Giovanni for AEROCOM

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Outline

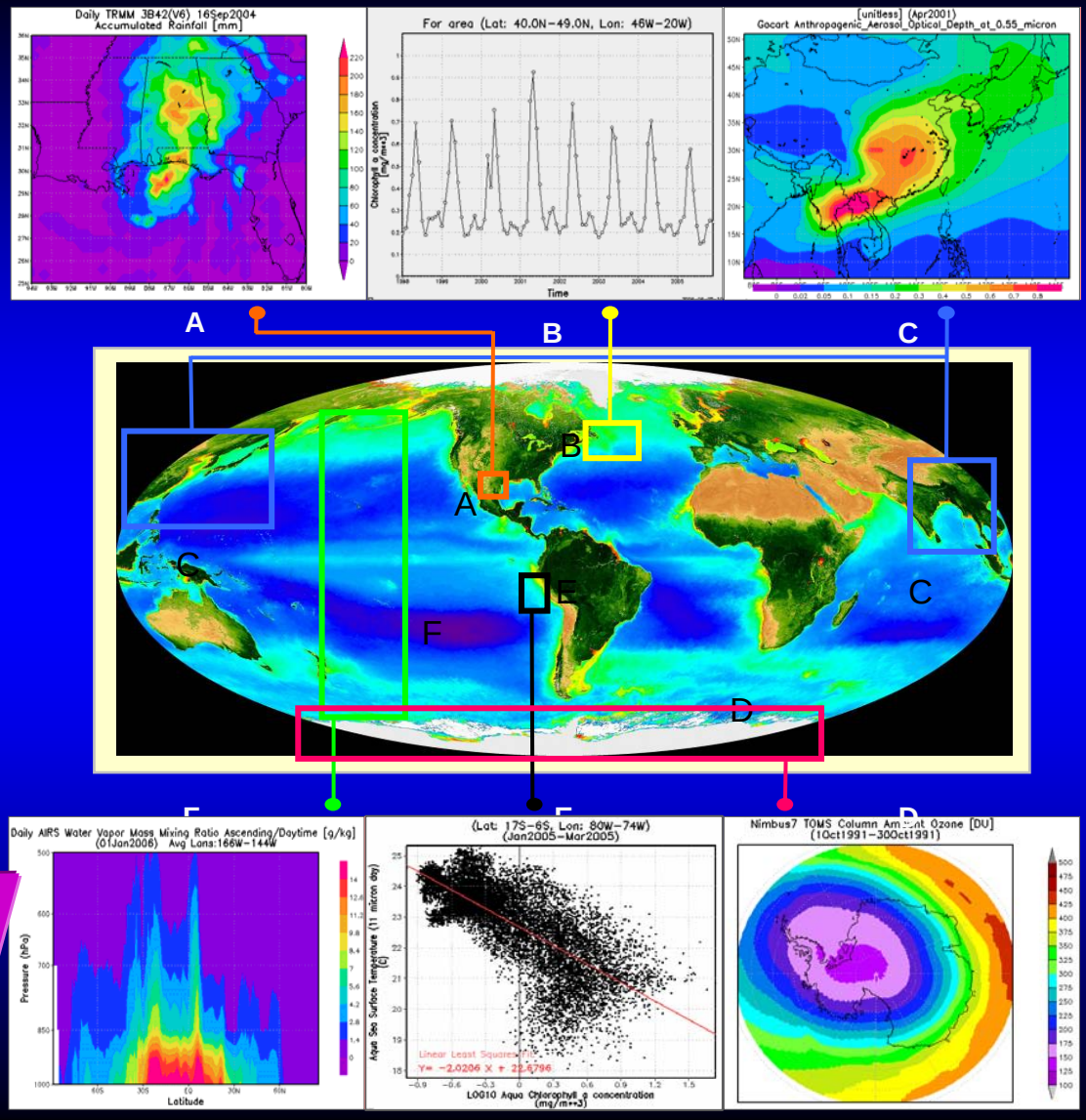
- Multi-sensor aerosol measurements: daily/monthly gridded maps
- Giovanni: online visualization and analysis
- Multi-sensor intercomparison
- Aerosol data fusion
- Comparison with models
- Swath co-location (A-Train)
- Plans for the future

What is Giovanni?

Data Inputs

- MLS Aura
- OMI Aura
- MODIS Aqua
- AIRS Aqua
- MODIS Terra
- SeaWiFS
- TRMM
- HALOE UARS
- TOMS EP Nimbus
- AMSR-E Aqua
- MISR Terra
- CloudSat
- CALIOP CALIPSO

Giovanni Instances



GES-DISC Interactive Online Visualization and Analysis Infrastructure (Giovanni)

- With Giovanni and a few mouse clicks, one can easily obtain information on atmosphere state from around the world
- No need to learn data formats and to retrieve and process data
- Assess various phenomena interactively
- Try various combinations of parameters measured by different instruments
- All the statistical analysis is done via a regular web browser

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

Caution: *Giovanni is an exploration tool*

Giovanni capabilities

Basic (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
- **Hovmoller plots** –longitude-time or latitude-time cross sections
- **ASCII output** – for all plot types (can be used with GIS apps)
- **Image animation** – for area plot
- **Vertical profiles**
- **Vertical cross-sections, zonal means**

Beyond basics:

- **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** - regional (i.e., spatially averaged) relationship between two parameters
- **Temporal correlation map** - relationship between two parameters at each grid point in the selected spatial area
- **Temporal correlation of area averaged parameters** - a single value of the correlation coefficient of a pair of selected parameters
- **Difference plots**
- **Anomaly plots**
- **Acquiring parameter and spatial subsets** in a batch mode through Giovanni

Giovanni - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

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

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+ Tech Lab Home
+ GES DISC Home

Giovanni

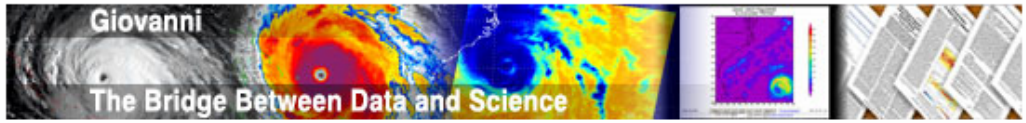
+ OVERVIEW

SEARCH DISC

leptoukh

+ GO

+ ADVANCED SEARCH



GIOVANNI

Current Giovanni Interfaces

These Giovanni interfaces are operational:

Agricultural Online Visualization and Analysis System	View snapshot
AIRS Online Visualization and Analysis System	View snapshot
Aura MLS Online Visualization and Analysis System	View snapshot
MODIS Online Visualization and Analysis System (MOVAS)	View snapshot
Ocean Color Time-Series Project	View snapshot
OMI Online Visualiation and Analysis System	View snapshot
TOMS Online Visualization and Analysis System	View snapshot
TRMM Online Visualization and Analysis System (TOVAS)	View snapshot
UARS HALOE Online Visualization and Analysis System	View snapshot

For full descriptions, features, and list of parameters available in each of our Giovanni interfaces, please check our Giovanni Interface Description Web page.

What is Giovanni?

The GES-DISC Interactive Online Visualization ANd aNalysis Infrastructure (Giovanni) is the underlying infrastructure for a growing family of Web interfaces that allows users to analyze gridded data interactively online without having to download any data. Through Giovanni, users are invited to discover and explore our data using sophisticated analyses and visualizations.

In the future, there will be more instances of Giovanni available and we

GIOVANNI NEWS

04.18.2006 OMI Level 2G now available in Giovanni
The OMI Level 2G total column ozone gridded product is now available in OMI Giovanni. This OMI Giovanni (now separated from TOMS Giovanni) allows users to interactively filter by quality flag and viewing zenith angle.
+ Explore OMI Giovanni

04.05.2006 GPCP Data now available in TOVAS Giovanni
Global Precipitation (GPCP, 1979 - 2005) data are available through TOVAS Giovanni. In addition, TRMM V5 data products have been replaced by TRMM V6. Also, new options have been made available on resultant image page, including "Unit options (mm or inch)" and "Nonlinear color scale".
+ Explore TOVAS

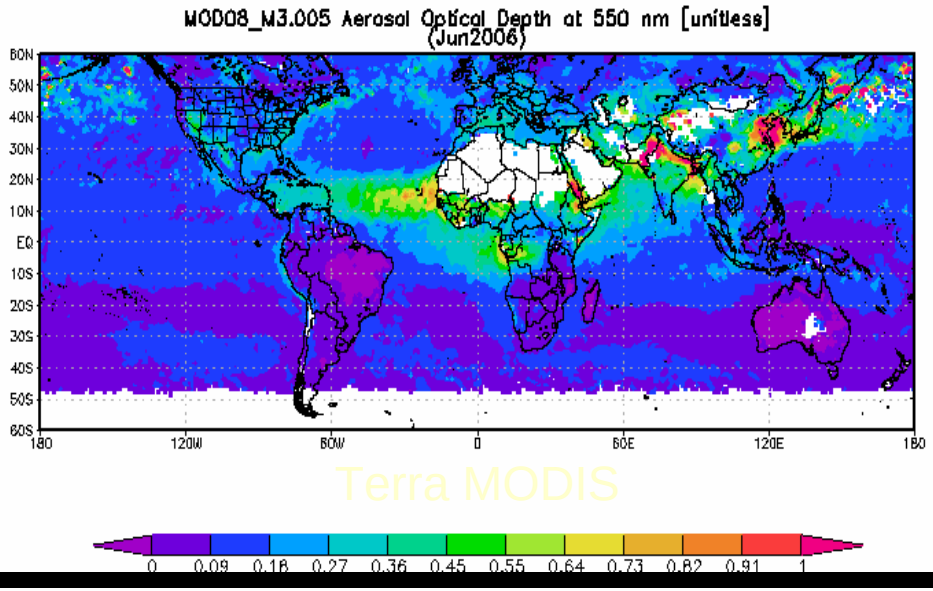
03.31.2006 New MODIS Aqua SST available in Giovanni
A new version of MODIS Aqua Sea Surface Temperature (SST) has been added to the Ocean Color Time-Series Project Giovanni subsequent to the full dataset reprocessing by the OBPG. The data product used in

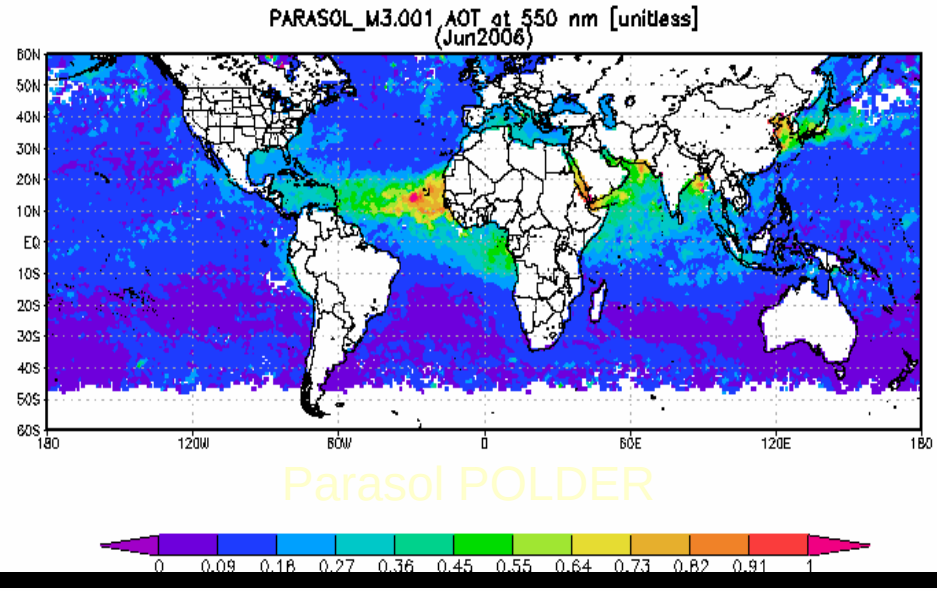
Gridded aerosol data in Giovanni

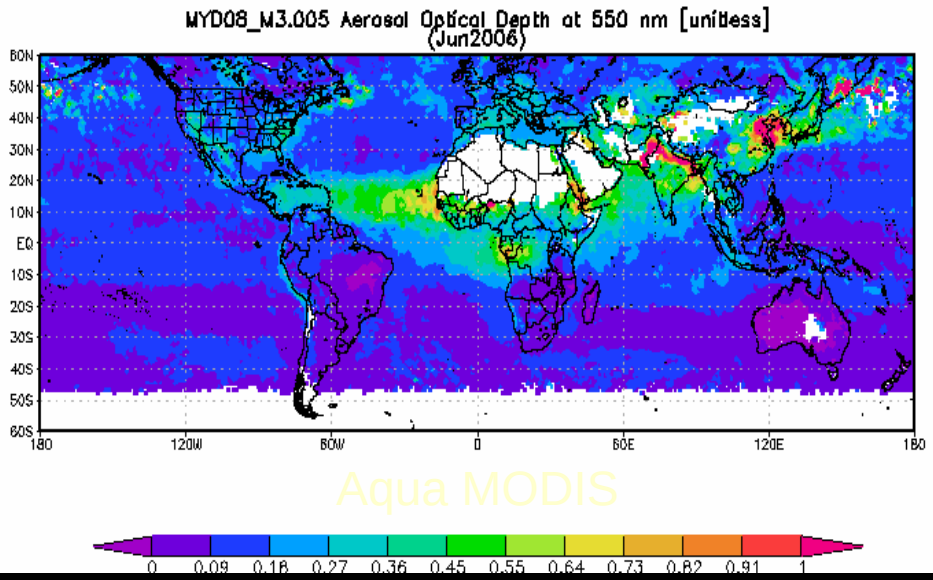
- MODIS Terra
- MODIS Aqua
- OMI Aura
- MISR Terra (re-introducing)
- POLDER Parasol (in testing)
- MERIS Envisat (prototype)
- GOCART (in preparation)

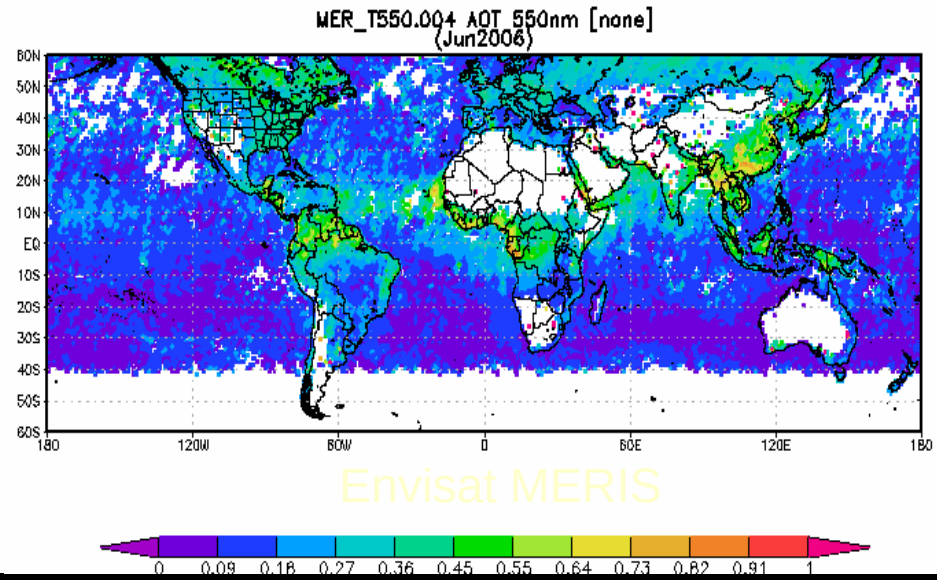
Also, CALIPSO feature mask for curtains

AOT for June 2006

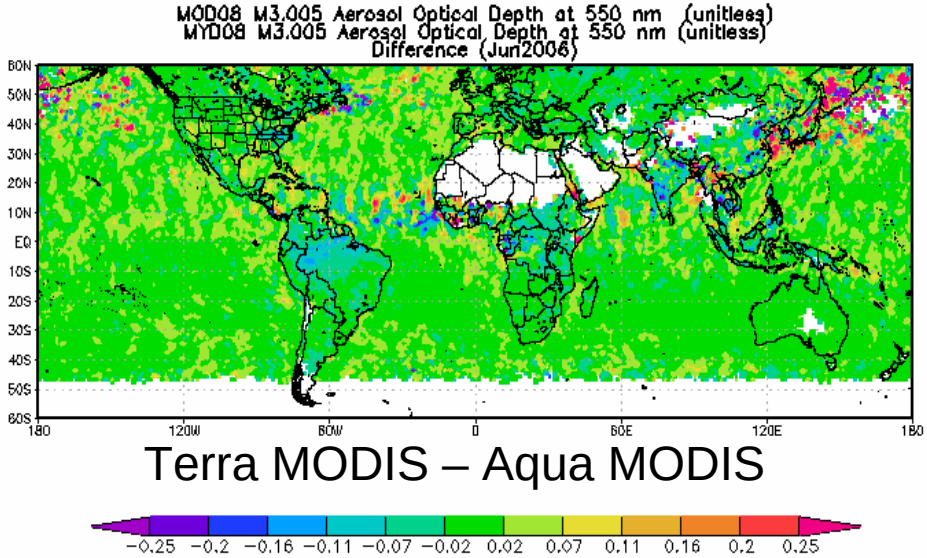




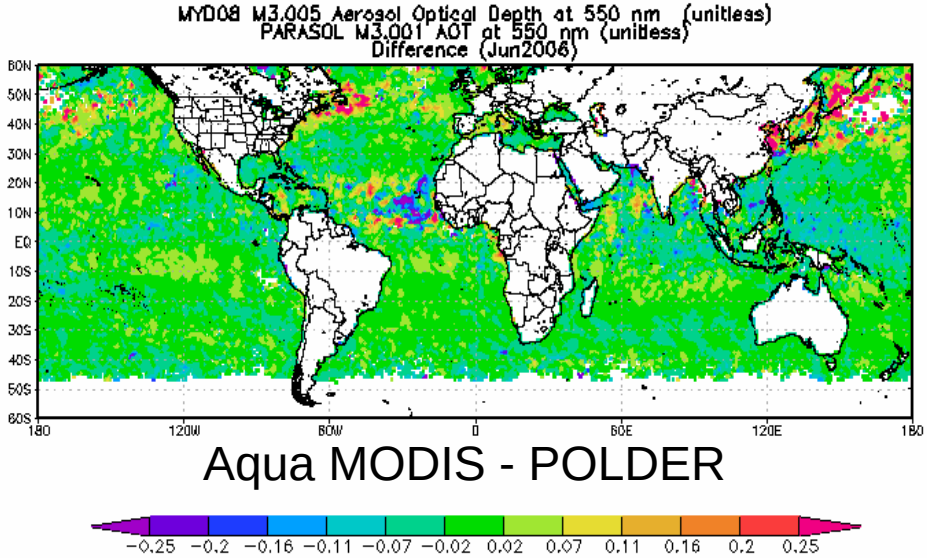




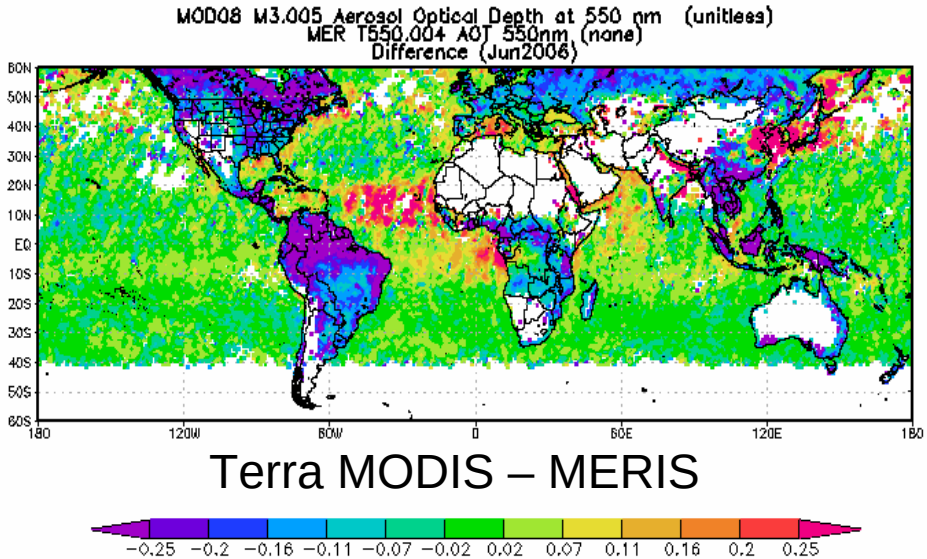
AOT Differences for June 2006



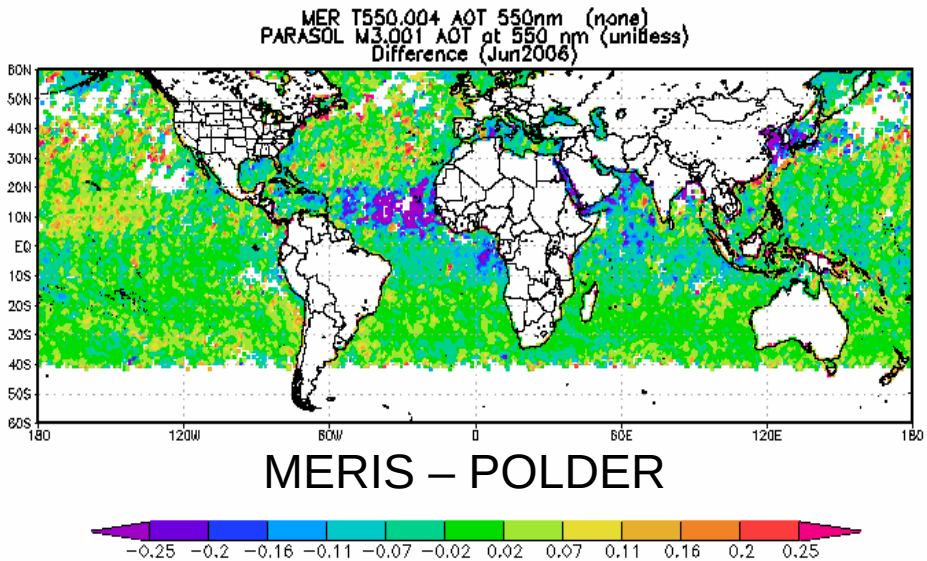
Terra MODIS – Aqua MODIS



Aqua MODIS - POLDER

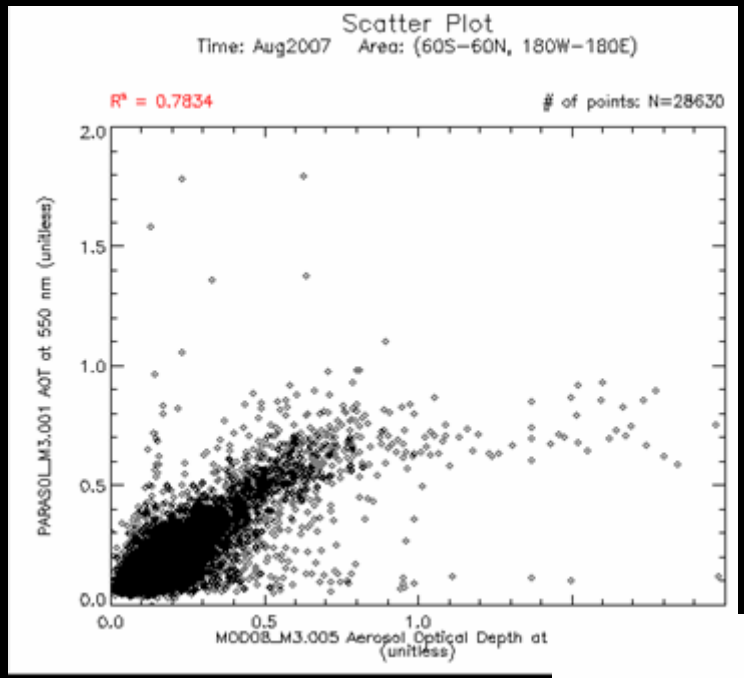


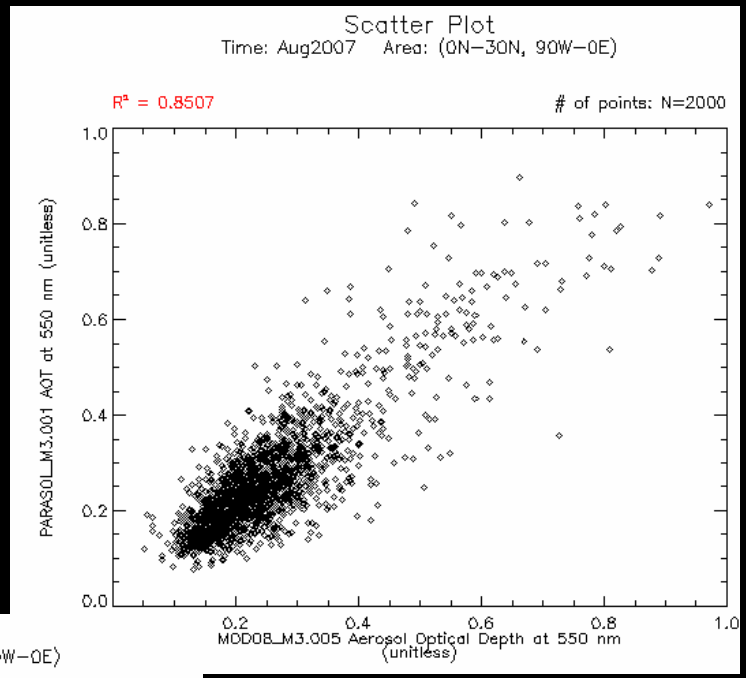
Terra MODIS – MERIS

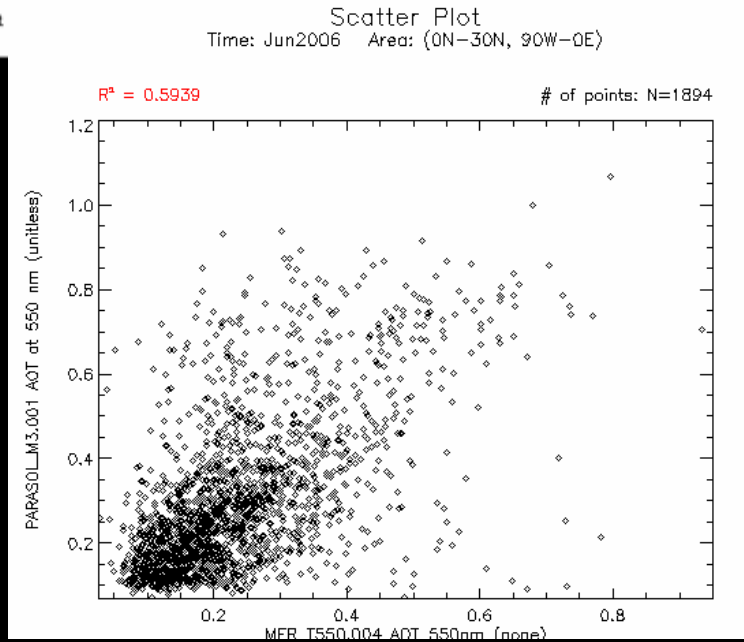


MERIS – POLDER

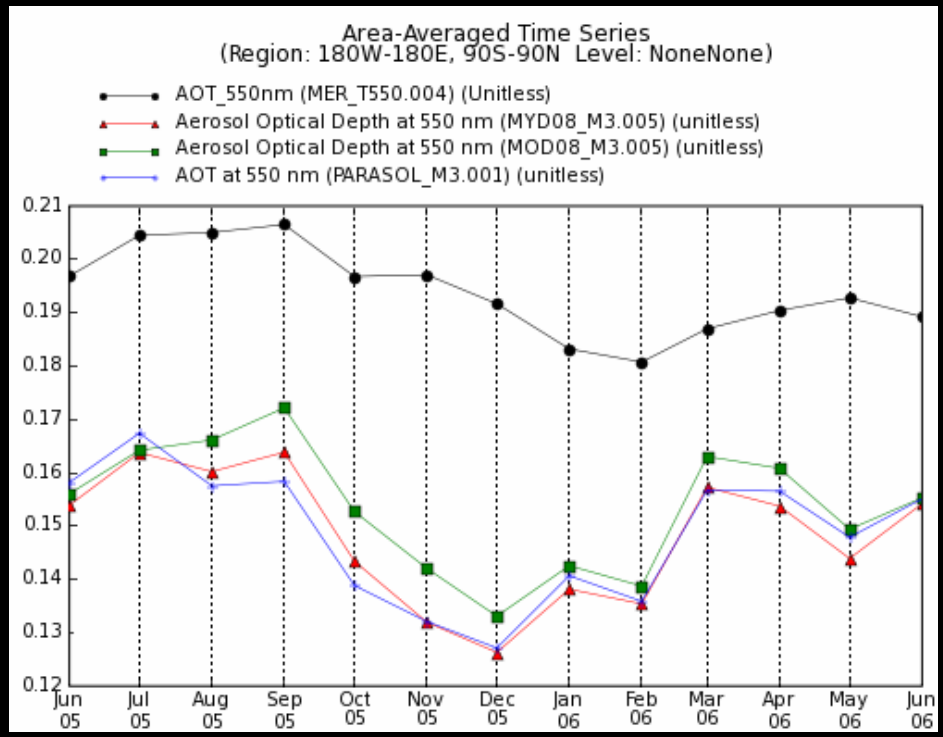
Scatter plots

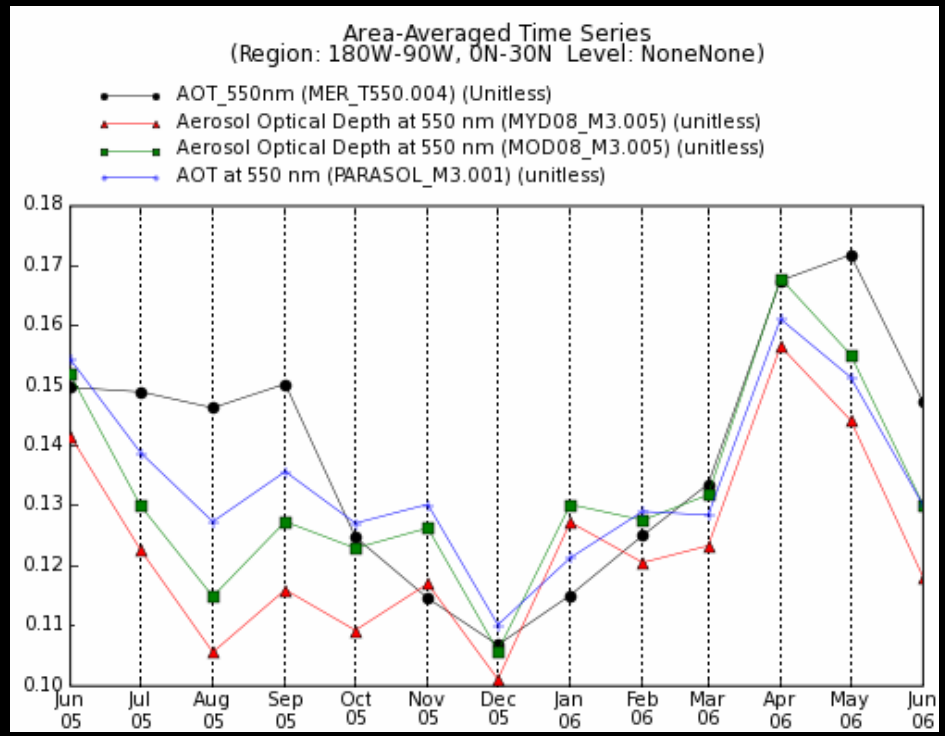






Time series


Area-Averaged Time Series
(Region: 180W-180E, 90S-90N Level: NoneNone)
AOT_550nm (MER_T550.004) (Unitless)
Aerosol Optical Depth at 550 nm (MYD08_M3.005) (unitless)
Aerosol Optical Depth at 550 nm (MOD08_M3.005) (unitless)
AOT at 550 nm (PARASOL_M3.001) (unitless)
0.21
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
Jun 05
Jul 05
Aug 05
Sep 05
Oct 05
Nov 05
Dec 05
Jan 06
Feb 06
Mar 06
Apr 06
May 06
Jun 06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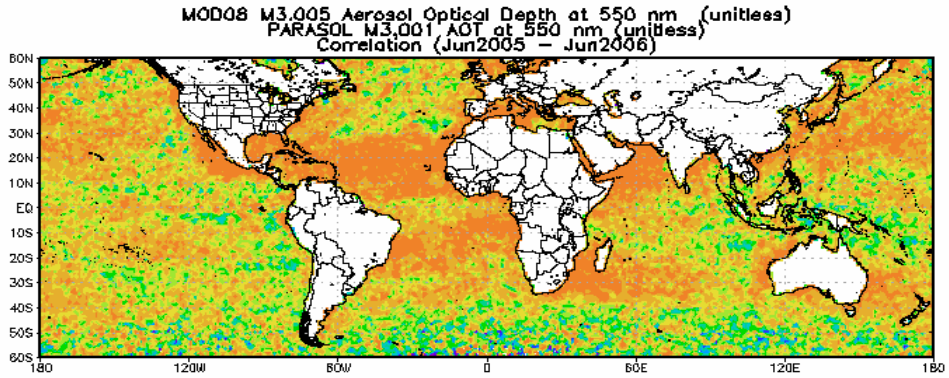
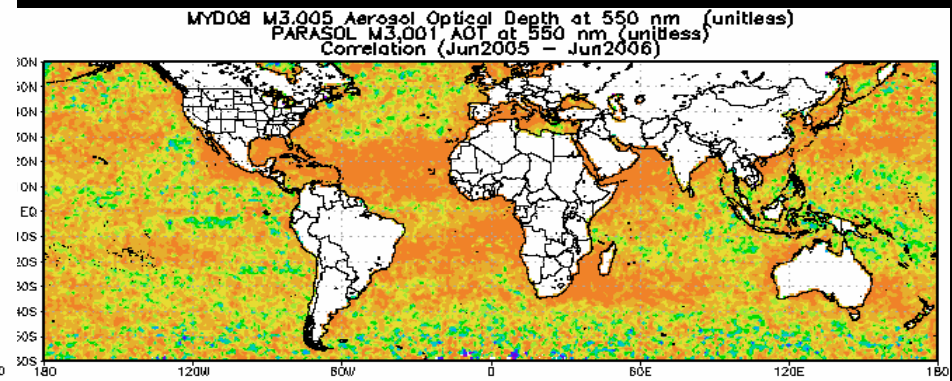
(Region: 180W-90W, 0N-30N Level: NoneNone)
AOT_550nm (MER_T550.004) (Unitless)
Aerosol Optical Depth at 550 nm (MYD08_M3.005) (unitless)
Aerosol Optical Depth at 550 nm (MOD08_M3.005) (unitless)
AOT at 550 nm (PARASOL_M3.001) (unitless)
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
Jun 05
Jul 05
Aug 05
Sep 05
Oct 05
Nov 05
Dec 05
Jan 06
Feb 06
Mar 06
Apr 06
May 06
Jun 06

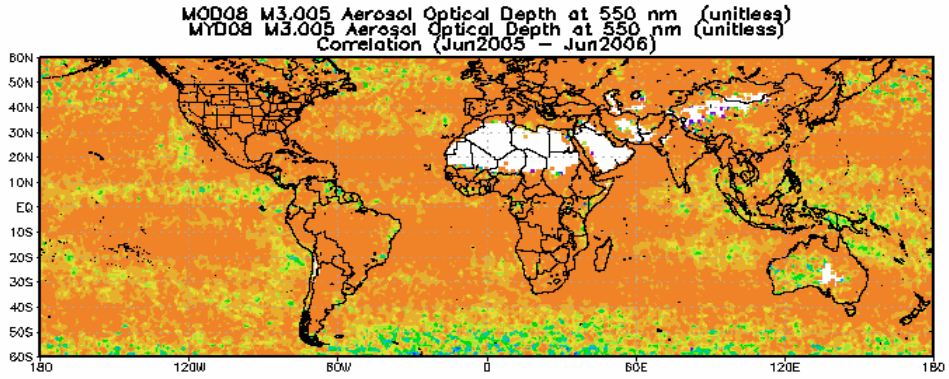
Maps of temporal correlations (June 2005 – June 2006)



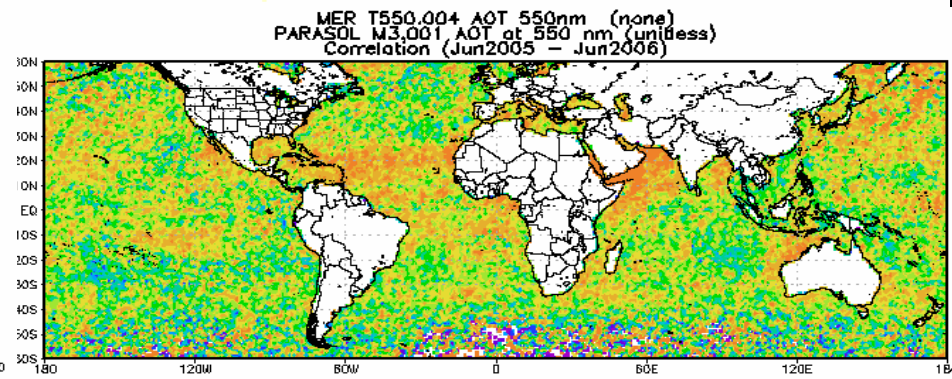
Terra MODIS - POLDER



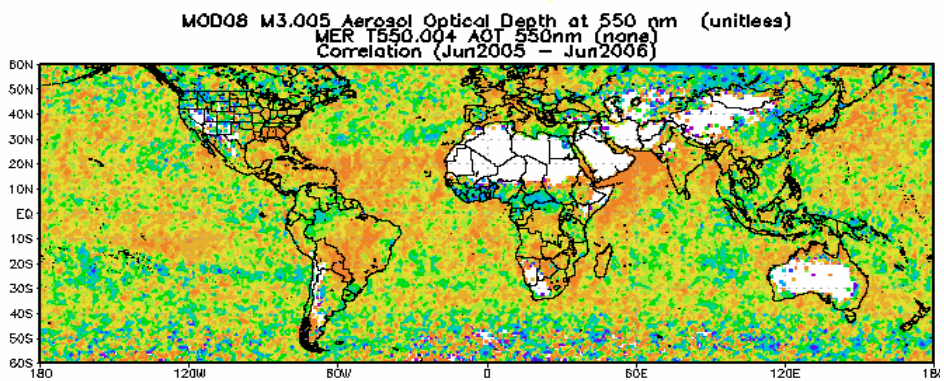
Aqua MODIS - POLDER



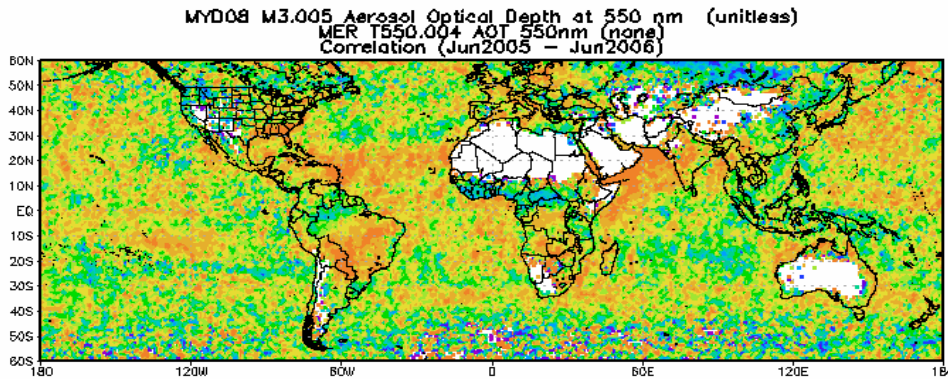
Terra MODIS – Aqua MODIS



MERIS – POLDER

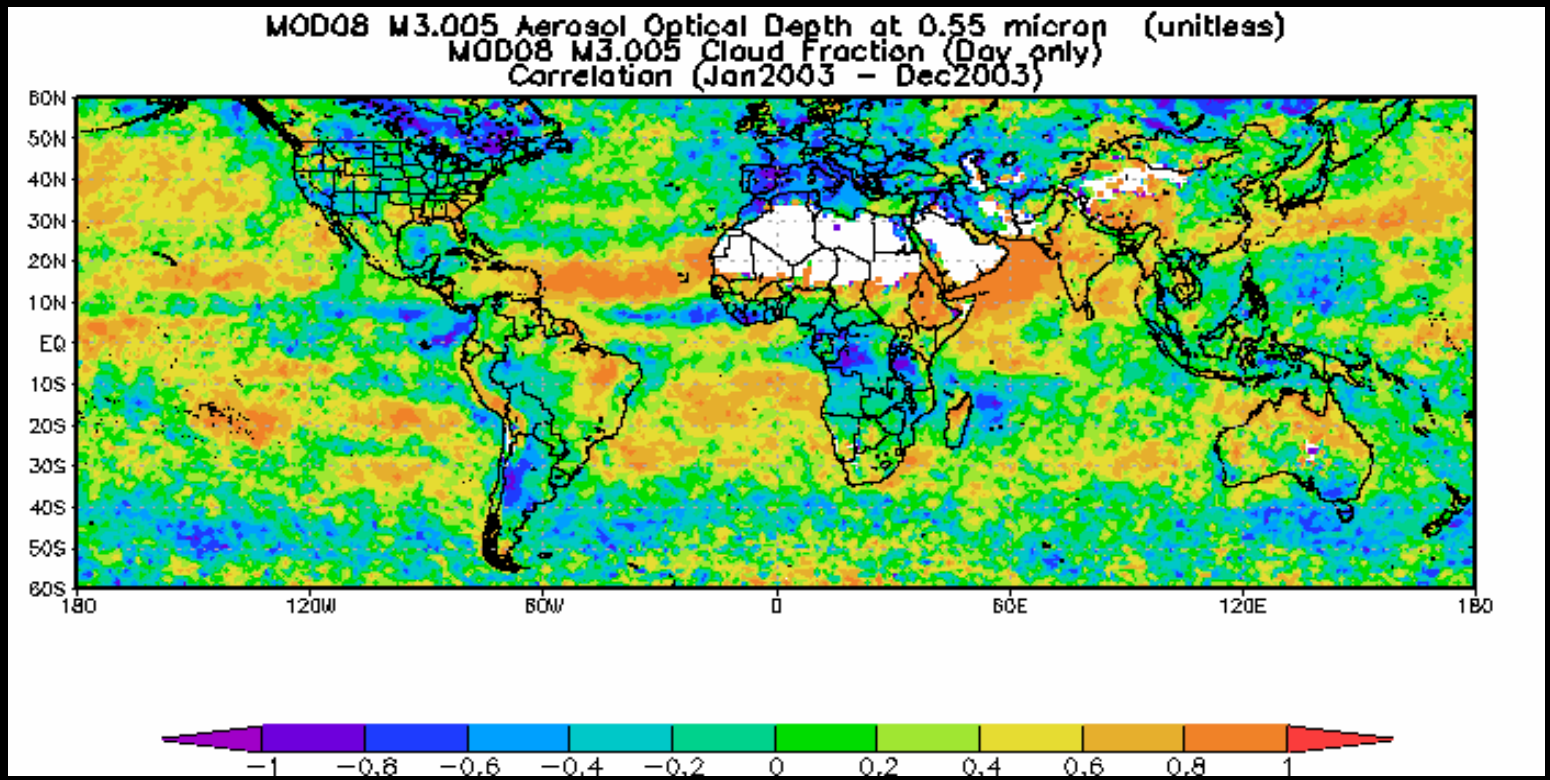


Terra MODIS – MERIS



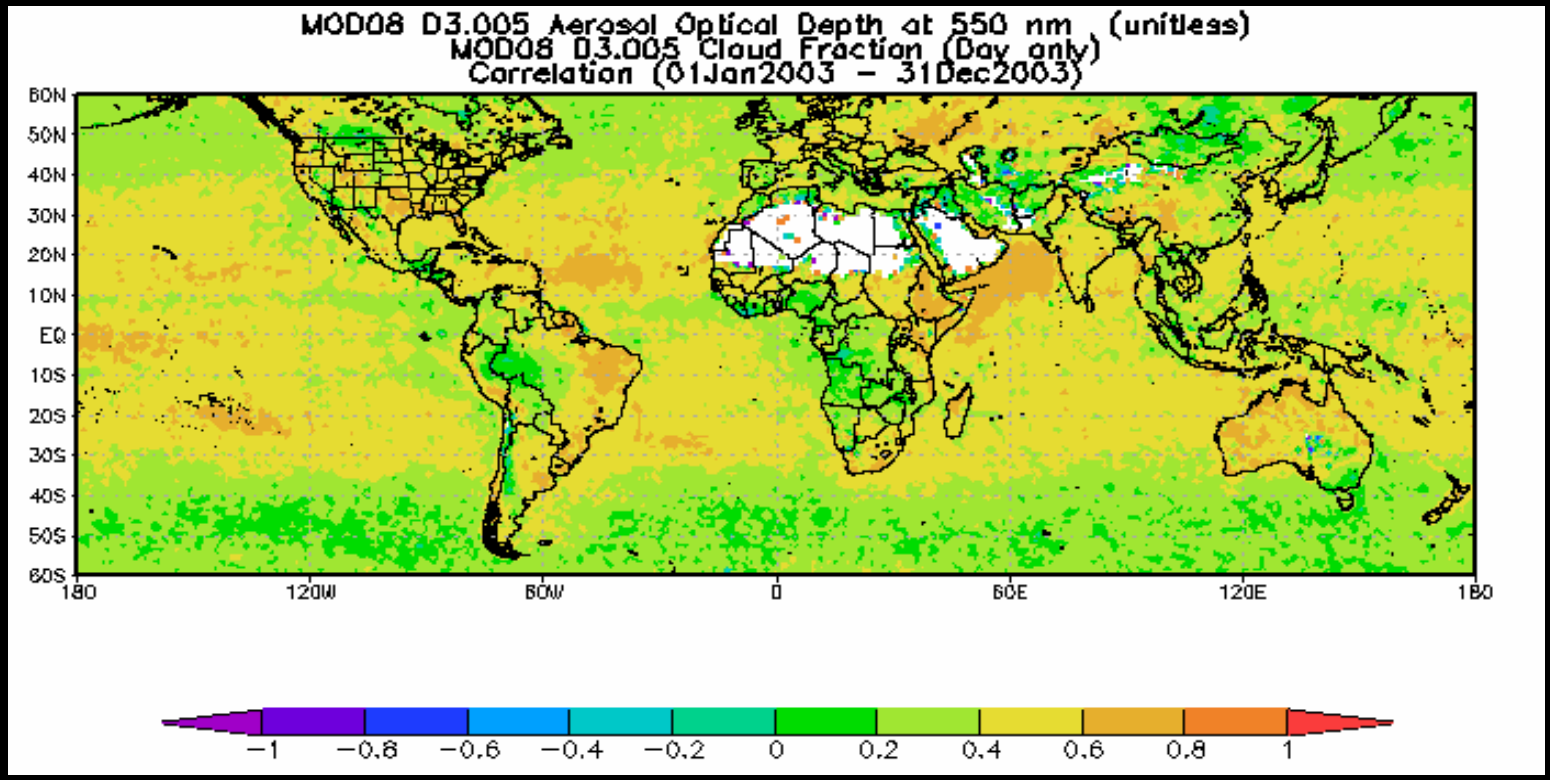
Aqua MODIS – MERIS

AOT-cloud fraction corr. using monthlies (2003)



The regional patterns of positive or negative correlation

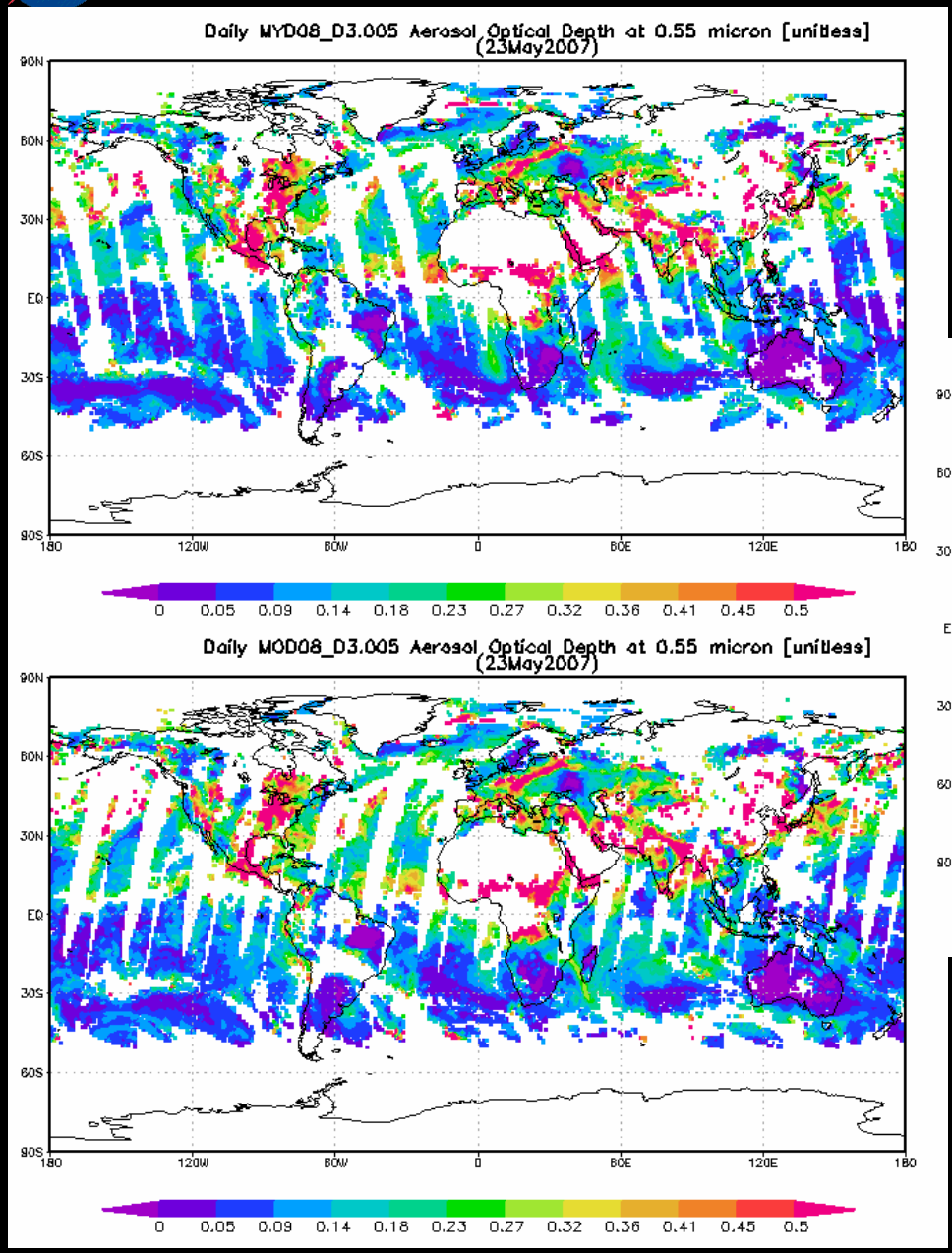
AOT- cloud fraction corr. using dailies (2003)

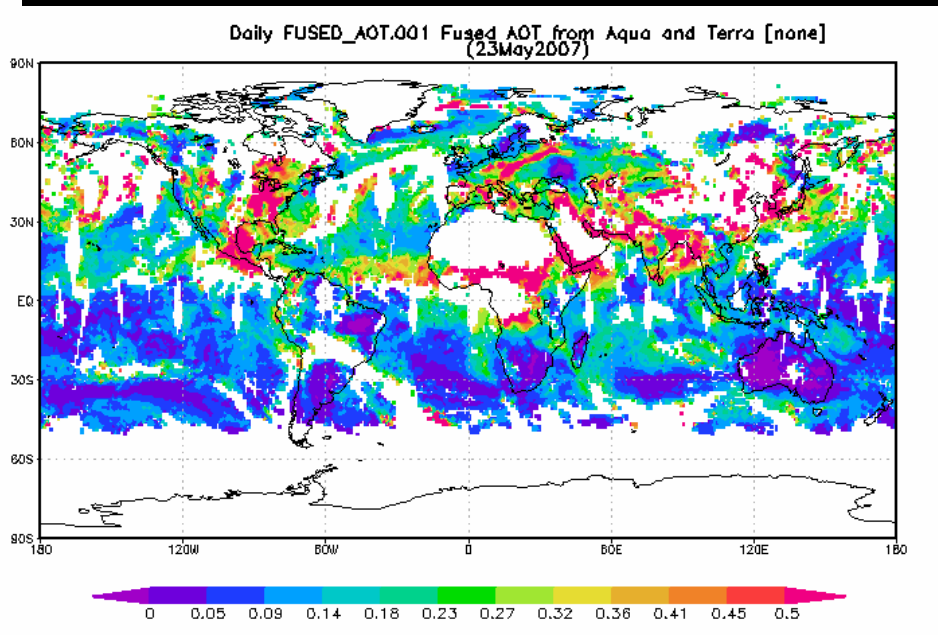


Less pronounced regional patterns of correlation

Data Fusion

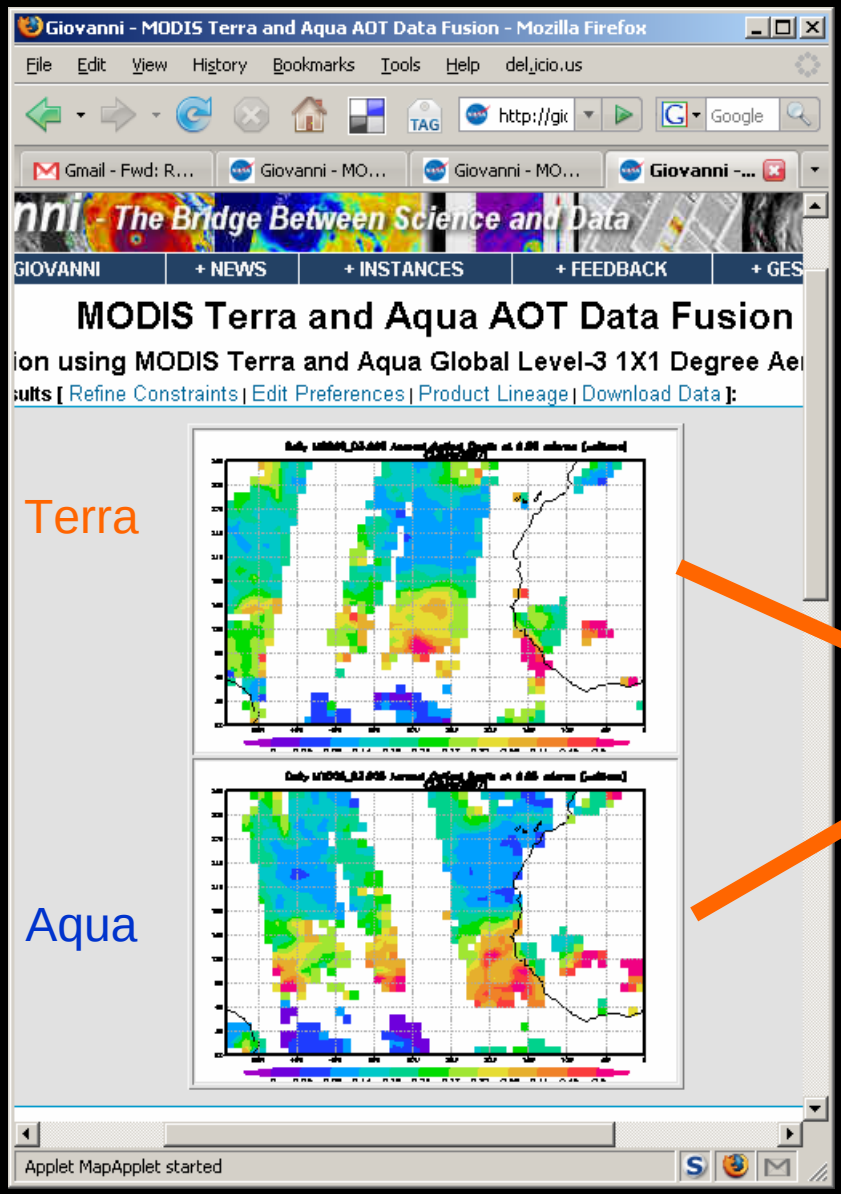
Increased spatial coverage: better feature tracking

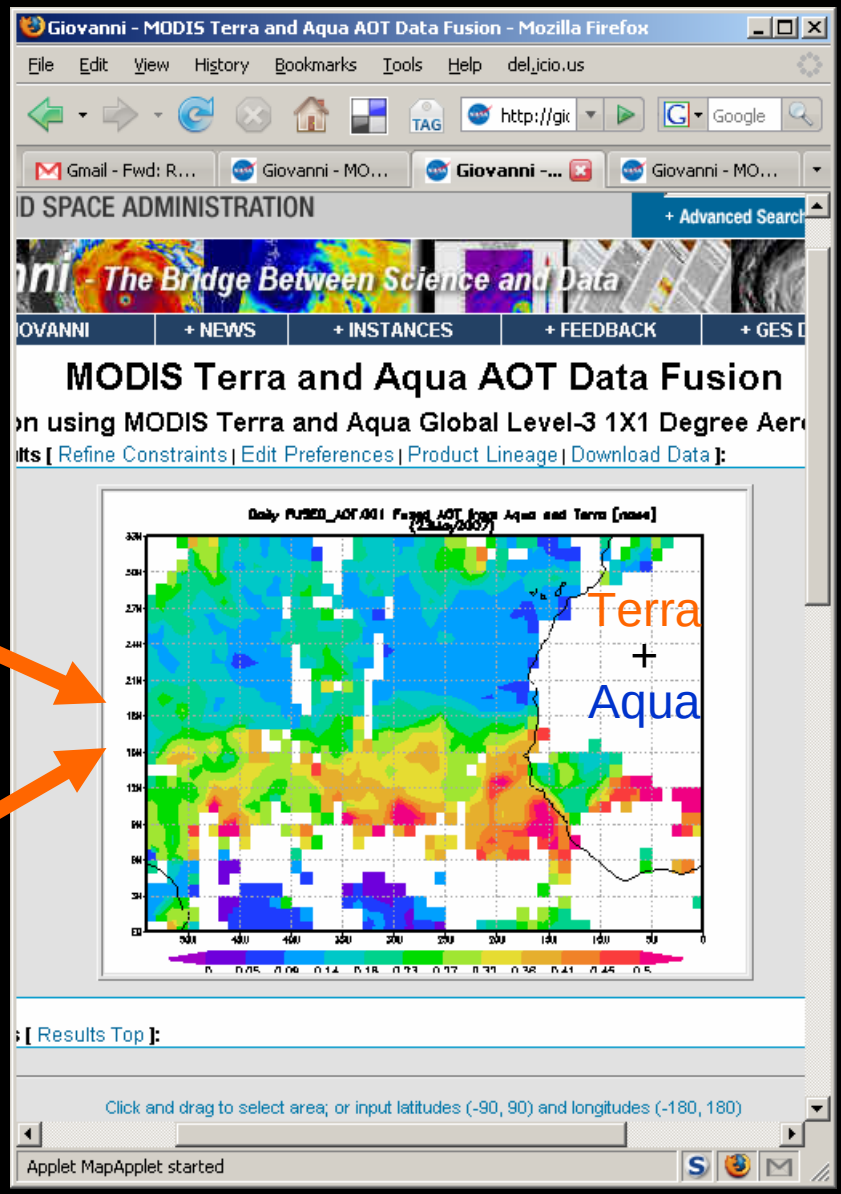




Terra + Aqua

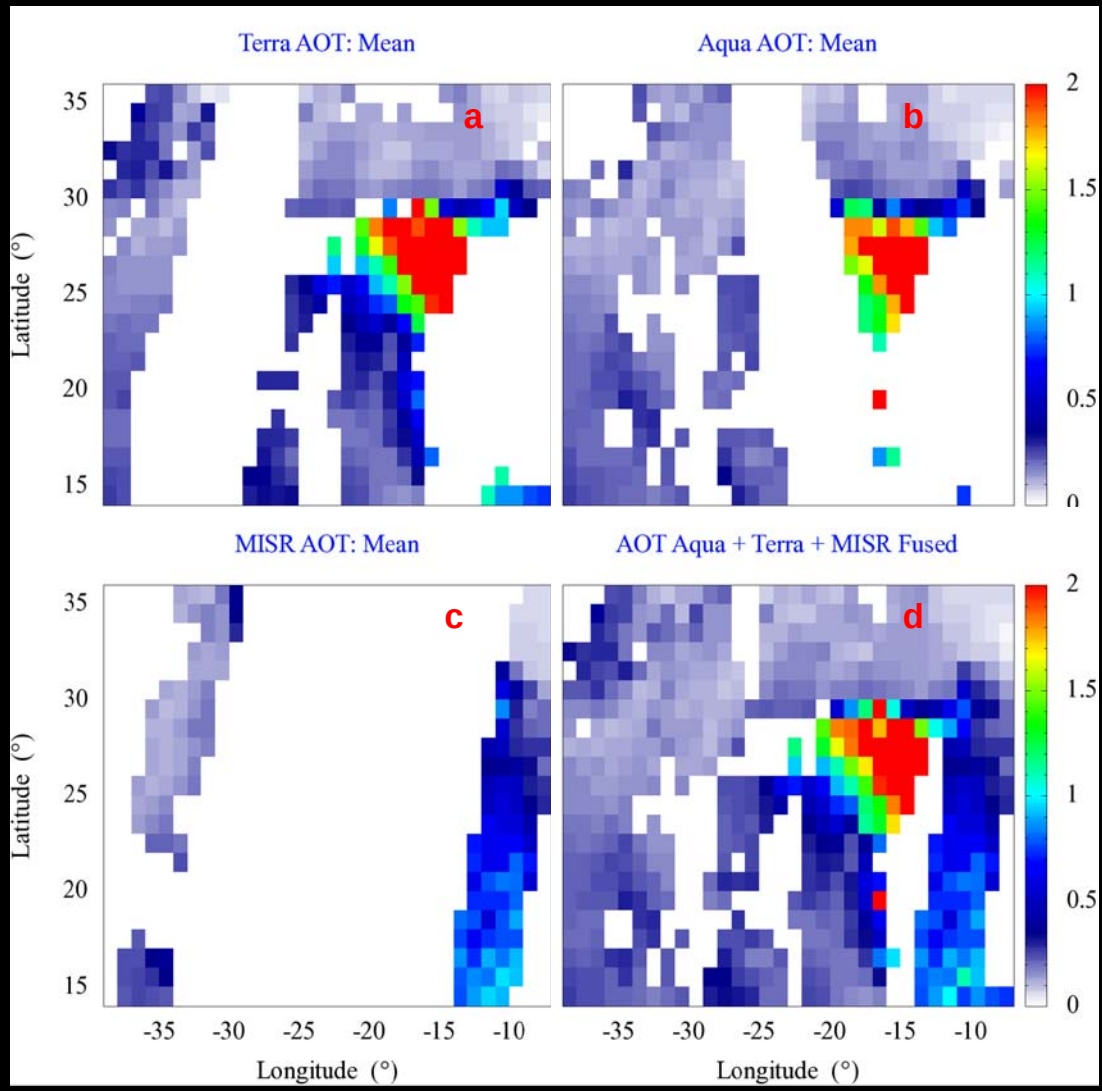
Data Fusion in Giovanni (prototype)



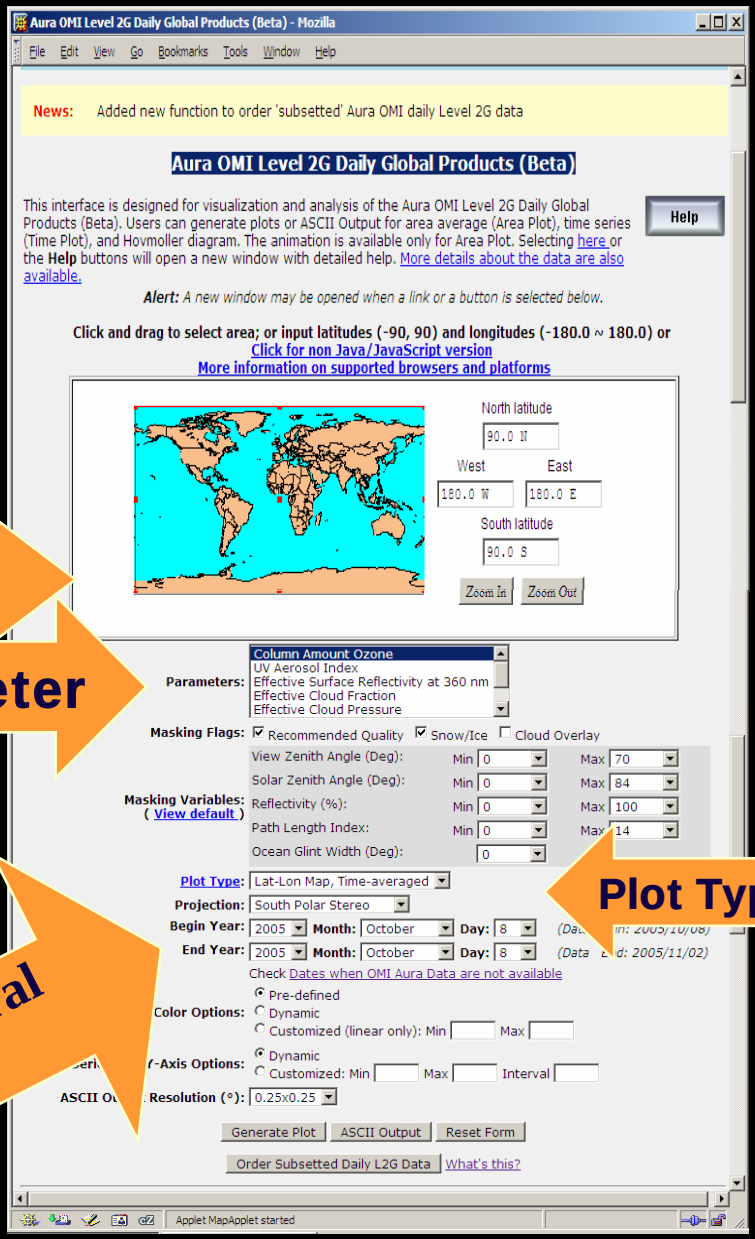


Dust event, May 23, 2007

Next step: Adding MISR



Trace gases



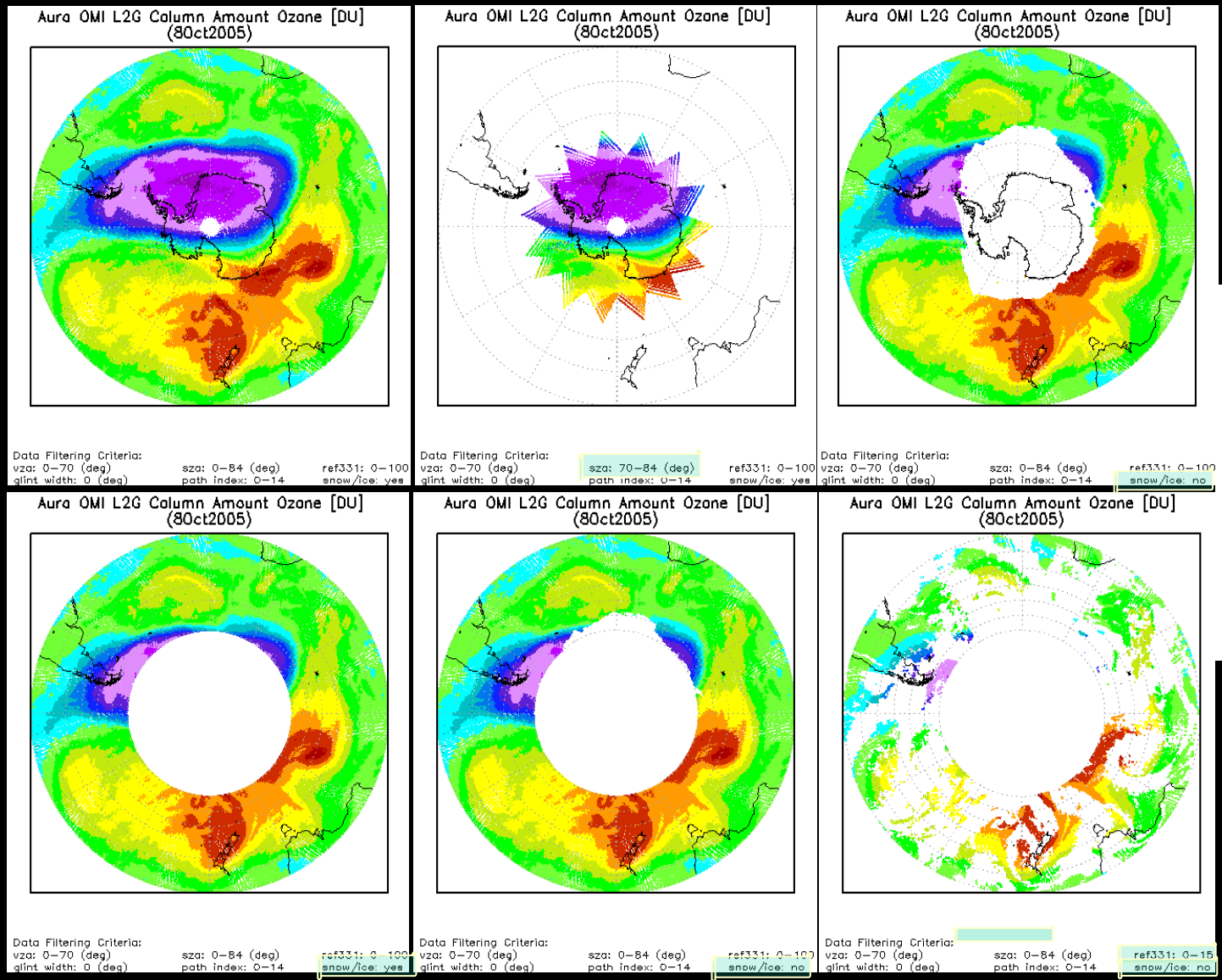
Area

Parameter

Daily temporal resolution !

Data filtering criteria

Plot Type


Aura OMI L2G Column Amount Ozone [DU]
(80ct2005)
Data Filtering Criteria:
vza: 0–70 (deg)
sza: 0–84 (deg)
ref331: 0–100
glint width: 0 (deg)
path index: 0–14
snow/ice: yes
Aura OMI L2G Column Amount Ozone [DU]
(80ct2005)
Data Filtering Criteria:
vza: 0–70 (deg)
sza: 70–84 (deg)
ref331: 0–100
glint width: 0 (deg)
path index: 0–14
snow/ice: yes
Aura OMI L2G Column Amount Ozone [DU]
(80ct2005)
Data Filtering Criteria:
vza: 0–70 (deg)
sza: 0–84 (deg)
glint width: 0 (deg)
path index: 0–14
snow/ice: no
500
475
450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
Aura OMI L2G Column Amount Ozone [DU]
(80ct2005)
Data Filtering Criteria:
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Aura OMI L2G Column Amount Ozone [DU]
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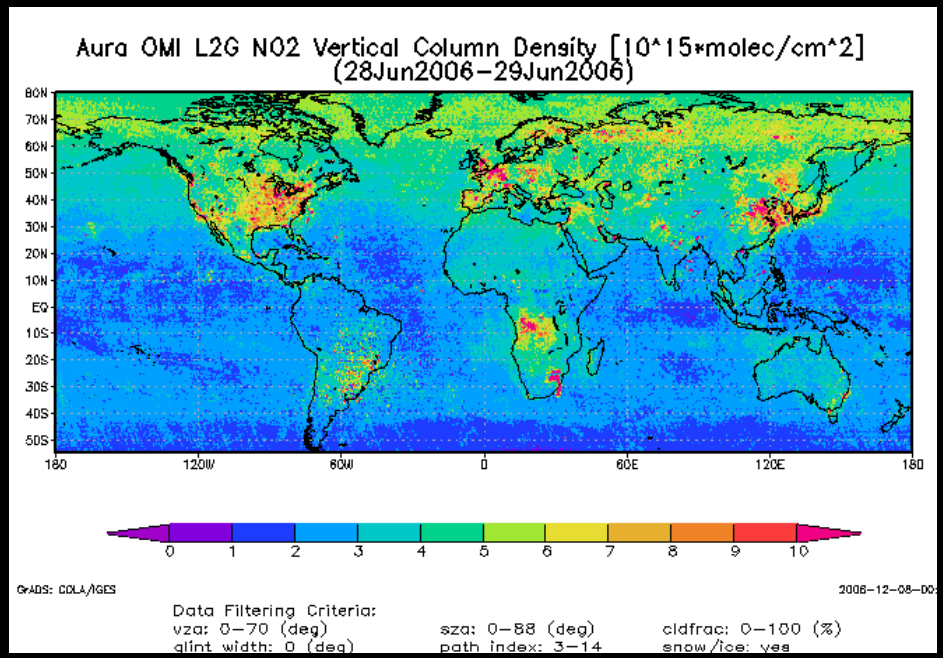
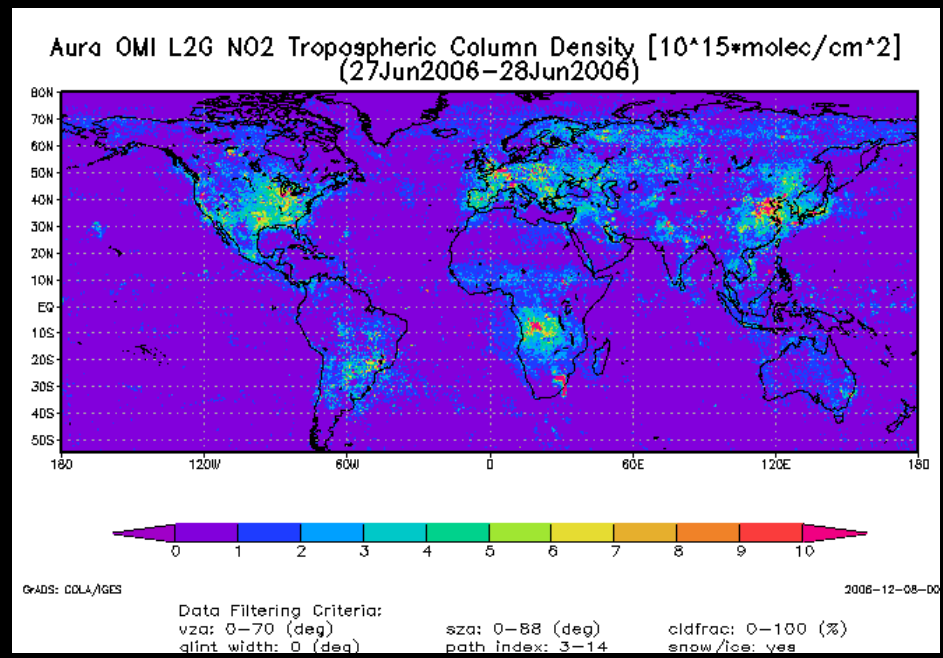
Aura OMI L2G Column Amount Ozone [DU]
(80ct2005)
Data Filtering Criteria:
vza: 0–70 (deg)
sza: 0–84 (deg)
glint width: 0 (deg)
path index: 0–14
snow/ice: no

OMI NO2 measurements





OMI Vertical Column NO2

OMI Tropospheric NO2

The A-Train Data Depot Purpose and Goals

Purpose

To be a focal point for researchers interested in learning about and using A-Train constellation data, by providing an integrated set of tools that facilitate/enhance the use of this data

Goals

- Co-locate data from A-Train sensors operationally
- Archive co-located data
- Provide quick exploration vis. Tool - Giovanni
- Provide convenient access to A-Train data…
- Facilitate A-Train data comparison (+ model data)….

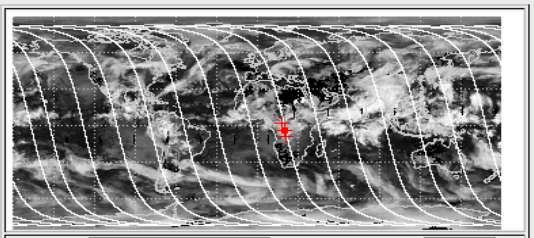
So A-Train researchers can concentrate on science!

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

Temporal

Orbit Date | Year 2007 | Month Sep | Day 6 | Update Map | *(Range: 02 Jun 2006 - 11 Sep 2007)*

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

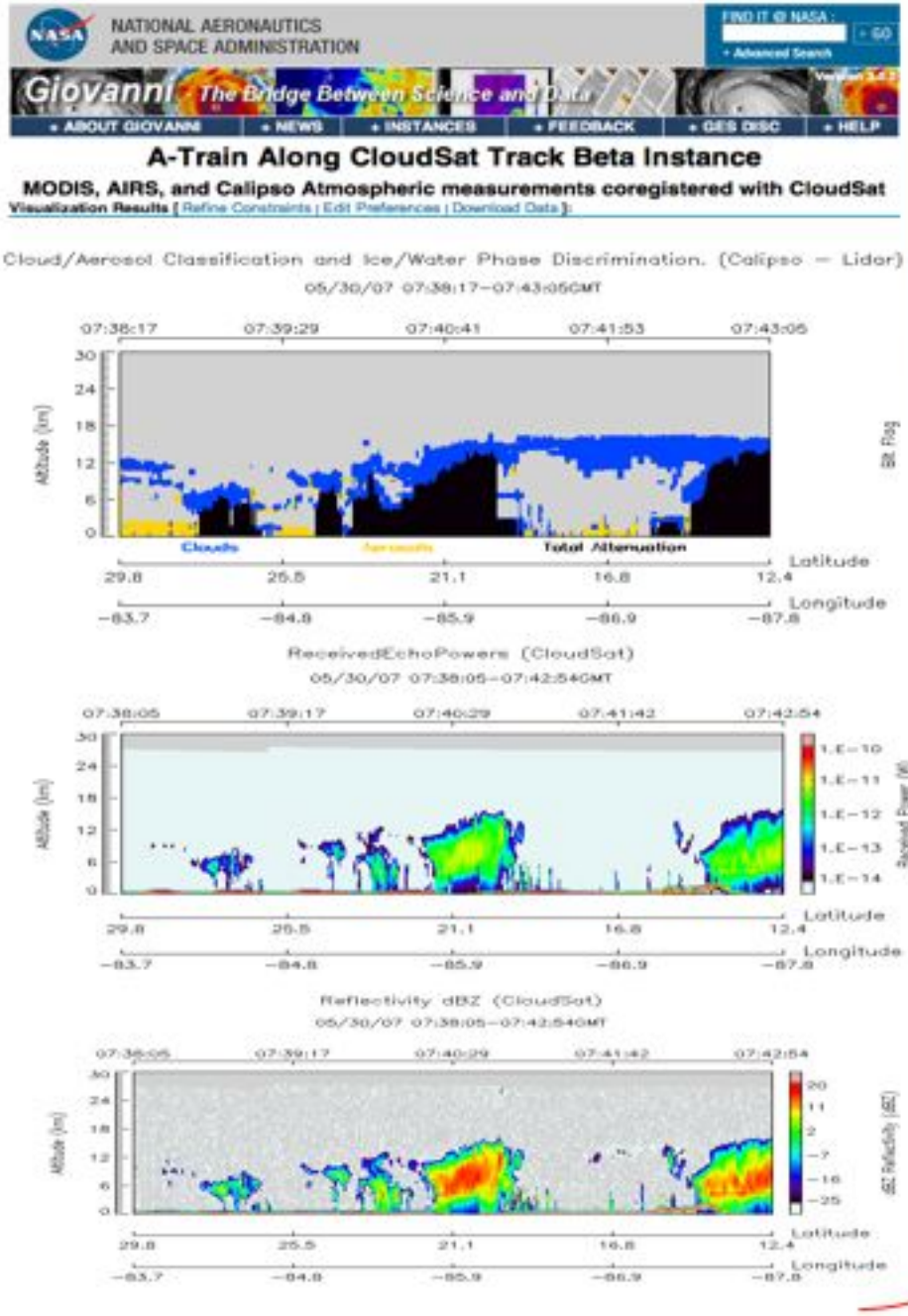
Surface(2002/08/30 - 2007/09/20)			
☑ Cloud Top Pressure in hPa (Horizontal Strip)	MAC06S1.002	MODIS Aqua	2006/06/02 - 2007/09/16
☑ Aerosol Optical Depth 550nm	MAC04S1.002	MODIS Aqua	2006/06/02 - 2007/09/16
☑ Effective Cloud Pressure for O3 (Raman Ring)	OMCLRRS0.001	OMI Aura	2007/08/11 - 2007/08/12
☑ 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

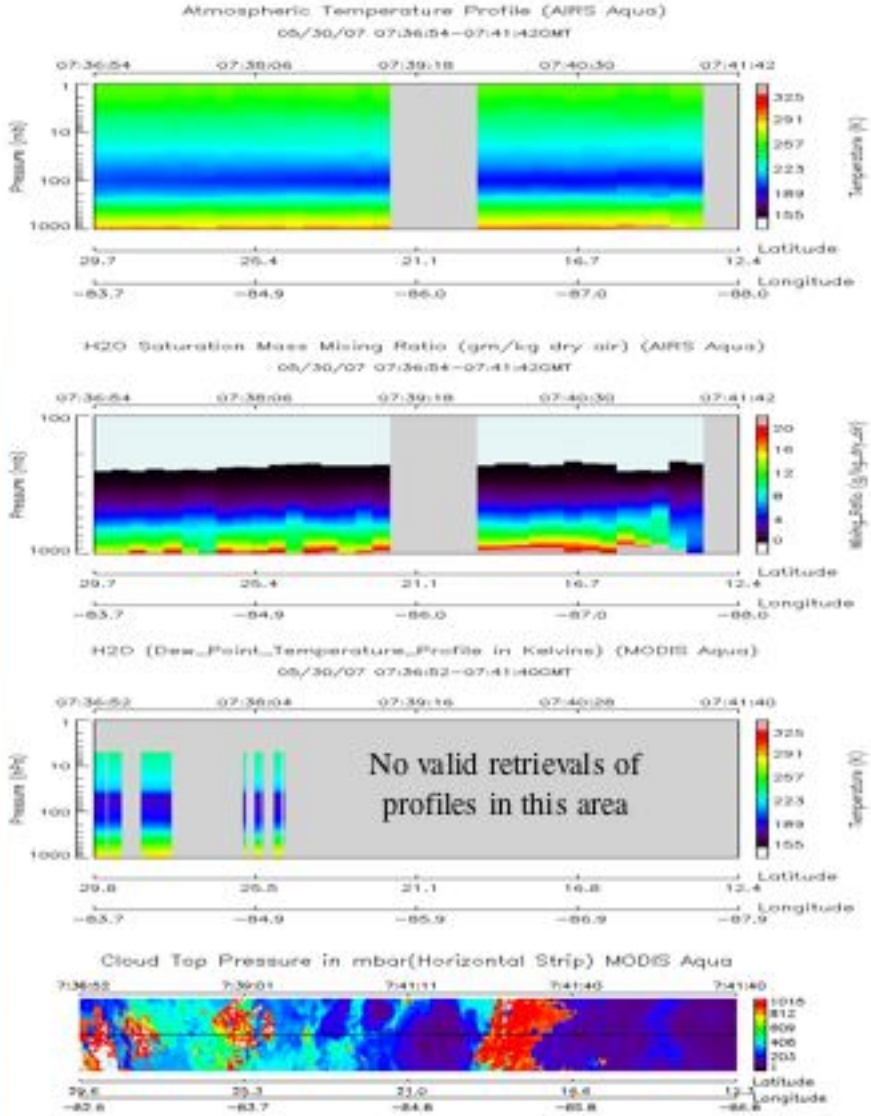
Select Visualization:

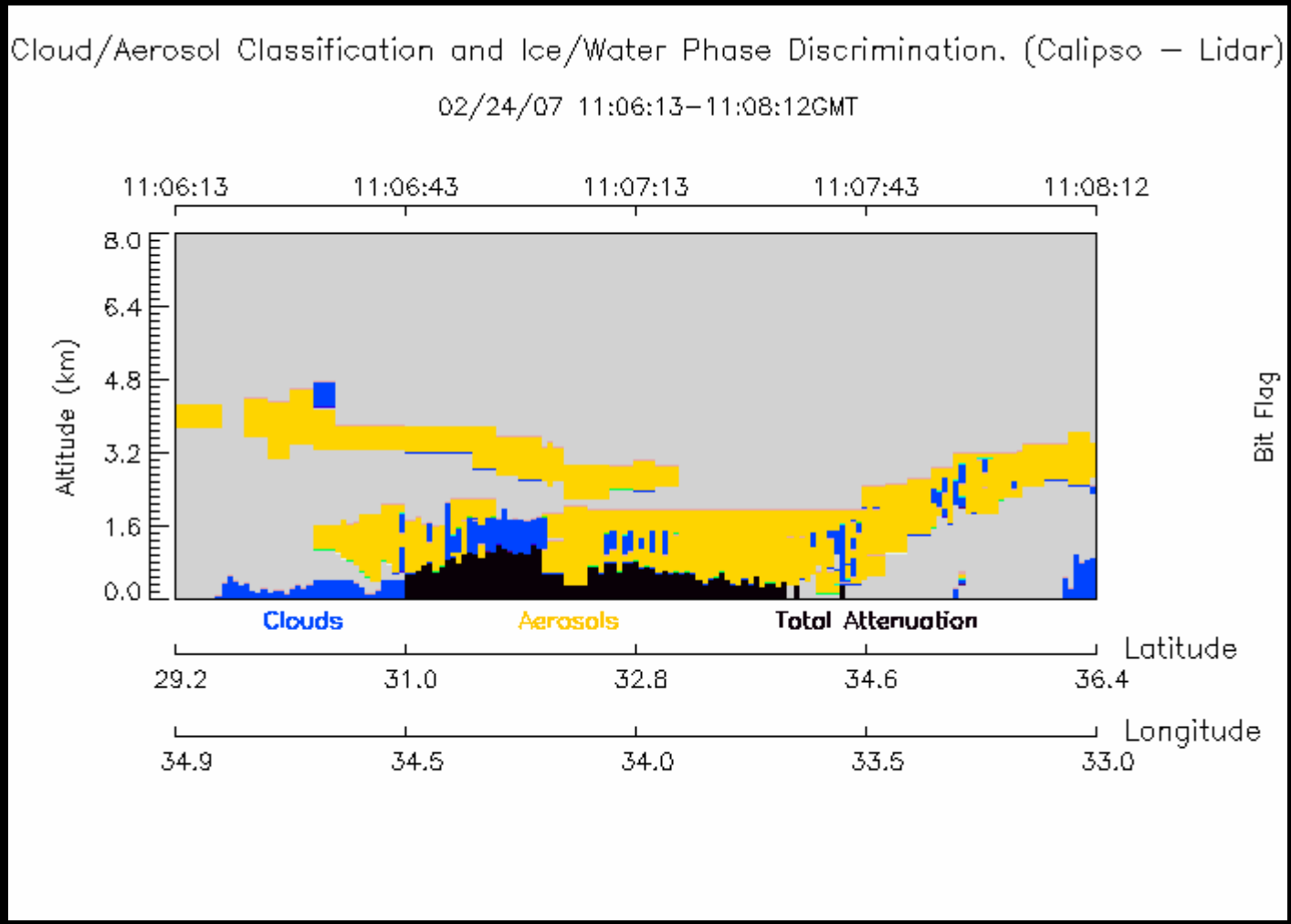
Subset Parameters Along Orbit Track - H2P | Services Help

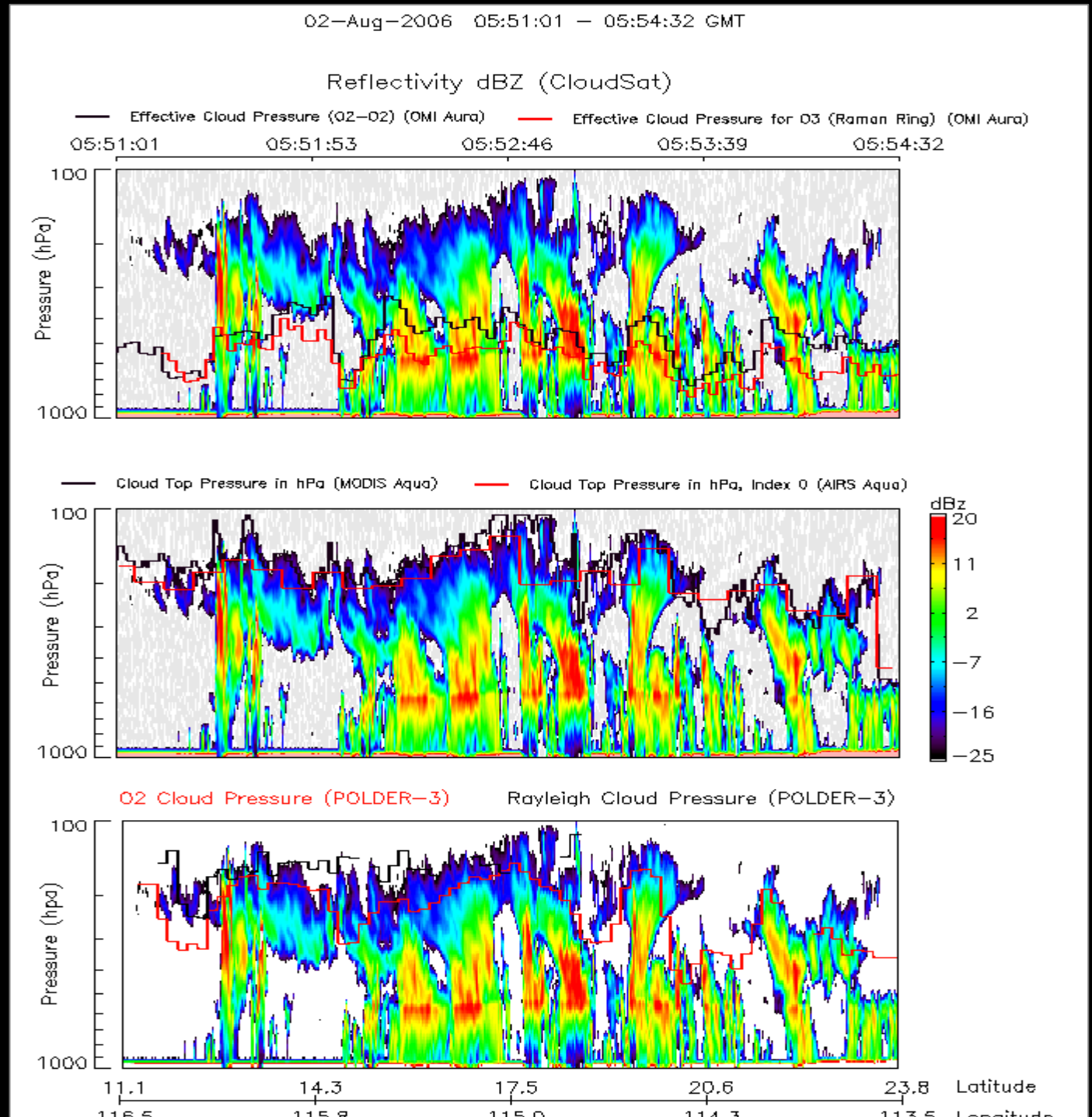
Generate Visualization | Reset | ***Alert:*** *A new window will be opened when"Generate Visualization" is selected.*

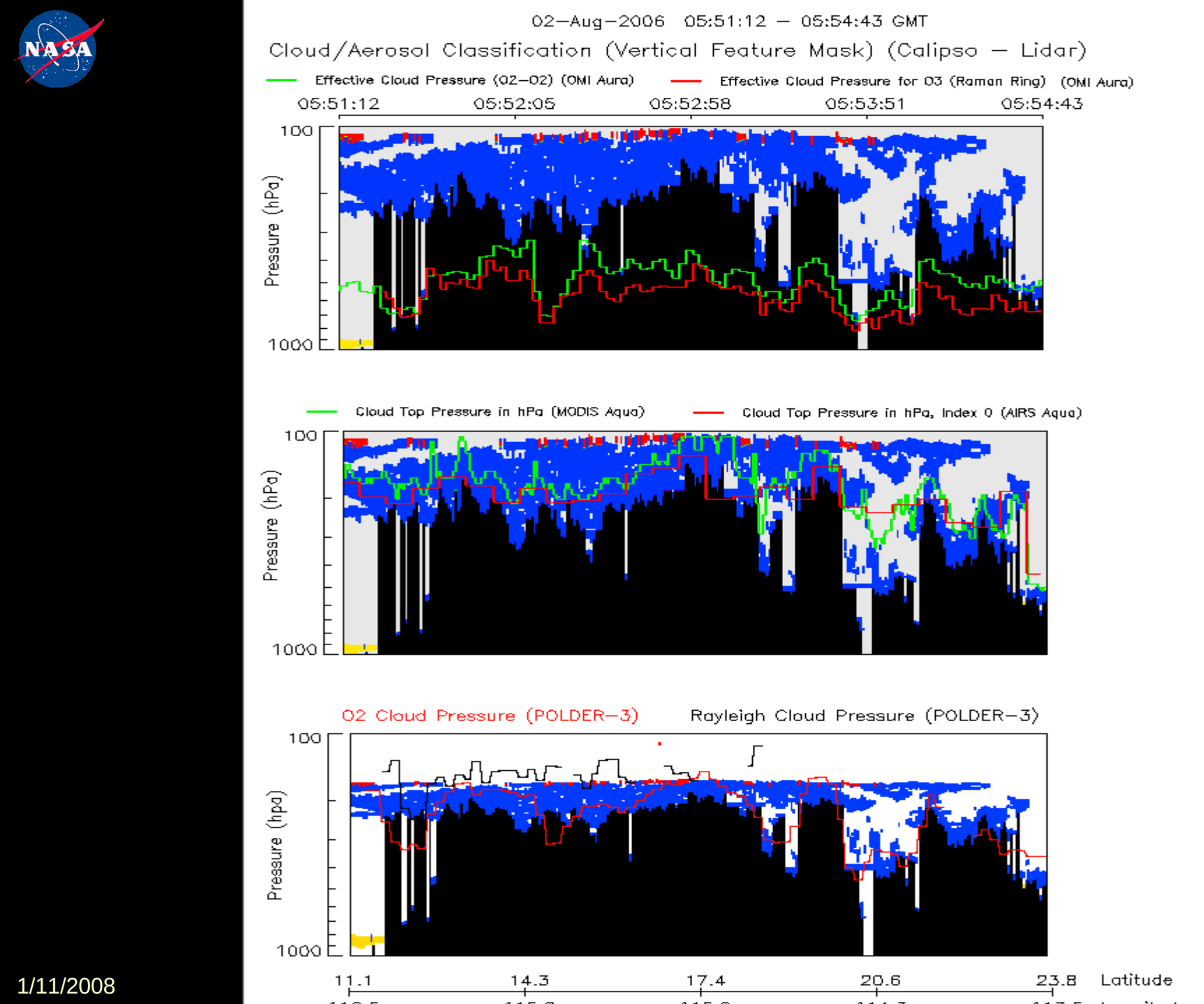
Tropical Storm Barry, May 30, 2007, forming in the Gulf of Mexico



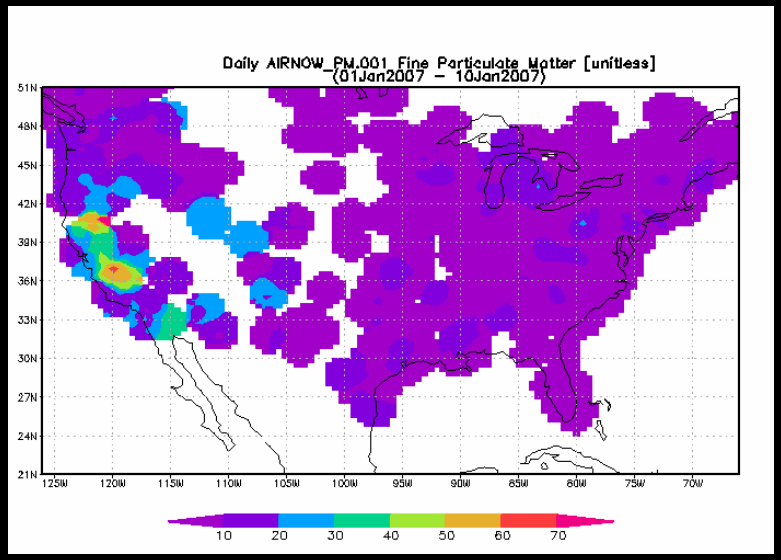



Cloud/Aerosol Classification and Ice/Water Phase Discrimination. (Calipso – Lidar)
02/24/07 11:06:13–11:08:12GMT
11:06:13
11:06:43
11:07:13
11:07:43
11:08:12
Altitude (km)
8.0
6.4
4.8
3.2
1.6
0.0
Clouds
Aerosols
Total Attenuation
Bit Flag
Latitude
29.2
31.0
32.8
34.6
36.4
Longitude
34.9
34.5
34.0
33.5
33.0

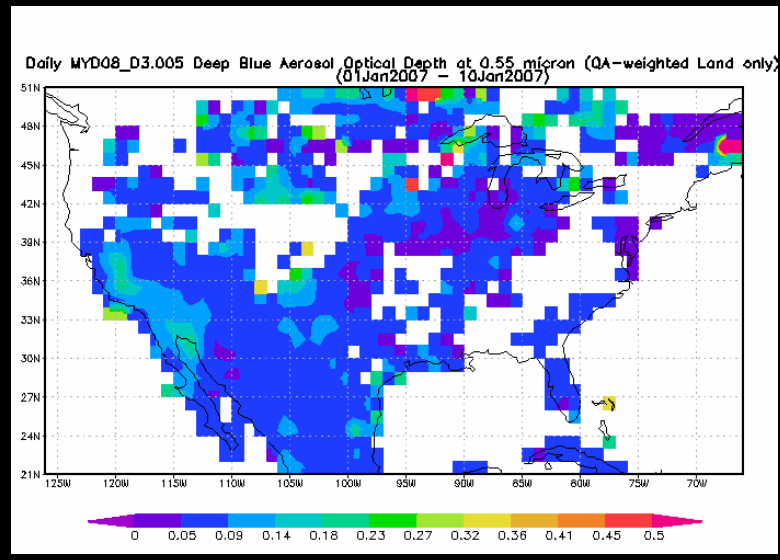

02–Aug–2006 05:51:01 – 05:54:32 GMT
Reflectivity dBZ (CloudSat)
Effective Cloud Pressure (O2–O2) (OMI Aura)
Effective Cloud Pressure for O3 (Raman Ring) (OMI Aura)
05:51:01
05:51:53
05:52:46
05:53:39
05:54:32
100
1000
Pressure (hPa)
Cloud Top Pressure in hPa (MODIS Aqua)
Cloud Top Pressure in hPa, Index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


02-Aug-2006 05:51:12 - 05:54:43 GMT
Cloud/Aerosol Classification (Vertical Feature Mask) (Calipso - Lidar)
Effective Cloud Pressure (O2-O2) (OMI Aura)
Effective Cloud Pressure for O3 (Raman Ring) (OMI Aura)
05:51:12
05:52:05
05:52:58
05:53:51
05:54:43
100
1000
Pressure (hPa)
Cloud Top Pressure in hPa (MODIS Aqua)
Cloud Top Pressure in hPa, Index 0 (AIRS Aqua)
O2 Cloud Pressure (POLDER-3)
Rayleigh Cloud Pressure (POLDER-3)
Pressure (hpa)
11.1
14.3
17.4
20.6
23.8
Latitude

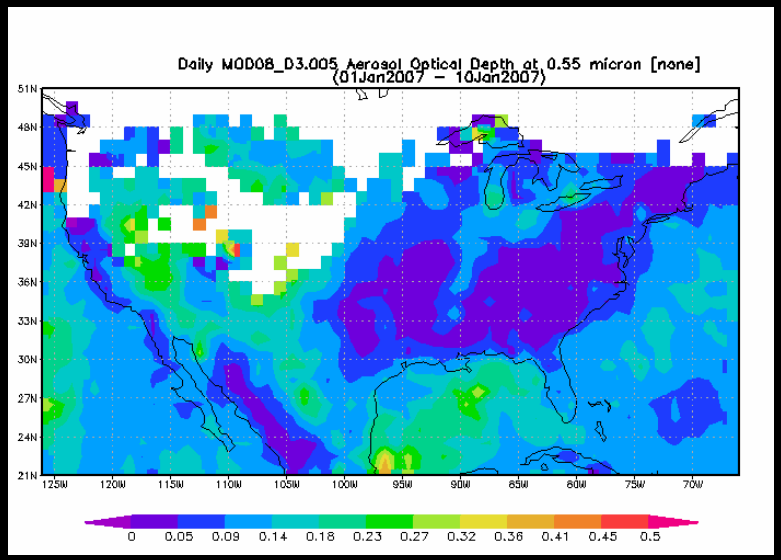
Prototyping PM25 data in Giovanni



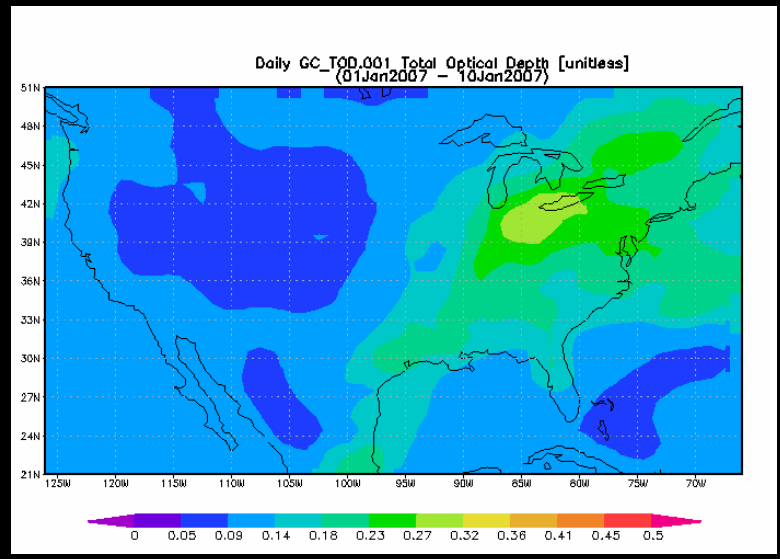
PM2.5 (EPA→ DataFed → Giovanni)



Deep Blue MODIS Aerosol Optical Depth

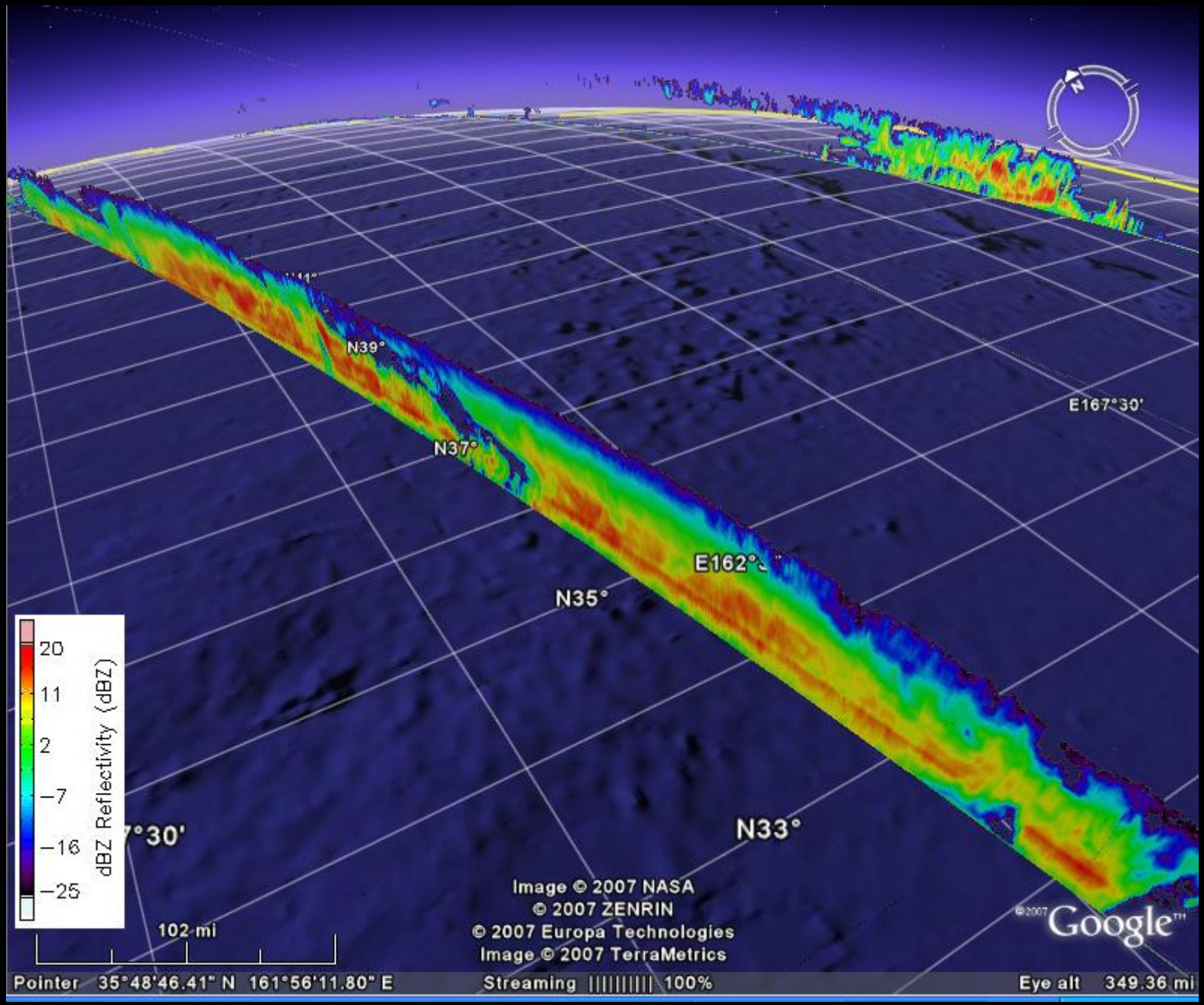


The standard MODIS AOT



GOCART AOT (Goddard → DataFed → Giovanni)

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

1/11/2008

Future plans related to AEROCOM

- Identify and agree on compatibility between model and observational data
- Add GOCART model data
- Create an AEROCOM Giovanni instance
- Add AEROCOM climatology data
- Initiate interoperability between model and RS archives
- Add Taylor diagram to the suite of statistical analysis capabilities
- Add ISCCP data
- Add maps of ground-based observations

Conclusions

- Giovanni is a very convenient online tool for remote sensing data exploration, visualization and analysis
- Giovanni can be very useful for providing easy access to model data along with various statistical intercomparison options
- Giovanni can provide convenient avenue for comparing models with observations
- Recent progress in Data Fusion allows to complement measurements by various sensors and increase spatial coverage
- Giovanni integration with Google Earth provides a convenient way to overlay maps of various parameters along with convenient visualization of vertical structures

http://giovanni.gsfc.nasa.gov