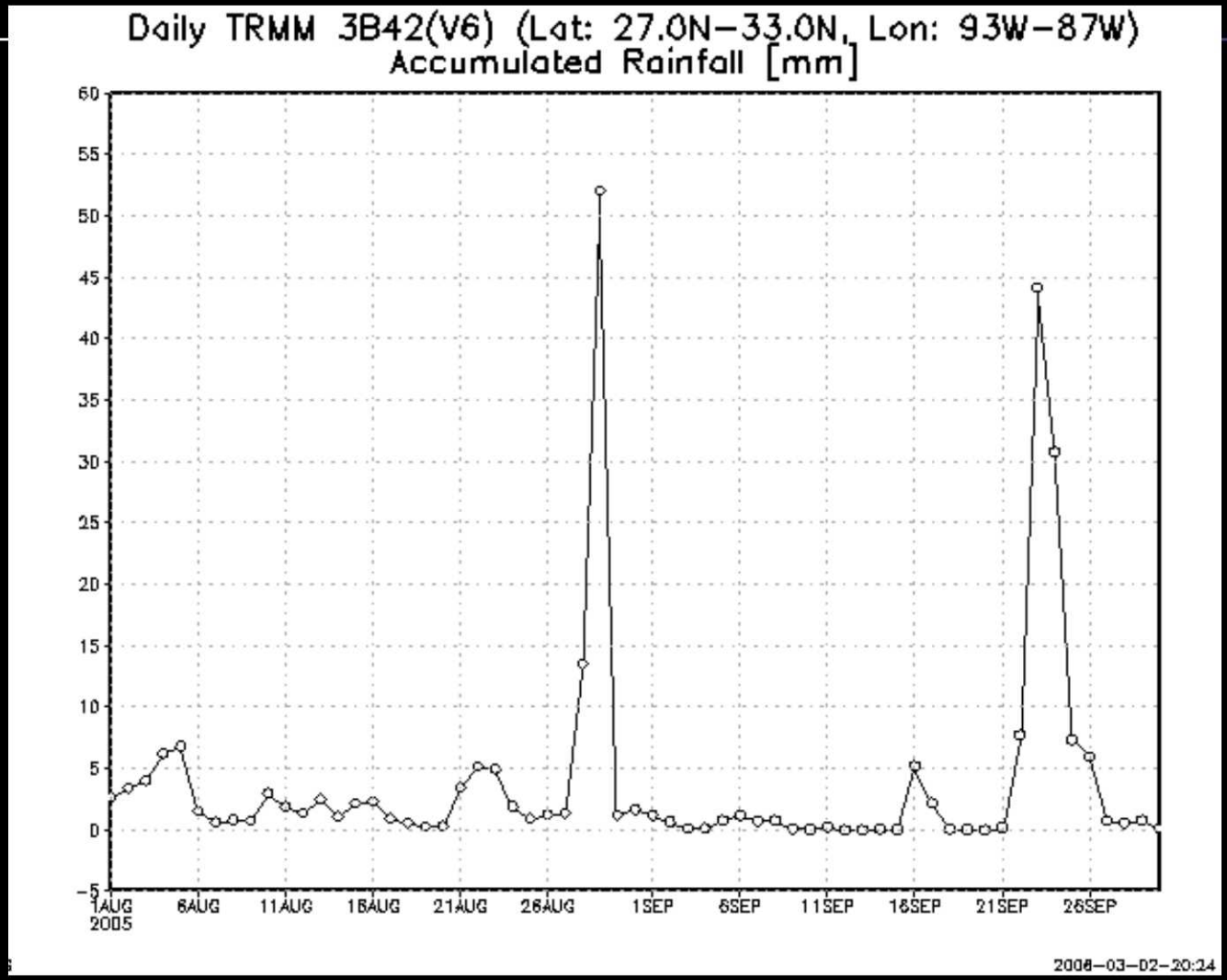


December 2003



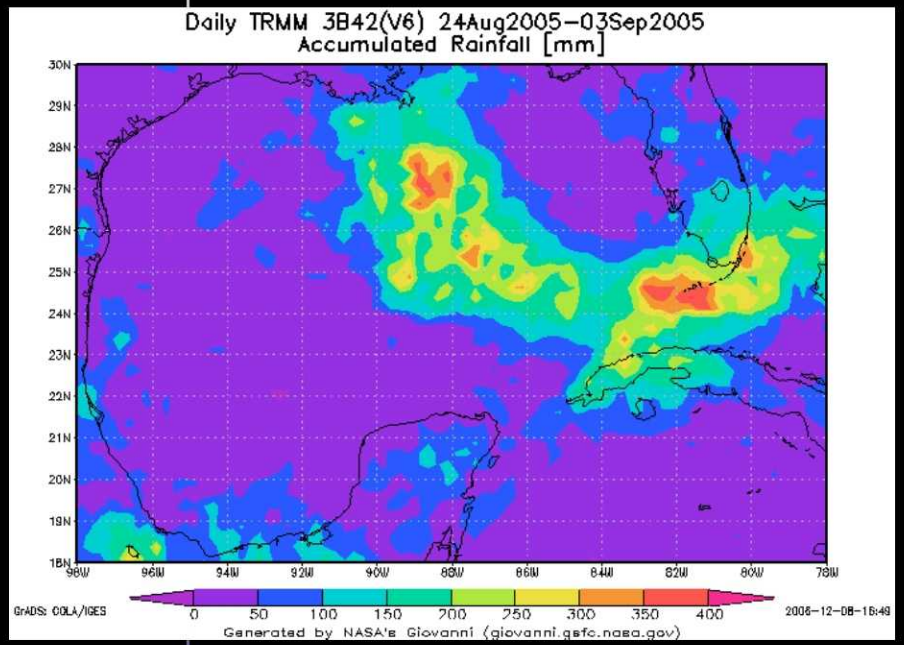
Scatter plots also demonstrate increased chlorophyll concentration, decreased SST during winter upwelling regime

Time-series of Accumulated Rainfall for Hurricanes Katrina and Rita

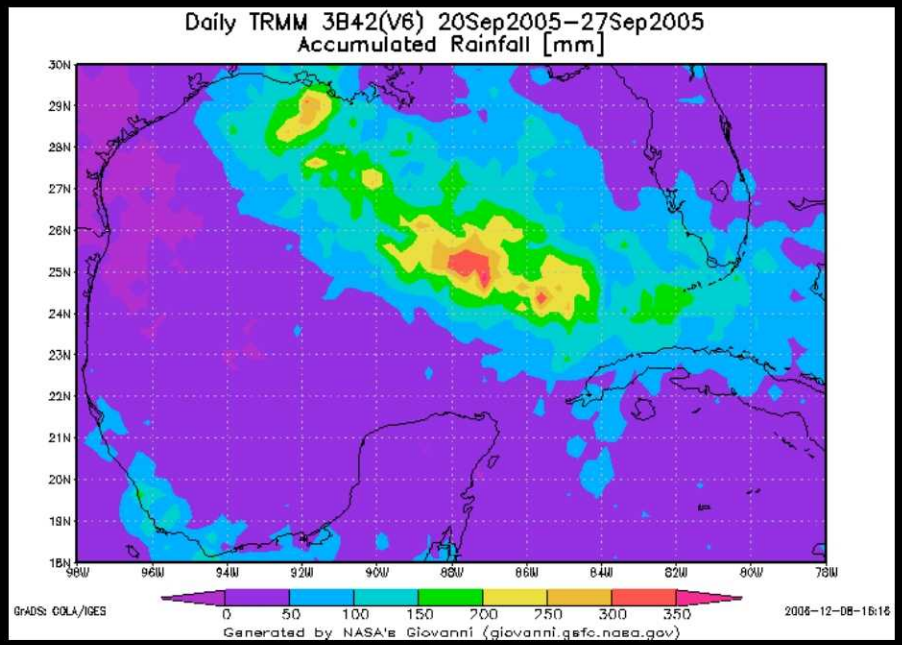


Accumulated Rainfall Tracks of Hurricanes Katrina and Rita

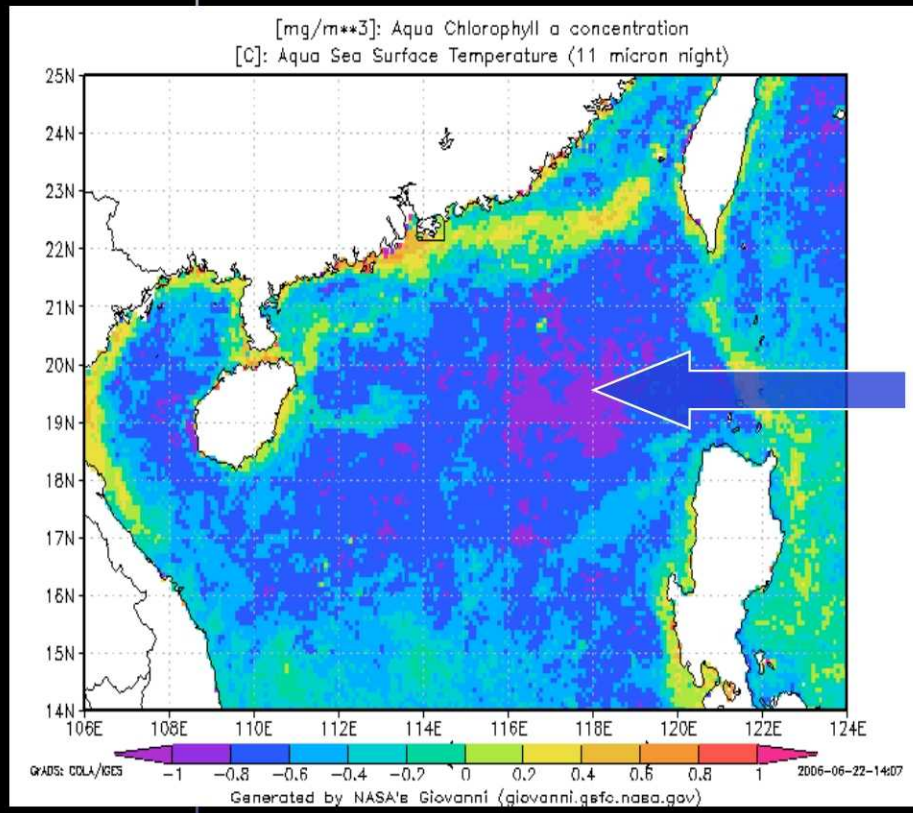
Katrina

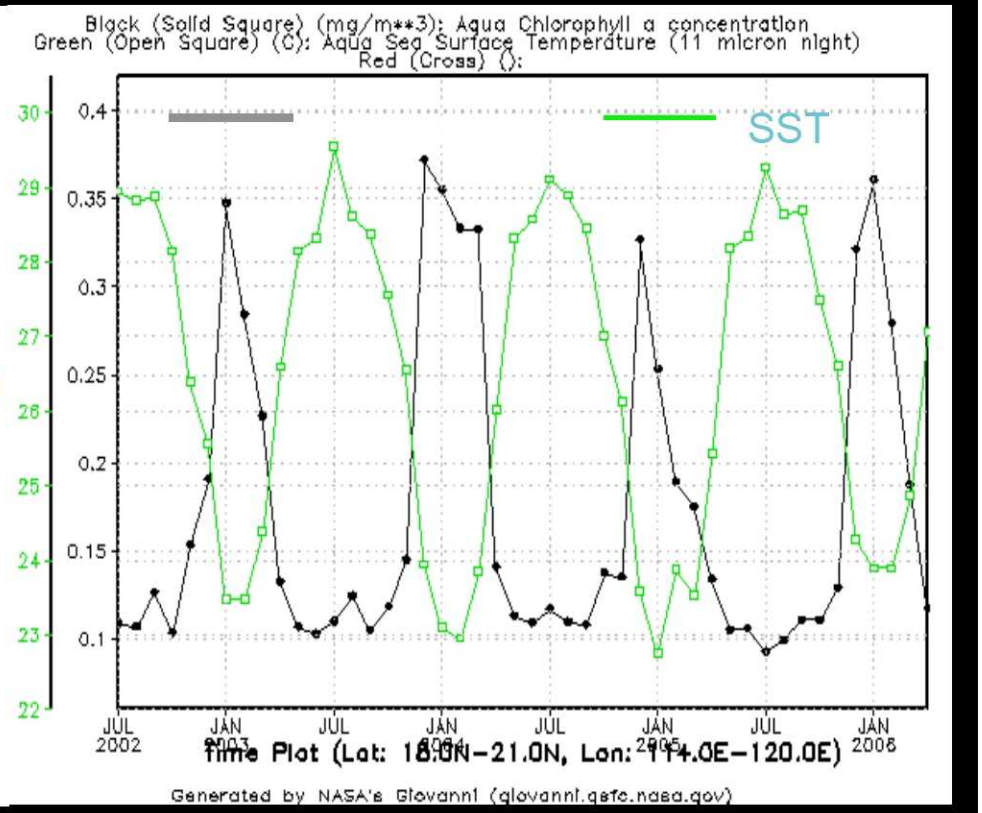


Rita



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





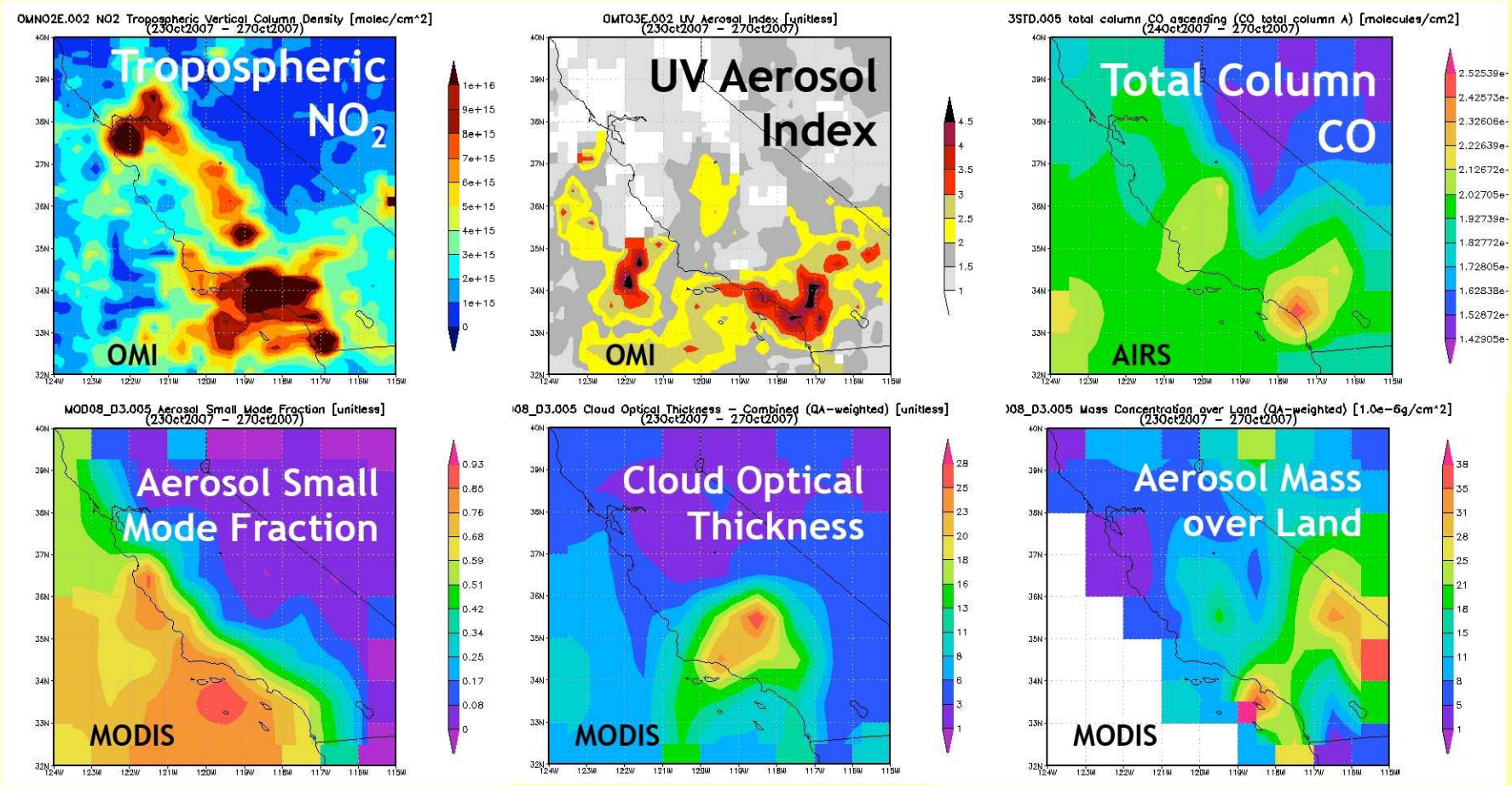
Temporal correlation map

Time-series

California's Wildfires from Space Using

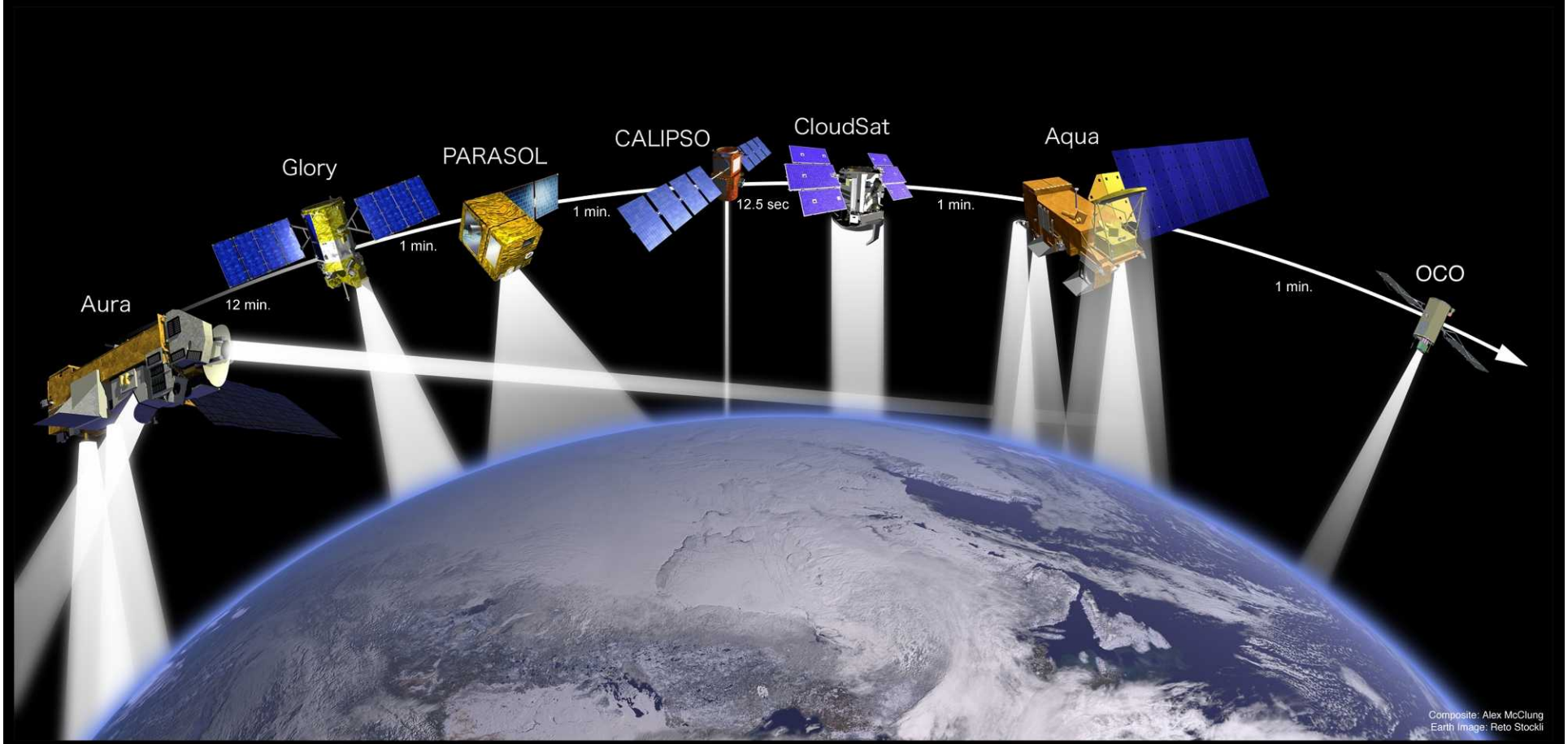
23-27 October 2007

Data from NASA's Aura OMI (Tropospheric NO_2 and UV Aerosol Index), Aqua AIRS (Total Column CO) and Terra MODIS (Aerosol Small Fraction, Cloud Optical Thickness and Aerosol Mass Concentration Over Land)

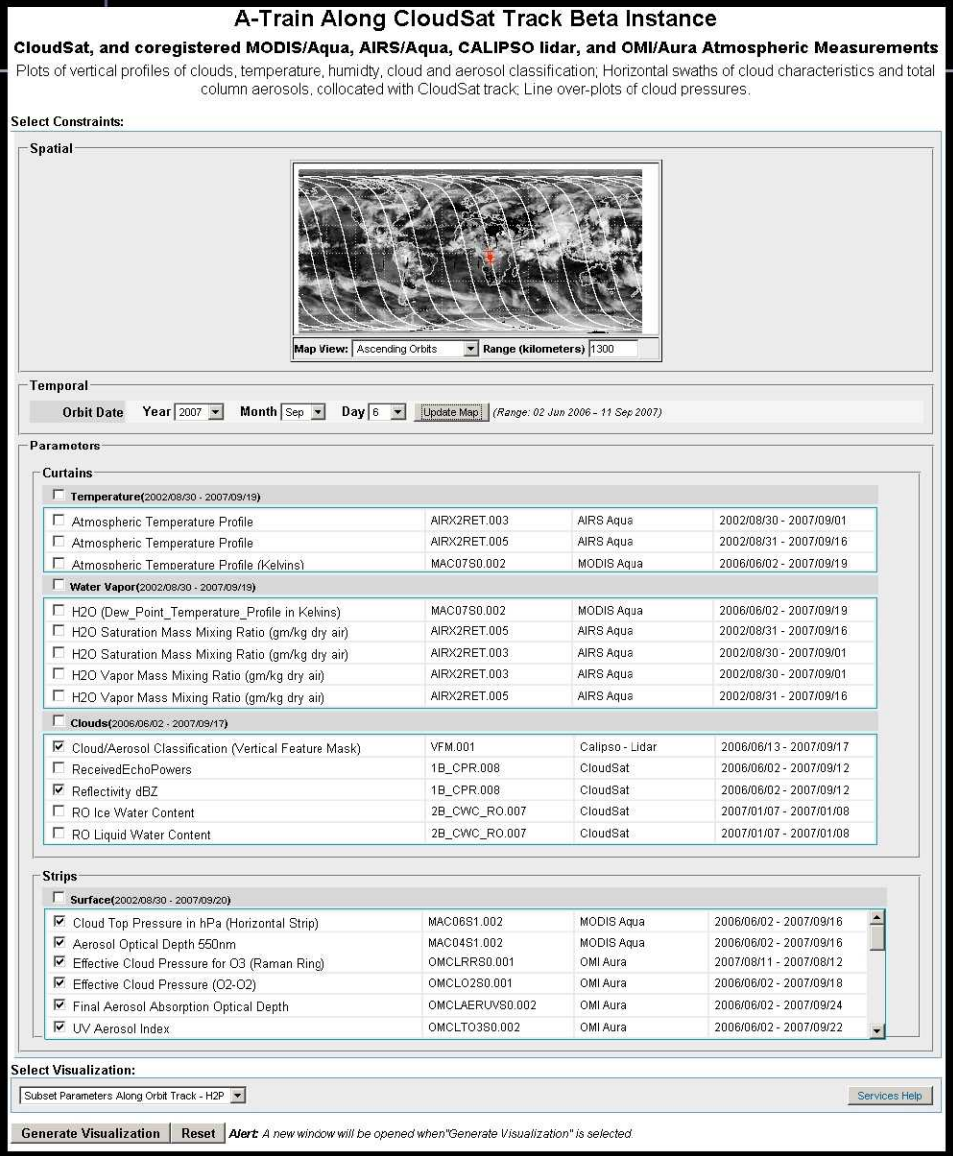


Multi-Instrument Data Exploration

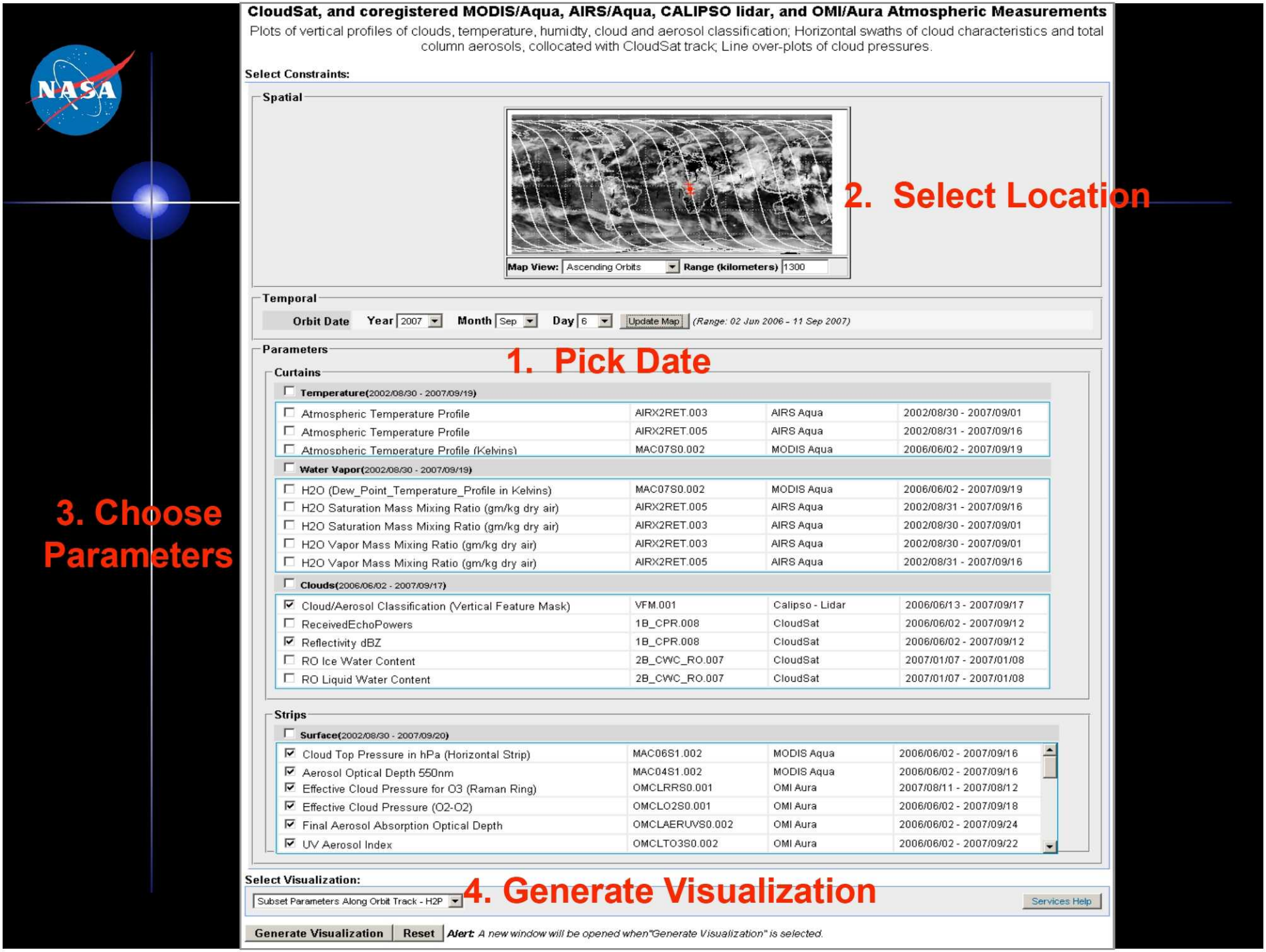
NASA's A-Train

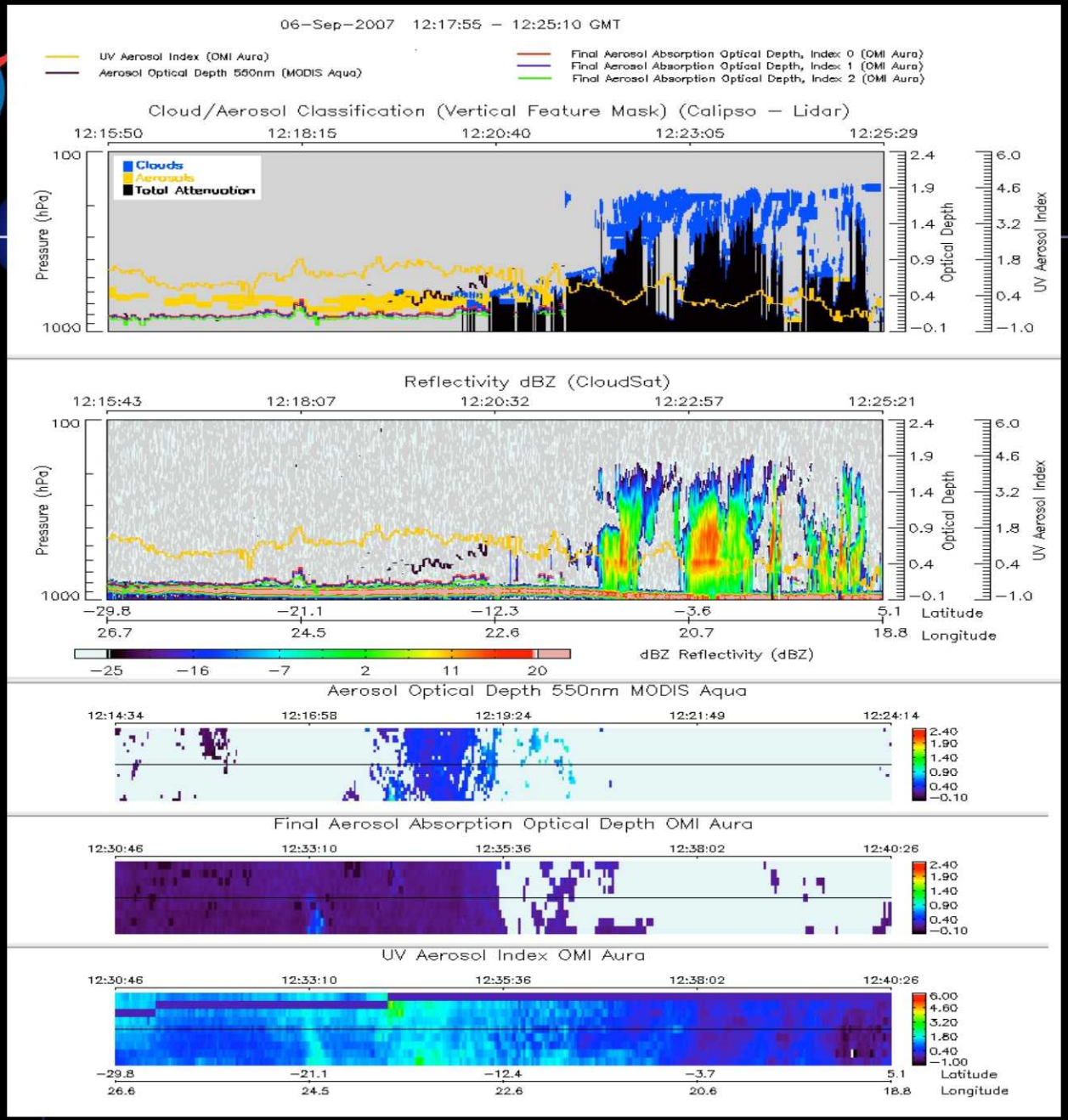


A-Train Data Depot



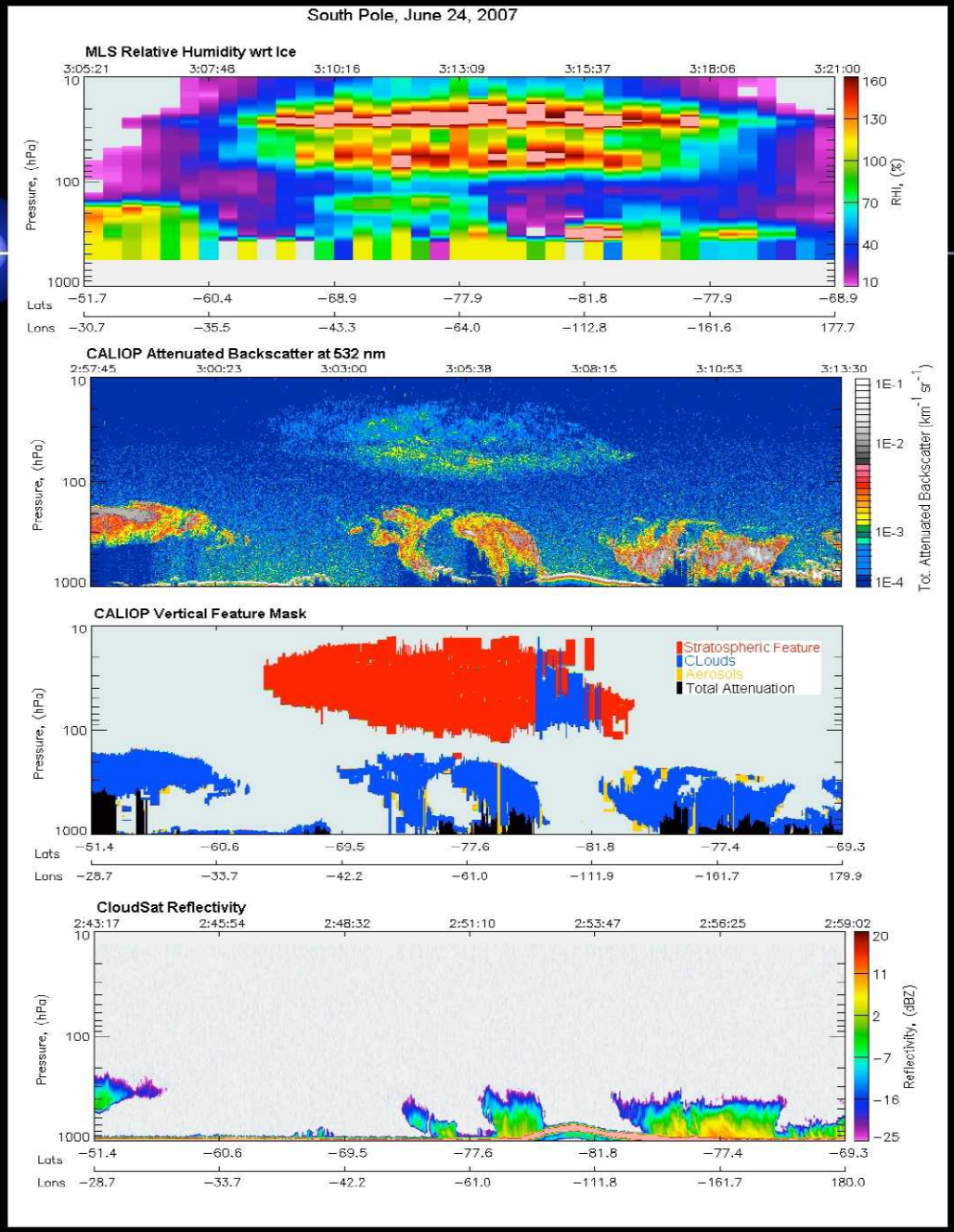
Comparison of A-Train Datasets Along CloudSat Orbital Track


CloudSat, and coregistered MODIS/Aqua, AIRS/Aqua, CALIPSO lidar, and OMI/Aura Atmospheric Measurements
Plots of vertical profiles of clouds, temperature, humidty, cloud and aerosol classification; Horizontal swaths of cloud characteristics and total column aerosols, collocated with CloudSat track; Line over-plots of cloud pressures.
Select Constraints:
Spatial
Map View: Ascending Orbits
Range (kilometers) 1300
2. Select Location
Temporal
Orbit Date
Year 2007
Month Sep
Day 6
Update Map
(Range: 02 Jun 2006 - 11 Sep 2007)
1. Pick Date
Parameters
Curtains
Temperature(2002/08/30 - 2007/09/19)
Atmospheric Temperature Profile AIRX2RET.003 AIRS Aqua 2002/08/30 - 2007/09/01
Atmospheric Temperature Profile AIRX2RET.005 AIRS Aqua 2002/08/31 - 2007/09/16
Atmospheric Temperature Profile (Kelvins) MAC07S0.002 MODIS Aqua 2006/06/02 - 2007/09/19
Water Vapor(2002/08/30 - 2007/09/19)
H2O (Dew_Point_Temperature_Profile in Kelvins) MAC07S0.002 MODIS Aqua 2006/06/02 - 2007/09/19
H2O Saturation Mass Mixing Ratio (gm/kg dry air) AIRX2RET.005 AIRS Aqua 2002/08/31 - 2007/09/16
H2O Saturation Mass Mixing Ratio (gm/kg dry air) AIRX2RET.003 AIRS Aqua 2002/08/30 - 2007/09/01
H2O Vapor Mass Mixing Ratio (gm/kg dry air) AIRX2RET.003 AIRS Aqua 2002/08/30 - 2007/09/01
H2O Vapor Mass Mixing Ratio (gm/kg dry air) AIRX2RET.005 AIRS Aqua 2002/08/31 - 2007/09/16
Clouds(2006/06/02 - 2007/09/17)
Cloud/Aerosol Classification (Vertical Feature Mask) VFM.001 Calipso - Lidar 2006/06/13 - 2007/09/17
ReceivedEchoPowers 1B_CPR.008 CloudSat 2006/06/02 - 2007/09/12
Reflectivity dBZ 1B_CPR.008 CloudSat 2006/06/02 - 2007/09/12
RO Ice Water Content 2B_CWC_RO.007 CloudSat 2007/01/07 - 2007/01/08
RO Liquid Water Content 2B_CWC_RO.007 CloudSat 2007/01/07 - 2007/01/08
Strips
Surface(2002/08/30 - 2007/09/20)
Cloud Top Pressure in hPa (Horizontal Strip) MAC06S1.002 MODIS Aqua 2006/06/02 - 2007/09/16
Aerosol Optical Depth 550nm MAC04S1.002 MODIS Aqua 2006/06/02 - 2007/09/16
Effective Cloud Pressure for O3 (Raman Ring) OMCLRRS0.001 OMI Aura 2007/08/11 - 2007/08/12
Effective Cloud Pressure (O2-O2) OMCLO2S0.001 OMI Aura 2006/06/02 - 2007/09/18
Final Aerosol Absorption Optical Depth OMCLAERUVS0.002 OMI Aura 2006/06/02 - 2007/09/24
UV Aerosol Index OMCLTO3S0.002 OMI Aura 2006/06/02 - 2007/09/22
3. Choose Parameters
Select Visualization:
Subset Parameters Along Orbit Track - H2P
4. Generate Visualization
Services Help
Generate Visualization
Reset
Alert: A new window will be opened when "Generate Visualization" is selected.

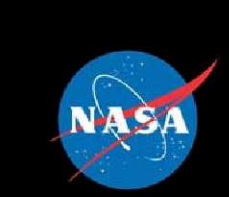


Studying Aerosols…

Vertical Profiles (curtain plots) and Horizontal Strips ±100 km from CloudSat and CALIPSO nadir

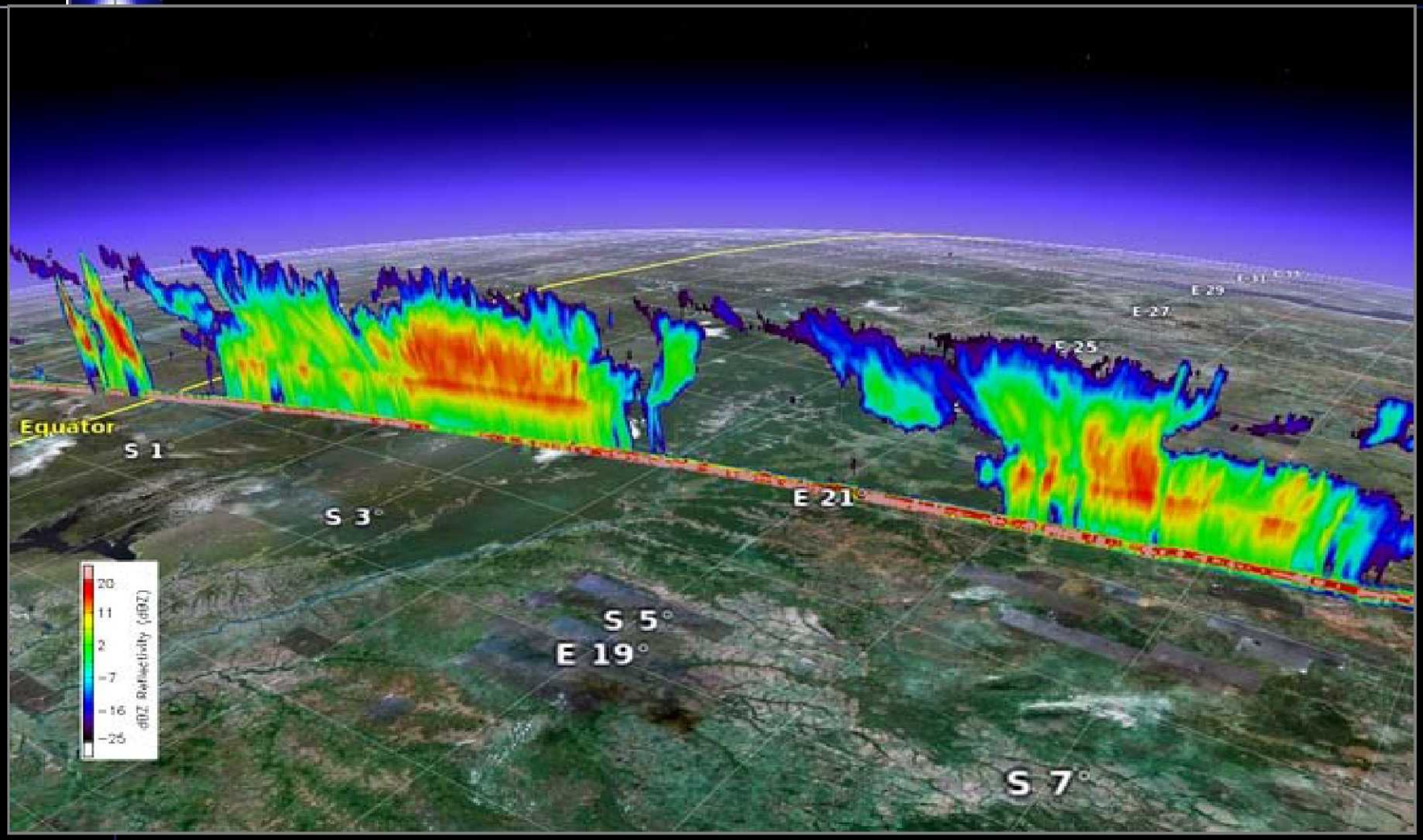


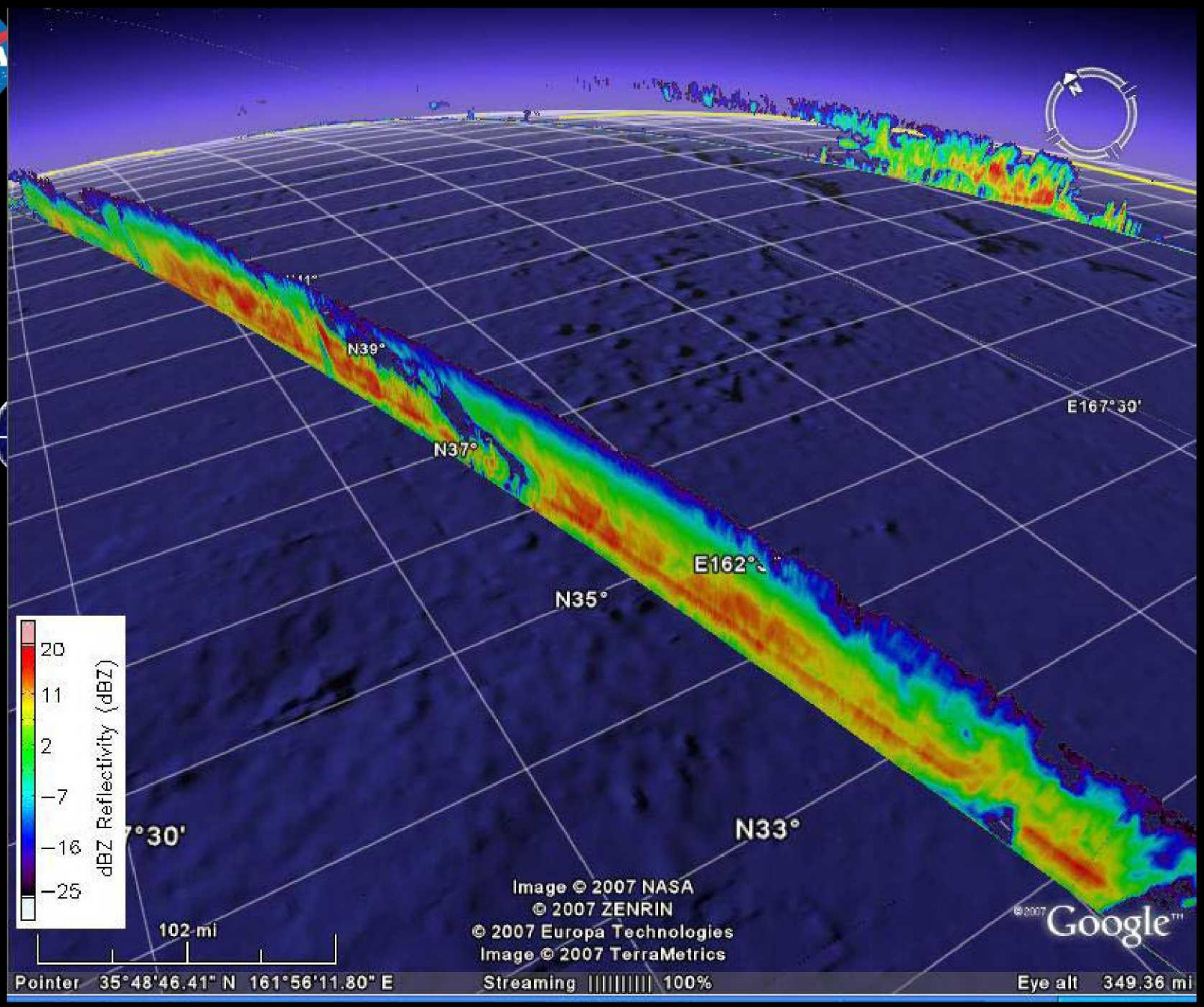
Comparison of Aura with other A-Train Satellite Datasets

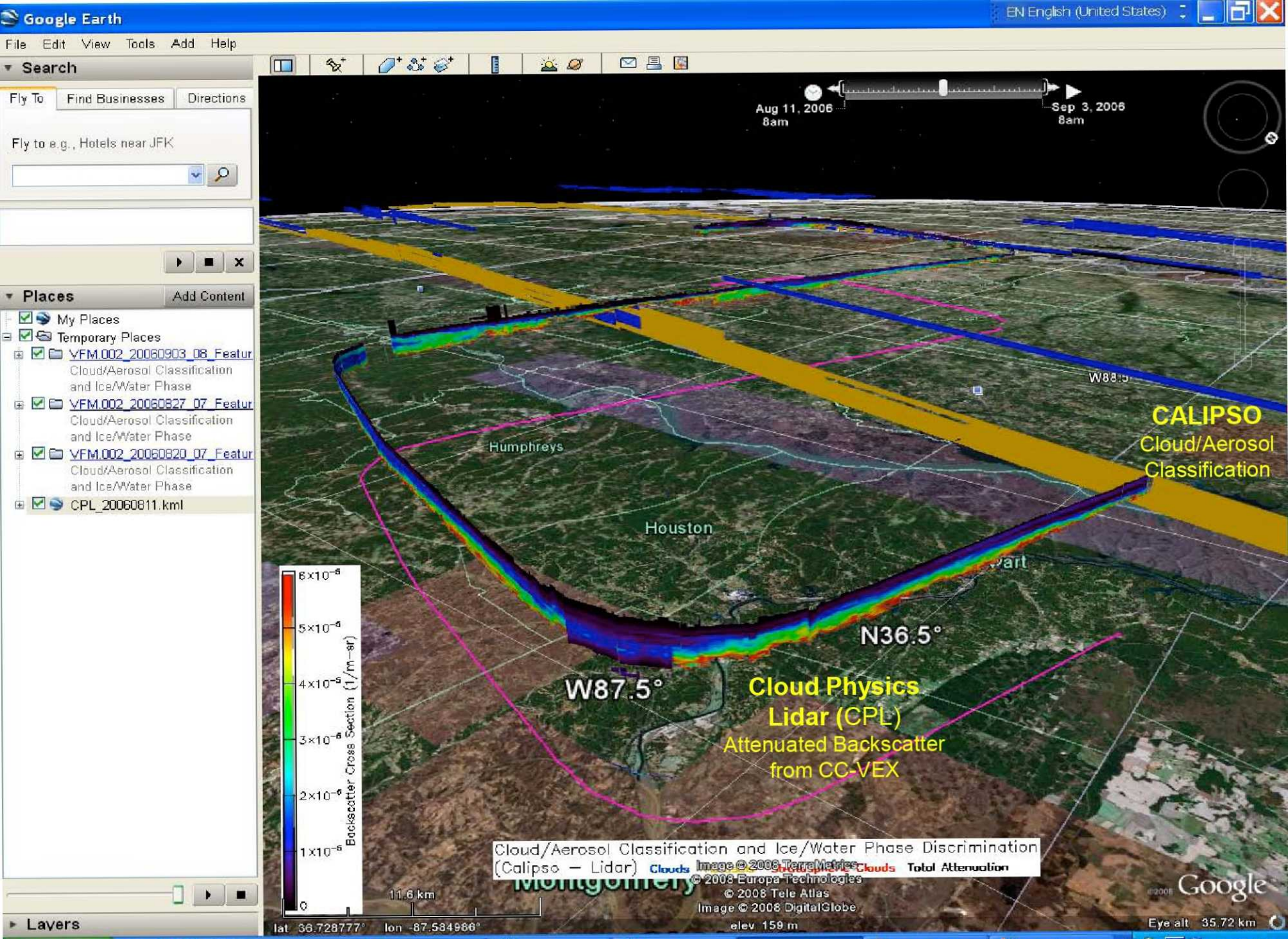


Google Earth$_{tm}$

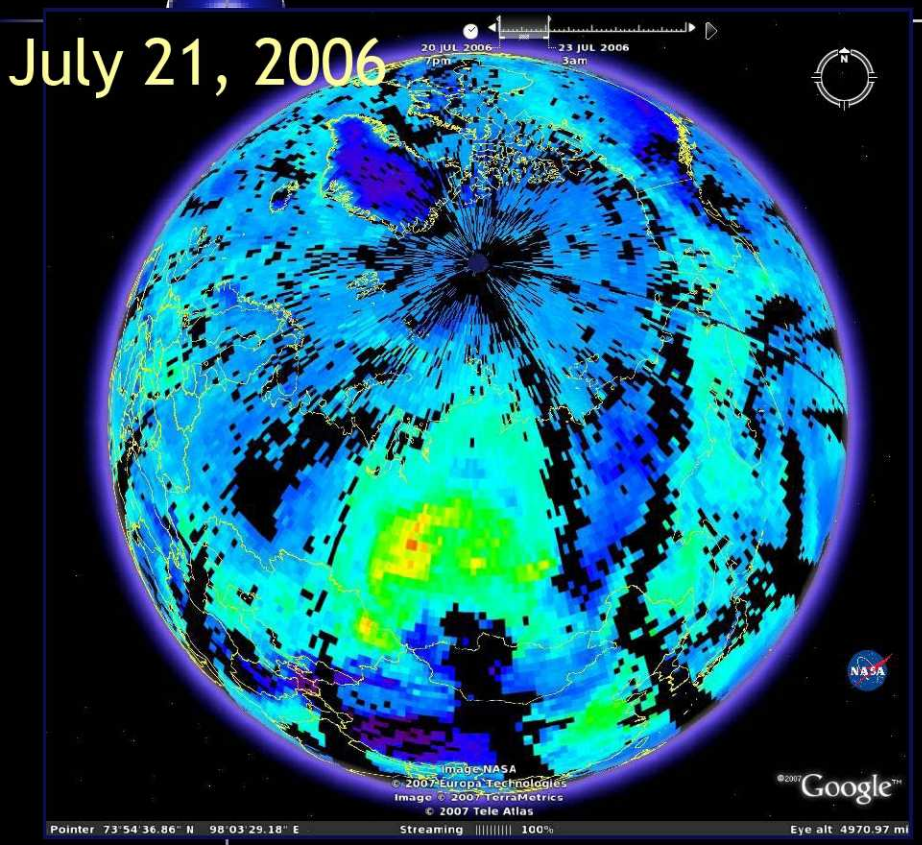
Importing Giovanni Data into Google Earth™

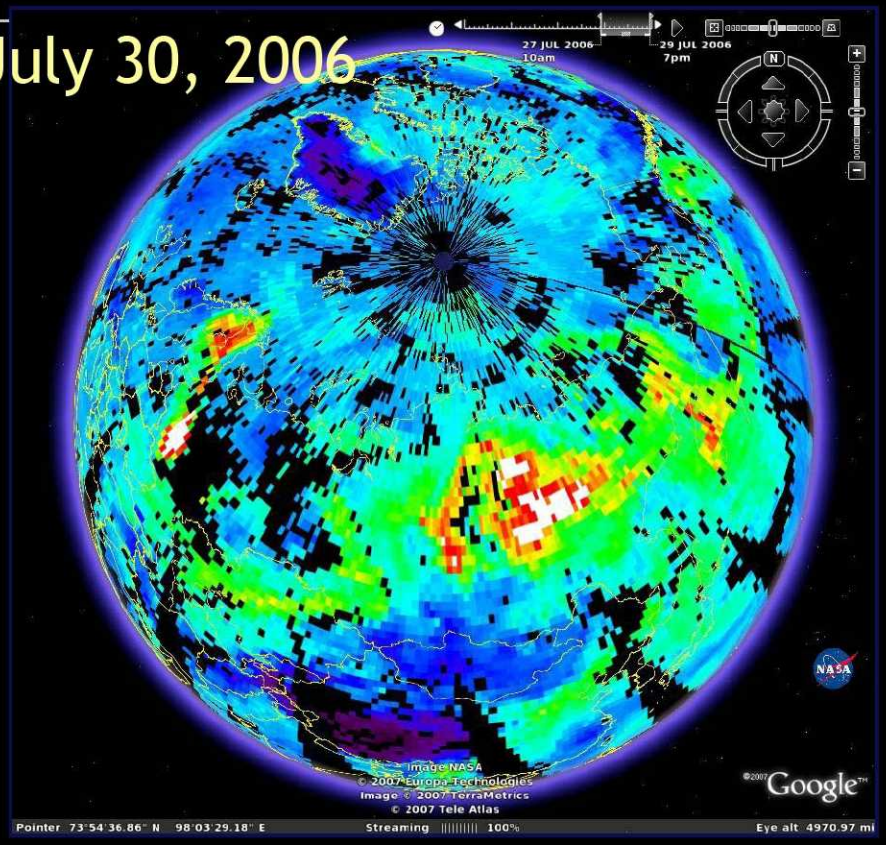



N39°
N37°
E167°30'
E162°
N35°
N33°
20
11
2
−7
−16
−25
dBZ Reflectivity (dBZ)
102 mi
Image © 2007 NASA
© 2007 ZENRIN
© 2007 Europa Technologies
Image © 2007 TerraMetrics
Google
Pointer 35°48'46.41" N 161°56'11.80" E
Streaming 100%
Eye alt 349.36 mi


Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Fly to e.g., Hotels near JFK
Places
Add Content
My Places
Temporary Places
VFM.002_20060903_08_Featur
Cloud/Aerosol Classification and Ice/Water Phase
VFM.002_20060827_07_Featur
Cloud/Aerosol Classification and Ice/Water Phase
VFM.002_20060820_07_Featur
Cloud/Aerosol Classification and Ice/Water Phase
CPL_20060811.kml
Layers
Aug 11, 2006 8am
Sep 3, 2006 8am
CALIPSO
Cloud/Aerosol Classification
Humphreys
Houston
N36.5°
W87.5°
Cloud Physics Lidar (CPL)
Attenuated Backscatter from CC-VEX
Backscatter Cross Section (1/m-sr)
6x10⁻⁵
5x10⁻⁵
4x10⁻⁵
3x10⁻⁵
2x10⁻⁵
1x10⁻⁵
0
Cloud/Aerosol Classification and Ice/Water Phase Discrimination (Calipso – Lidar)
Clouds
Total Attenuation
11.6 km
lat 36.728777°
lon -87.584986°
elev 159 m
Eye alt 35.72 km
Google
start
1:22 PM

Importing AIRS Data into Google Earth™

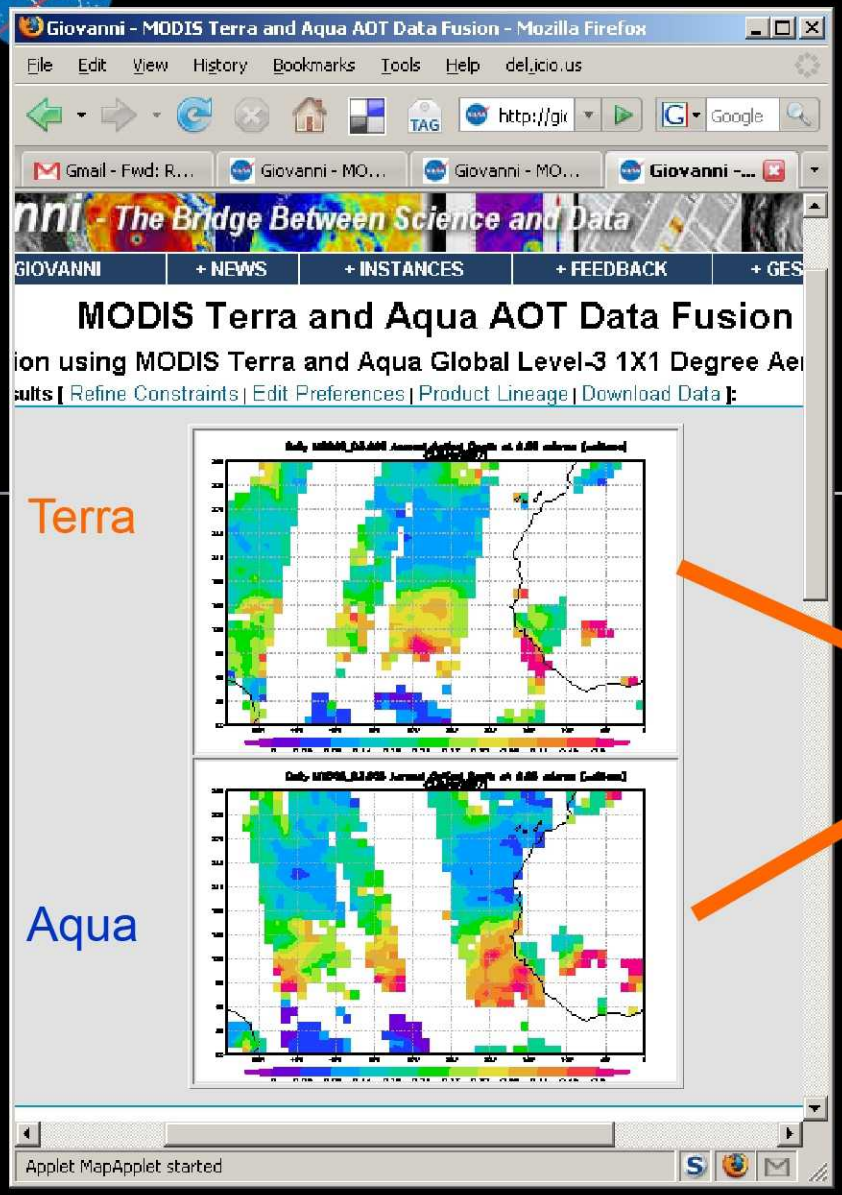


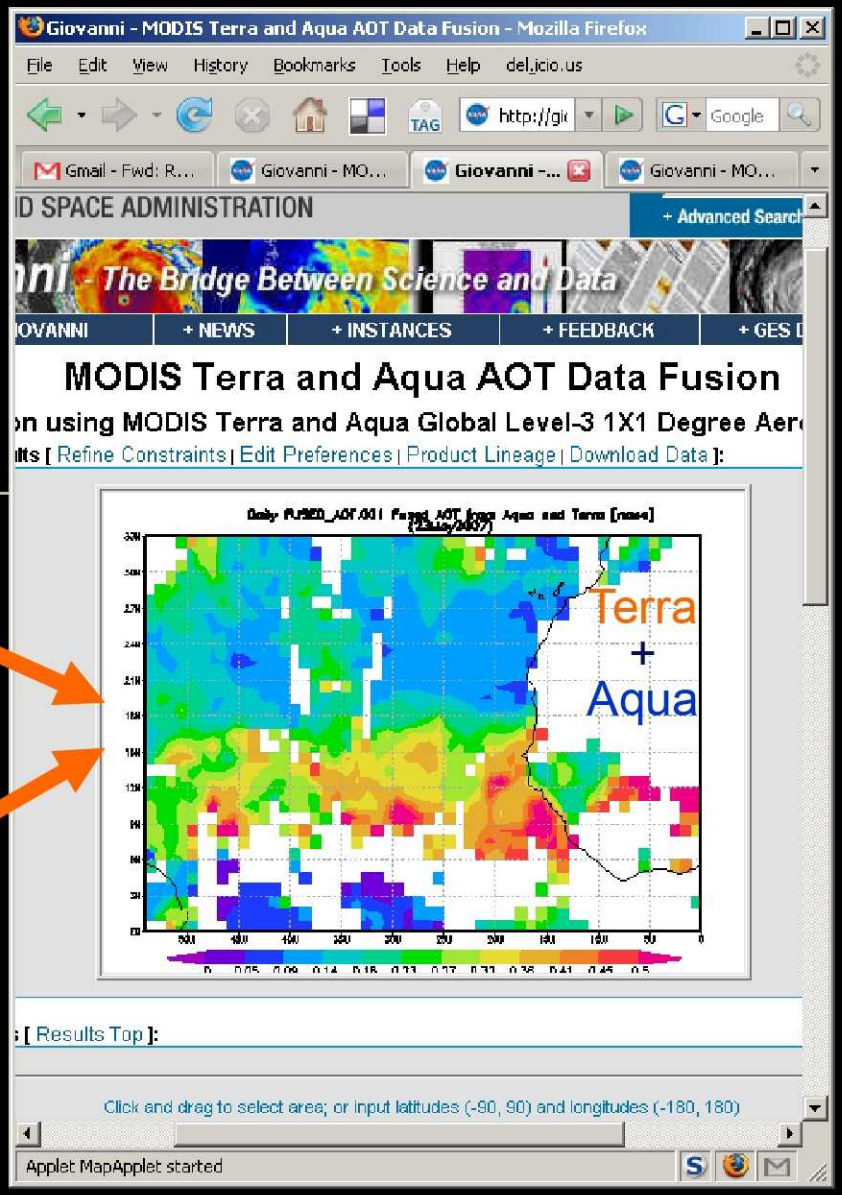


KMZ files for AIRS Level-3 products (2D variables only) can be downloaded from GES DISC. These example images track CO transport at the beginning and end of Siberian fires between July 21 - 30, 2006.

Data Merging

Data Fusion in Giovanni (prototype)

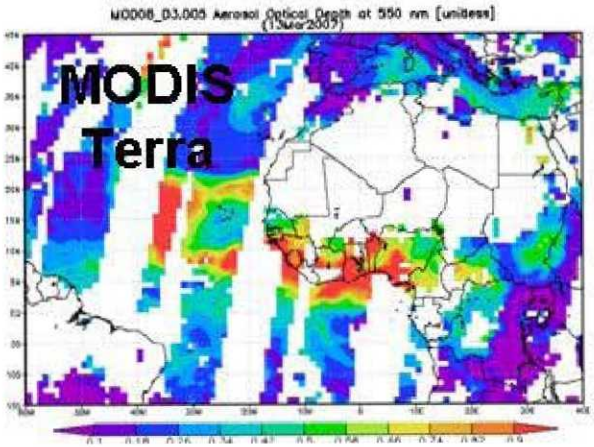


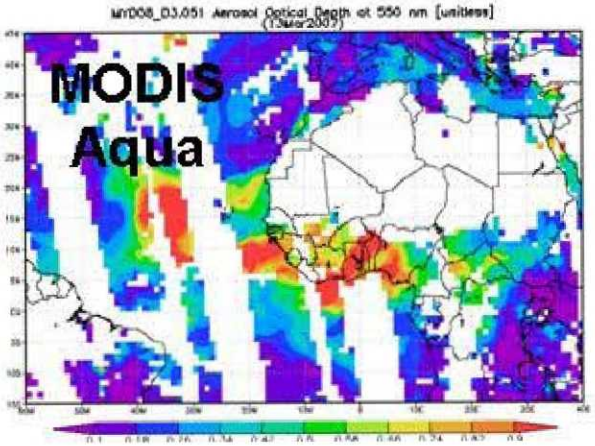


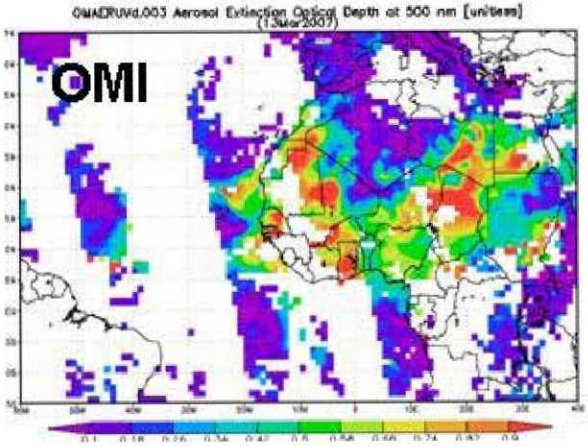
Dust event, May 23, 2007

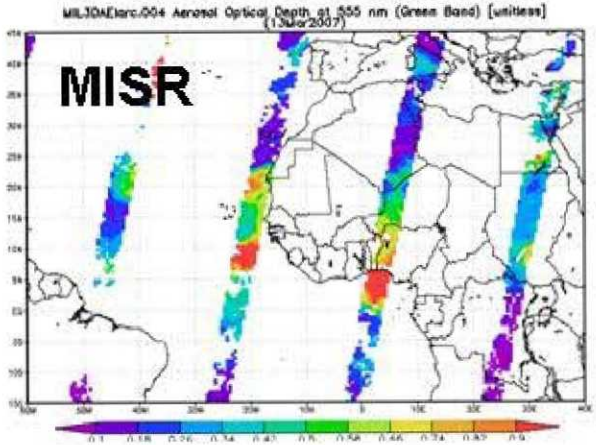
Merged multi-sensor aerosol data

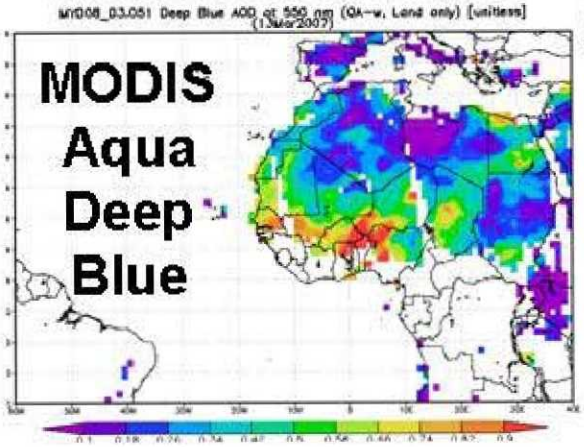
March 13, 2007

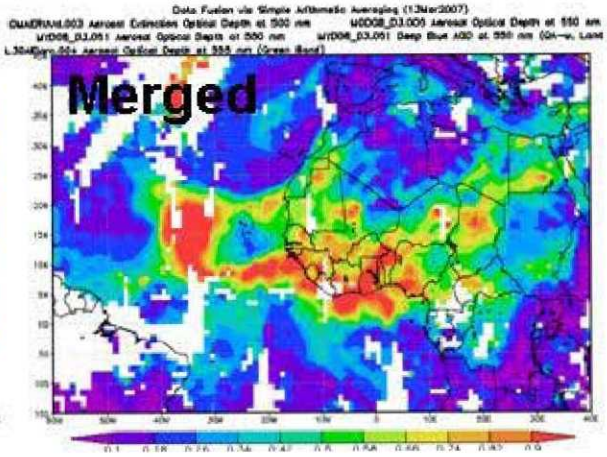






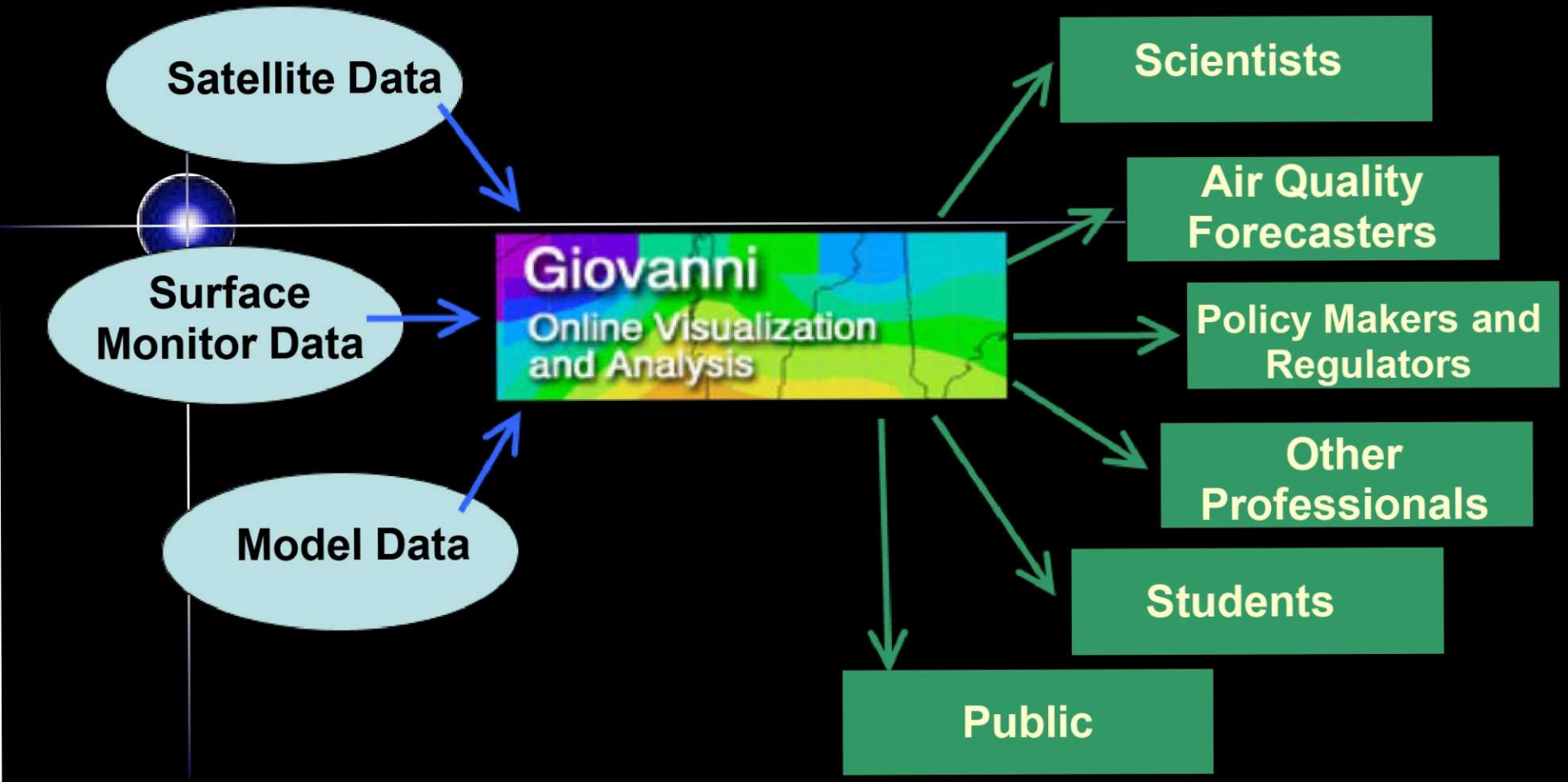






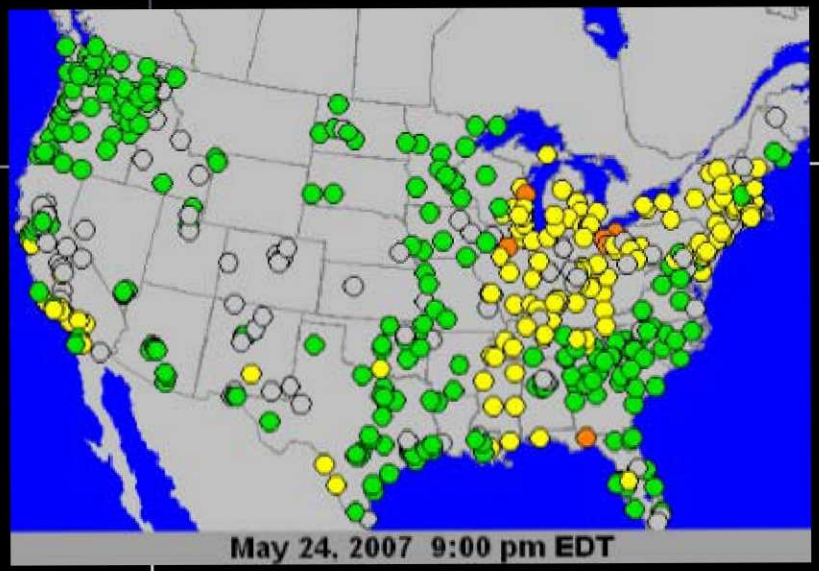
Applications

Multi-Sensor Air Quality

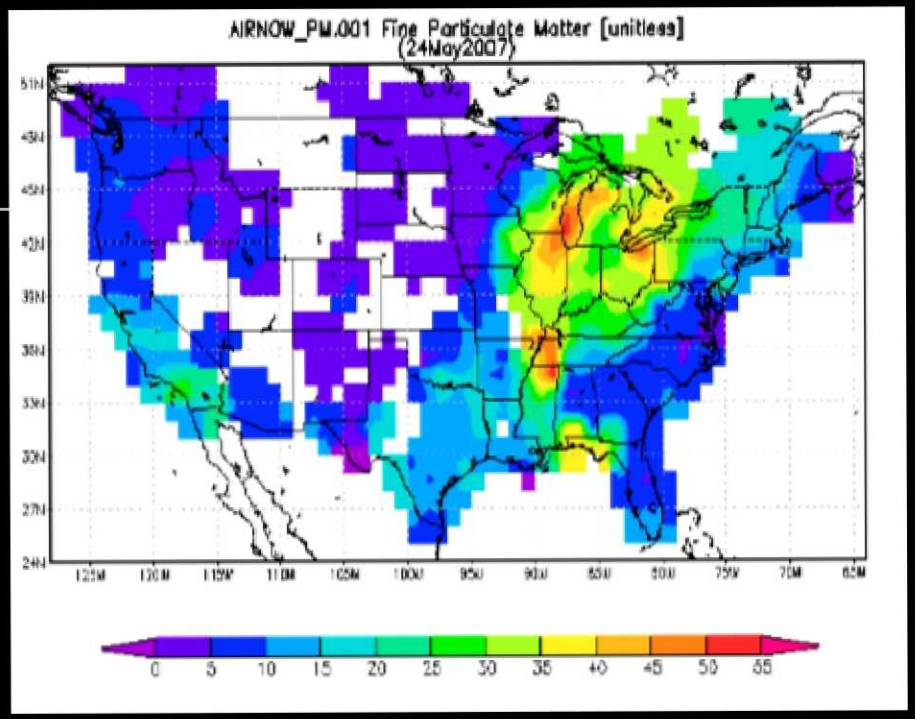


Giovanni: PM2.5 Gridded Data

$PM_{2.5}$ data from EPA AirNow provided in GIOVANNI as 1 deg gridded product, which makes easy to compare with other satellite & ground observation

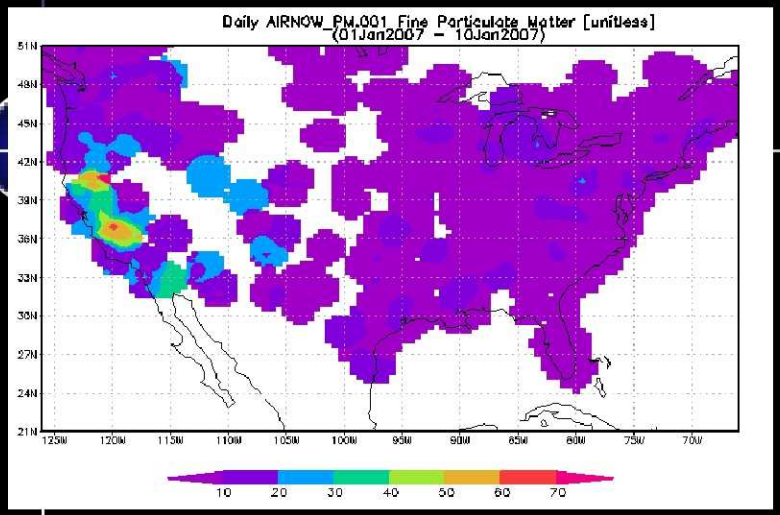


$PM_{2.5}$ Air Quality Index

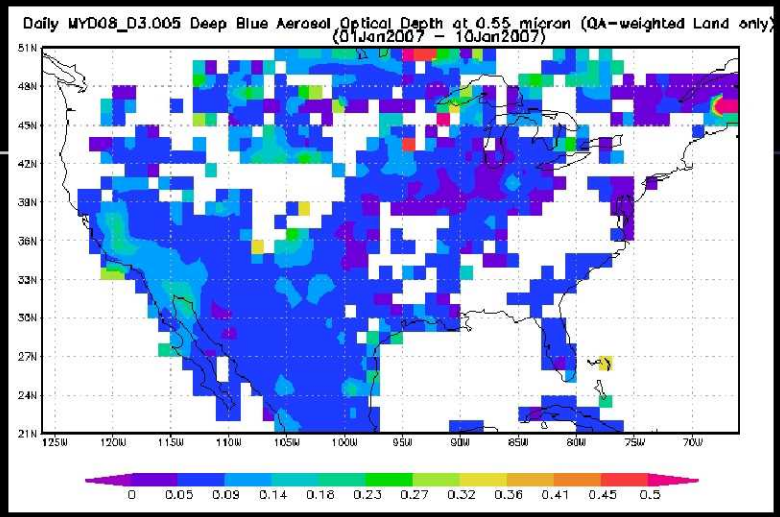


Gridded GIOVANNI $PM_{2.5}$ (μgm^{-3})

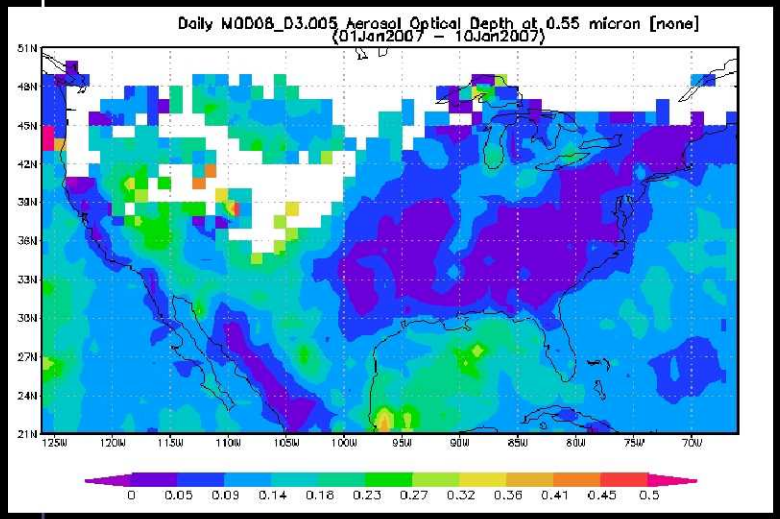
Prototyping PM25 data in Giovanni



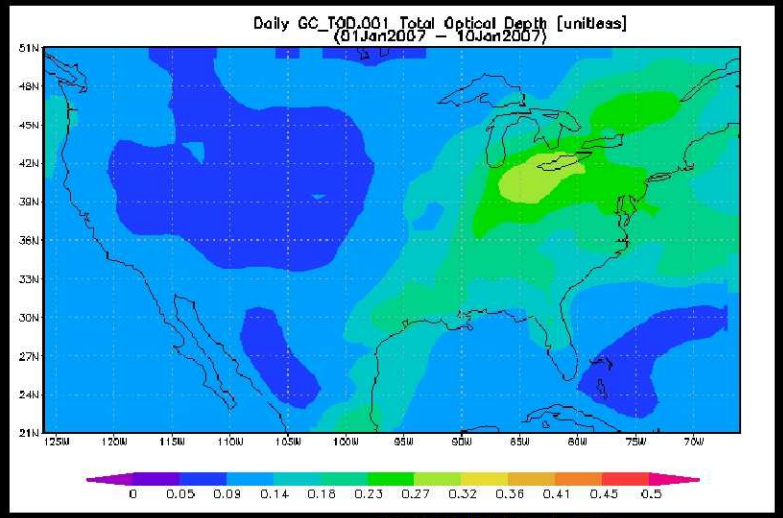
PM2.5 (EPA→ DataFed → Giovanni)



Deep Blue MODIS Aerosol Optical Depth

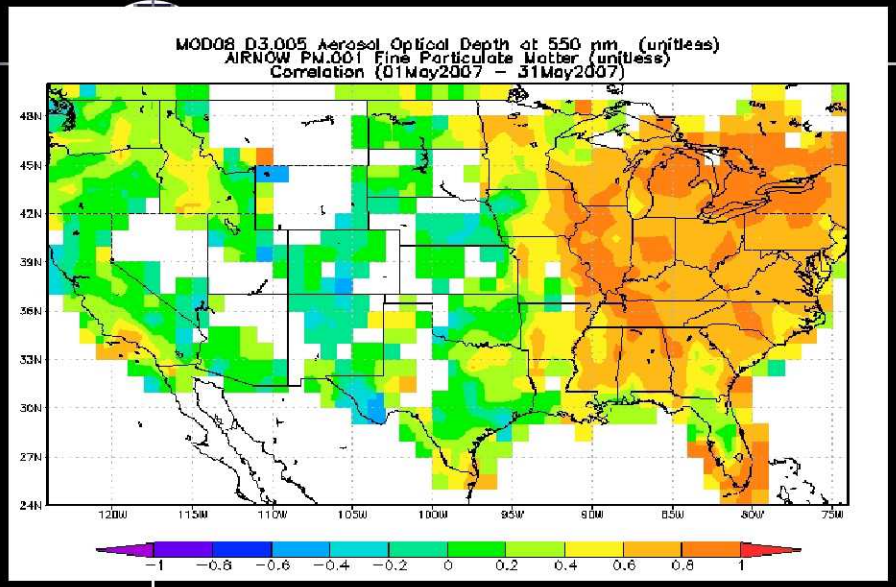


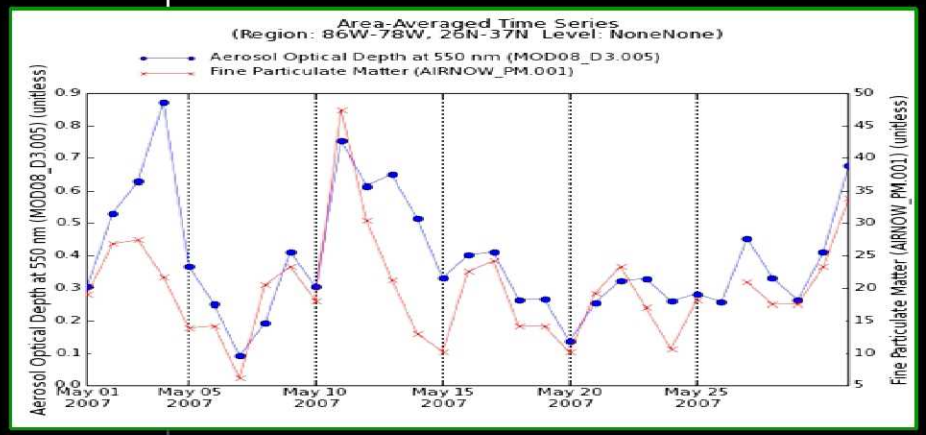
The standard MODIS AOT



GOCART AOT

Giovanni Air Quality Services: AOD/$PM_{2.5}$ Correlation Maps and Time Series





May 2007 AOD/$PM_{2.5}$ correlation map over the U.S

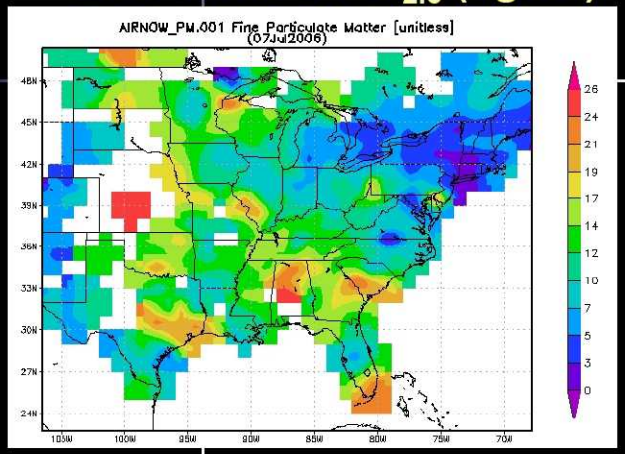
Moderate to good correlation in the eastern U.S

No significant differences were found when using the Fine Mode MODIS AOD.

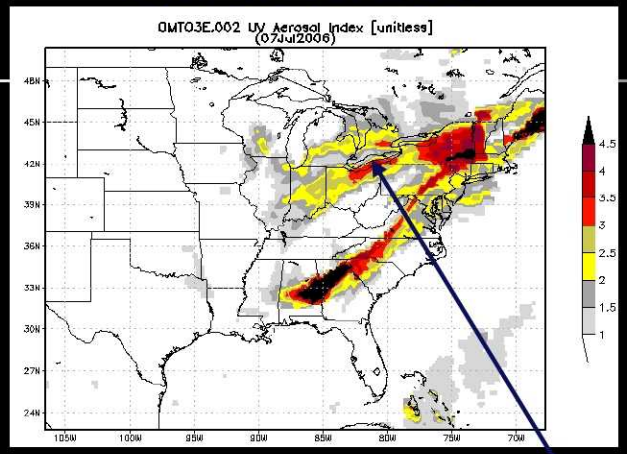
May 2007- AOD and $PM_{2.5}$ Time series over the southeast

Air Quality Data (July 7th, 2006)

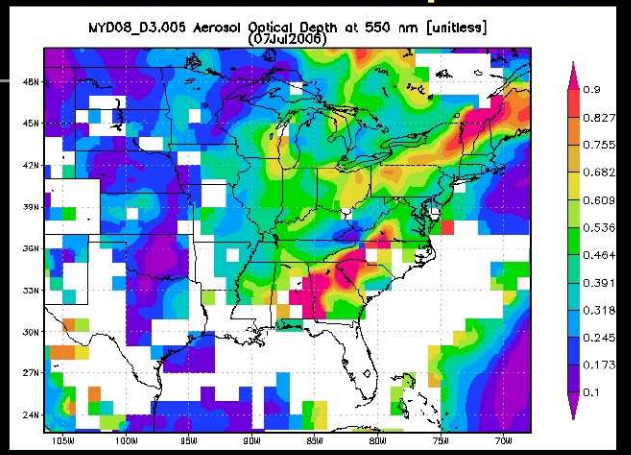
EPA AirNow $PM_{2.5}$ (ug/m^3)



OMI Aerosol Index

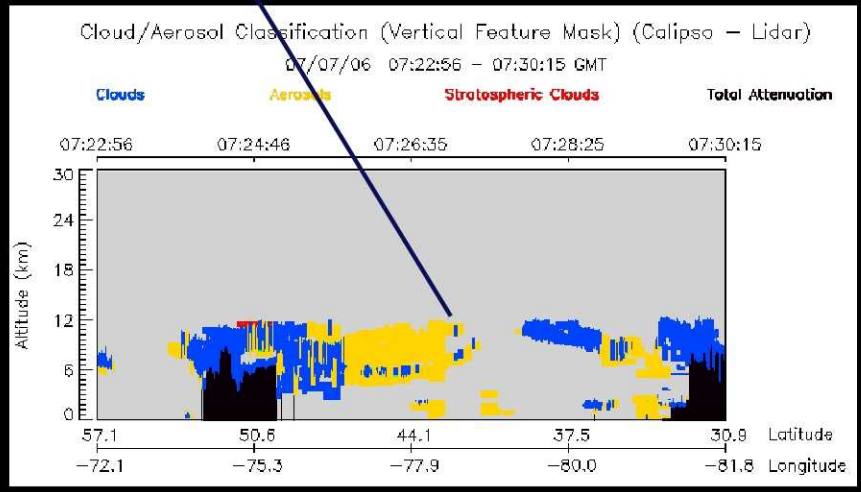


Level-3 MODIS Aqua AOD



- MODIS and OMI imagery show smoke aerosols over the northeast, southeast and Great Lakes.
- CALIOP Aerosol Flag (yellow) confirms that aerosols are above the boundary layer
- EPA AirNow $PM_{2.5}$ doesn't show anything around Great Lakes, i.e. aerosols are primarily above the boundary layer

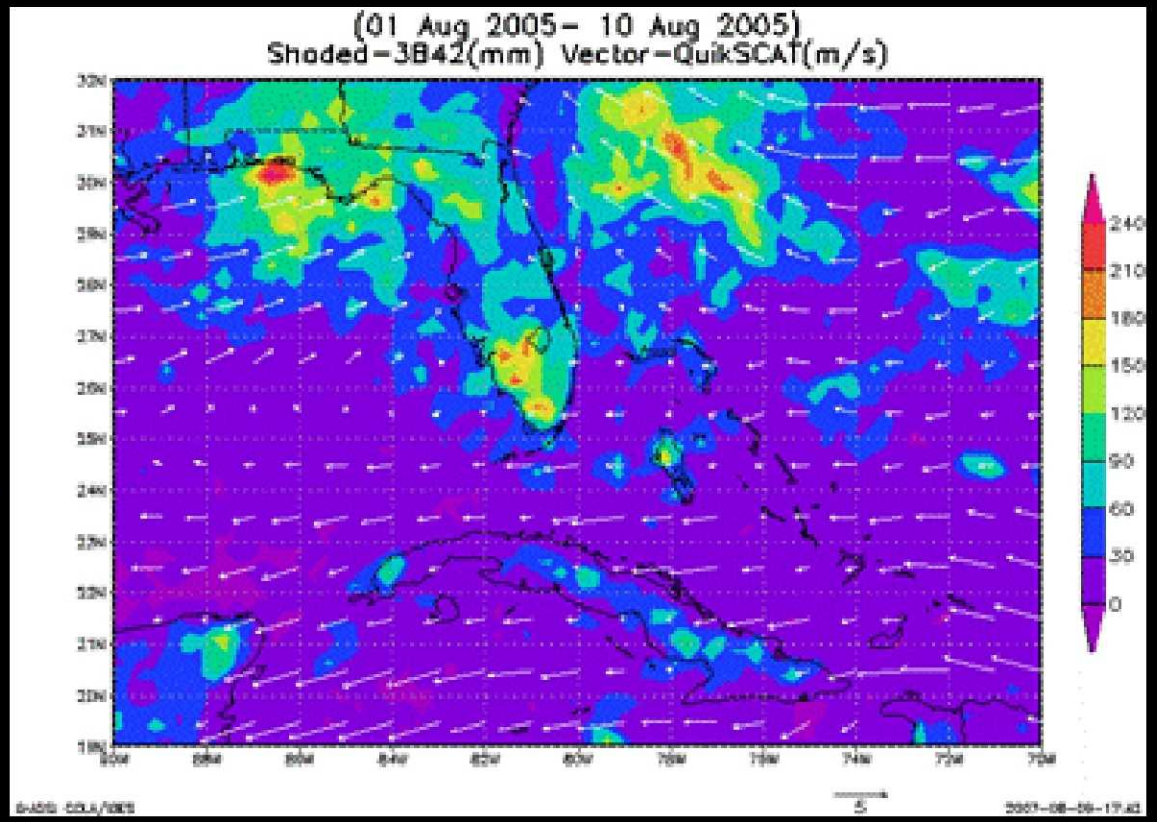
CALIOP Aerosol Flag (yellow)



Thank You

http://disc.gsfc.nasa.gov/

QuikSCAT wind vector data overlaid upon TRMM precipitation data



Backup

Data Archive and Distribution with *S4PA*

Simple, Scalable, Script-based, Science Product Archive

- Radically simplified architecture for archive and distribution
- Features
  - Public and restricted-access
  - Subscriptions
  - Automated data integrity checking

Interfaces to:

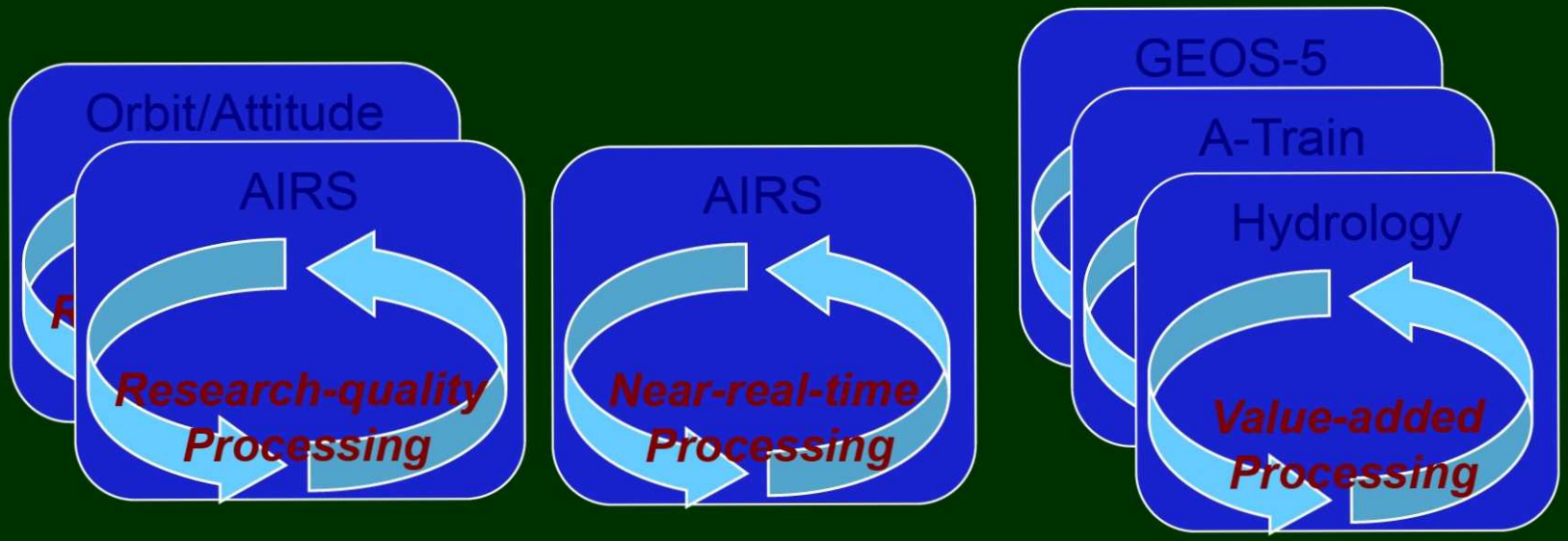
- S4PM processing system
- Science Investigator Processing Systems (SIPS)
- EOS Data Operations (EDOS)
- Mirador search tool
- Giovanni
- Global Change Master Directory
- EOS Clearinghouse

Data Processing with *S4PM*

Simple, Scalable, Script-based Science Processor for Measurements

- In-house developed open-source software
- Runs all data processing at the GES DISC since 2002
- Near-real-time processing: AIRS, MLS/Aura (in progress)
- Reused by LaRC for CALIPSO, FlashFlux, MISR, EDC for ASTER On-Demand

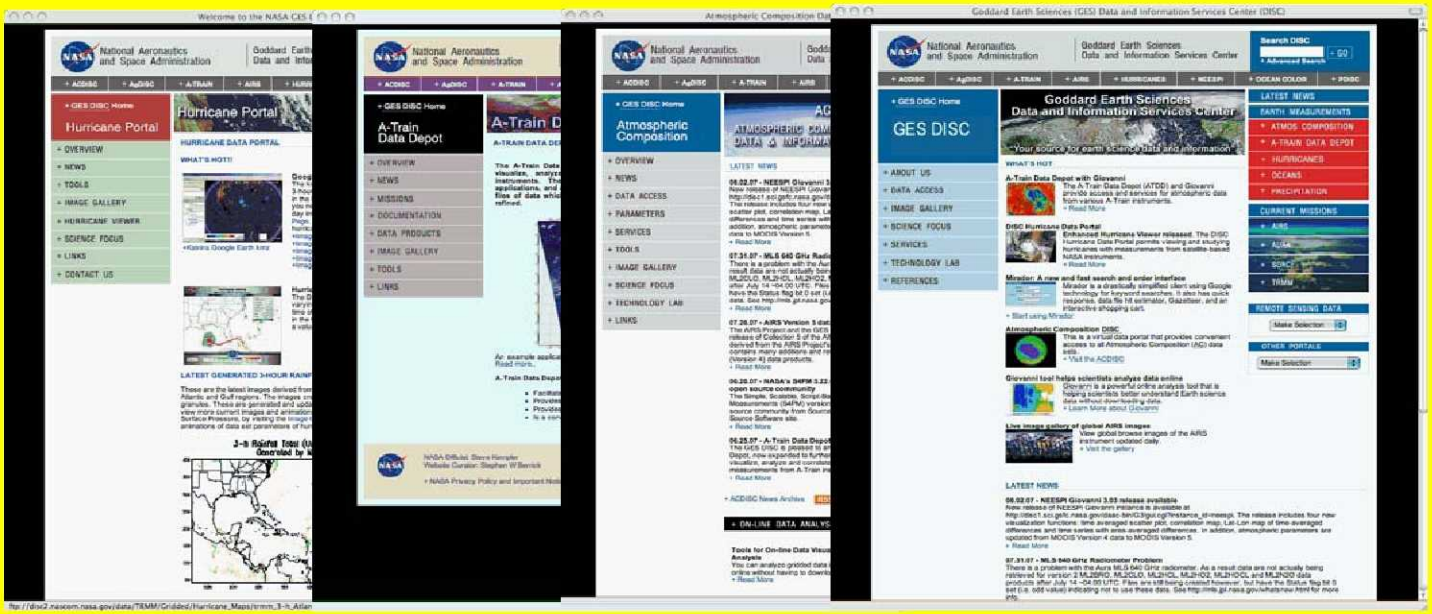
http://s4pm.sci.gsfc.nasa.gov



Data & Information Web Portals

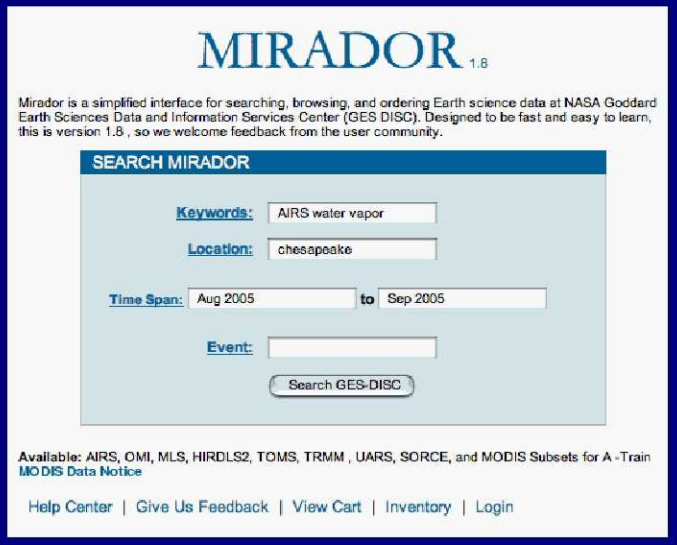
Community and project based portals
Accessible from http://disc.gsfc.nasa.gov
Tailored to the users being served

- Multi-mission science research
- Discipline specific portals
- Remote data access

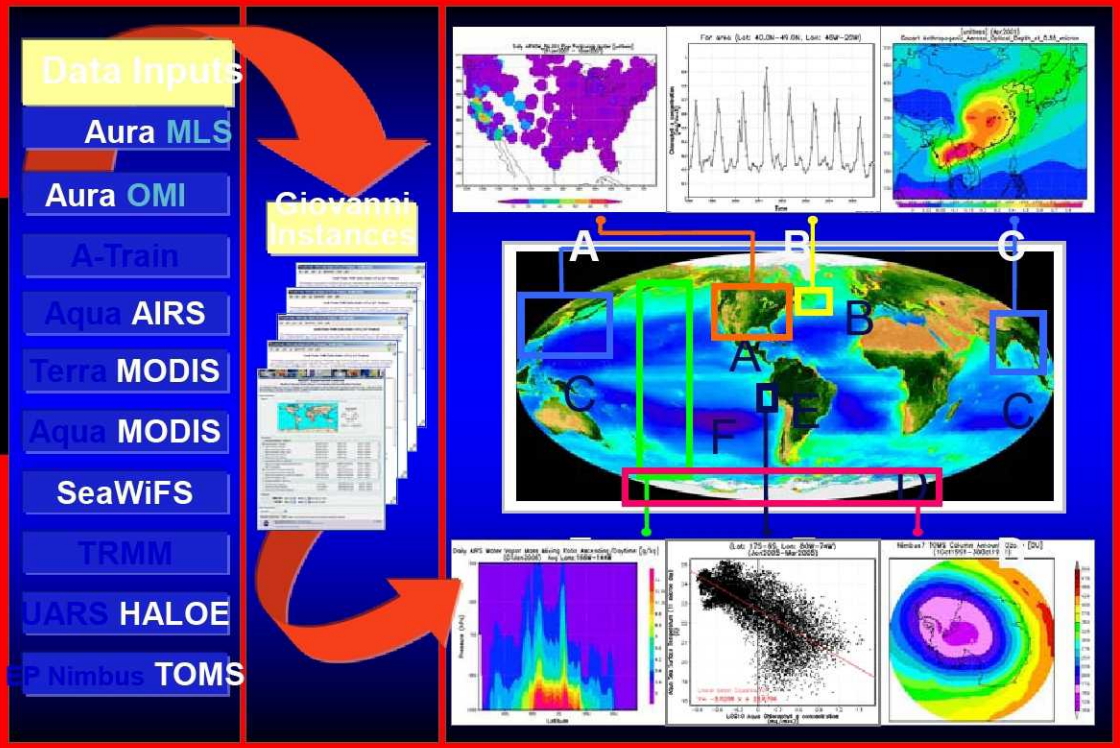


Mirador Data Search

- http://mirador.gsfc.nasa.gov
- Based on Google
- Fast, easy to use
- Gazetteers for places and events
- Can support portals
- Also available as Web Service



Giovanni: Data Visualization and Analysis



http://giovanni.gsfc.nasa.gov

- Data from multiple sensors
- Single- and multi-parameter statistics
- Multiple output formats and protocols
  - JPEG and PNG
  - WMS
  - HDF
  - netCDF
  - ASCII
  - KML for Google Earth
- Multiple input formats & protocols
  - HDF4 and HDF5
  - OPeNDAP
  - WCS
  - Web Services (including SciFlo)
  - Standard FTP
- Data lineage support (in development)

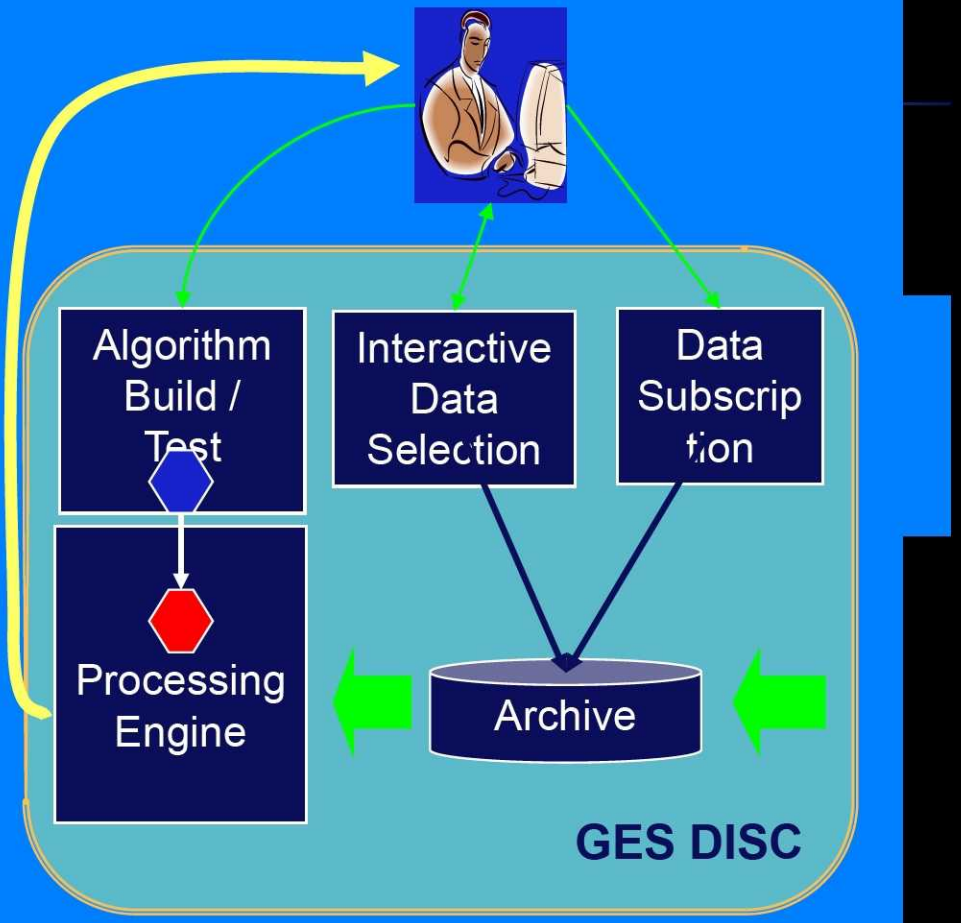
Data Mining

Data mining services available in S4PM

- Users submit and execute data mining algorithms
- Simple Web interface
- Subscriptions process new data as they arrive
- Mining results are made available to user via FTP

Coming Soon: Mining Web Services

- ADaM mining algorithms from Univ. Alabama-Huntsville
- Invoked via Web Services interface



Some Handy Acronyms

- DAAC – Distributed Active Archive Center (the collective name for all NASA Earth science data centers)
- GES DISC – GSFC Earth Sciences Data and Information Services Center (the name of the DAAC located at NASA's Goddard Space Flight Center)
- EOS – Earth Observing System
- EOSDIS – EOS Data and Information System
- ESDIS – Earth Science Data and Information Systems Project
- GSFC – Goddard Space Flight Center

EOSDIS Evolution at the GES DISC: 2006-2007

Pre-Evolution System Characteristics	Evolved System Characteristics
Generalized interface(s)	Discipline-specific interfaces in addition to generalized interface(s)
Tape archive - All products archived - Order data for delivery	Disk archive - Some products processed on demand (virtual products) - Download data automatically upon choosing
Search and order tools	Tools to find, explore, and analyze data
Distribute standard products	Distribute lower volume tailored products
System changes require long lead time	System changes implemented quickly according to priority
Steward data	Steward data

EOSDIS Evolution at the GES DAAC: 2009 – 2013

Evolved System Characteristics	Future System Characteristics
Discipline-specific interfaces in addition to generalized interface(s)	Discipline-specific, multi-mission, services oriented interfaces in addition to generalized interface(s)
Disk archive - Some products processed on demand (virtual products) - Download data automatically	Disk archive - Access provided to all products archived locally and remotely - Download data automatically upon choosing
Tools to find, explore, and analyze data	Web-based tools to provide for comprehensive discovery, access, visualization and analysis of coherently related Earth science datasets (satellite, ground-based and model output) to enable interdisciplinary Earth science research
Distribute lower volume tailored products	- Distribute lower volume tailored products - Broker hard to get data
System changes implemented quickly according to priority	System changes implemented quickly according to priority within given budget cap
Steward data	Steward data