Simple AIRS applications at NASA Goddard

Earth Sciences Data and Information Services Center

(GES DISC)

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Bruce Volmer[3], Chris Lynnes[3], Greg Leptoukh[3], Steve Kempler[3]

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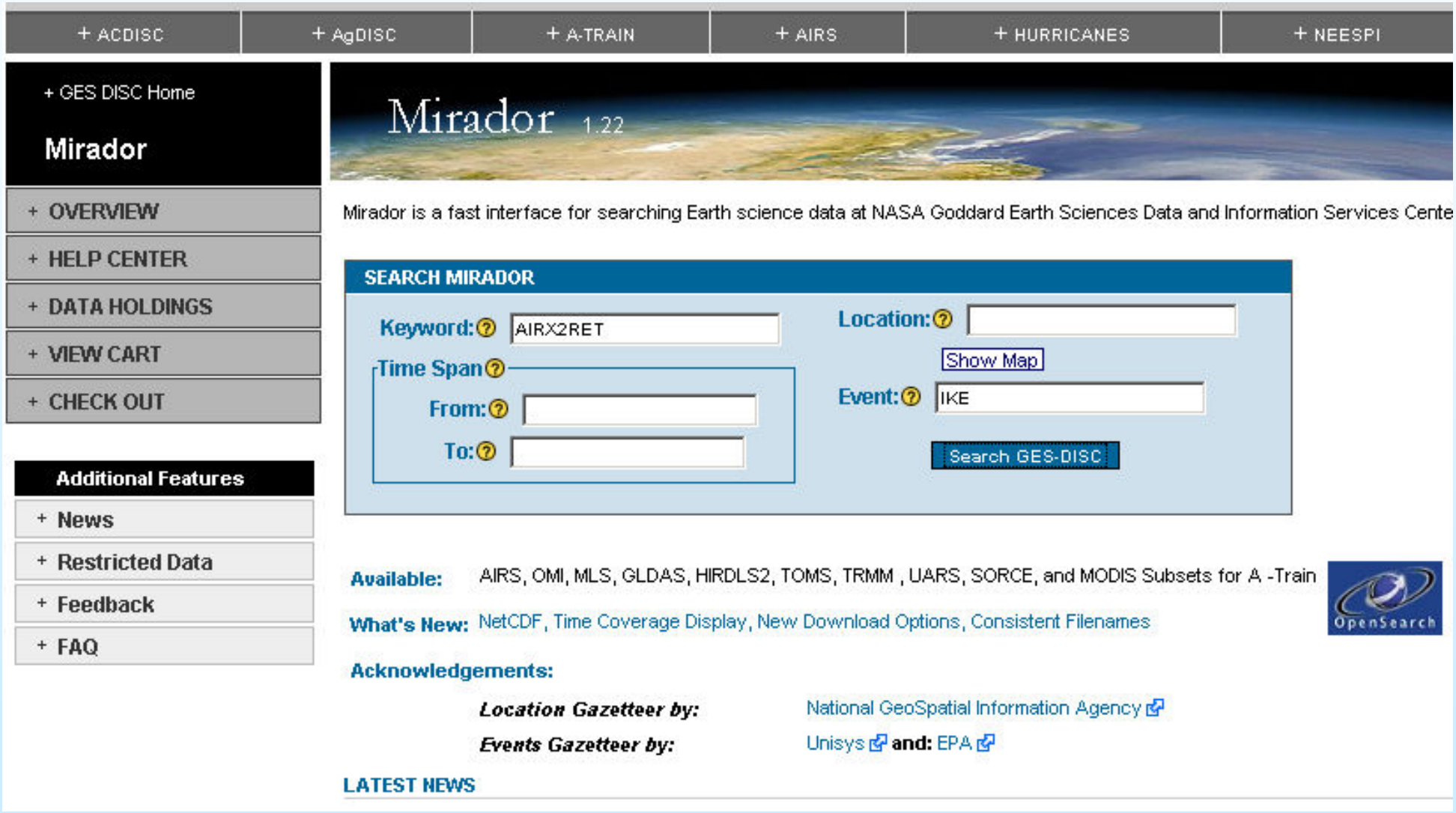
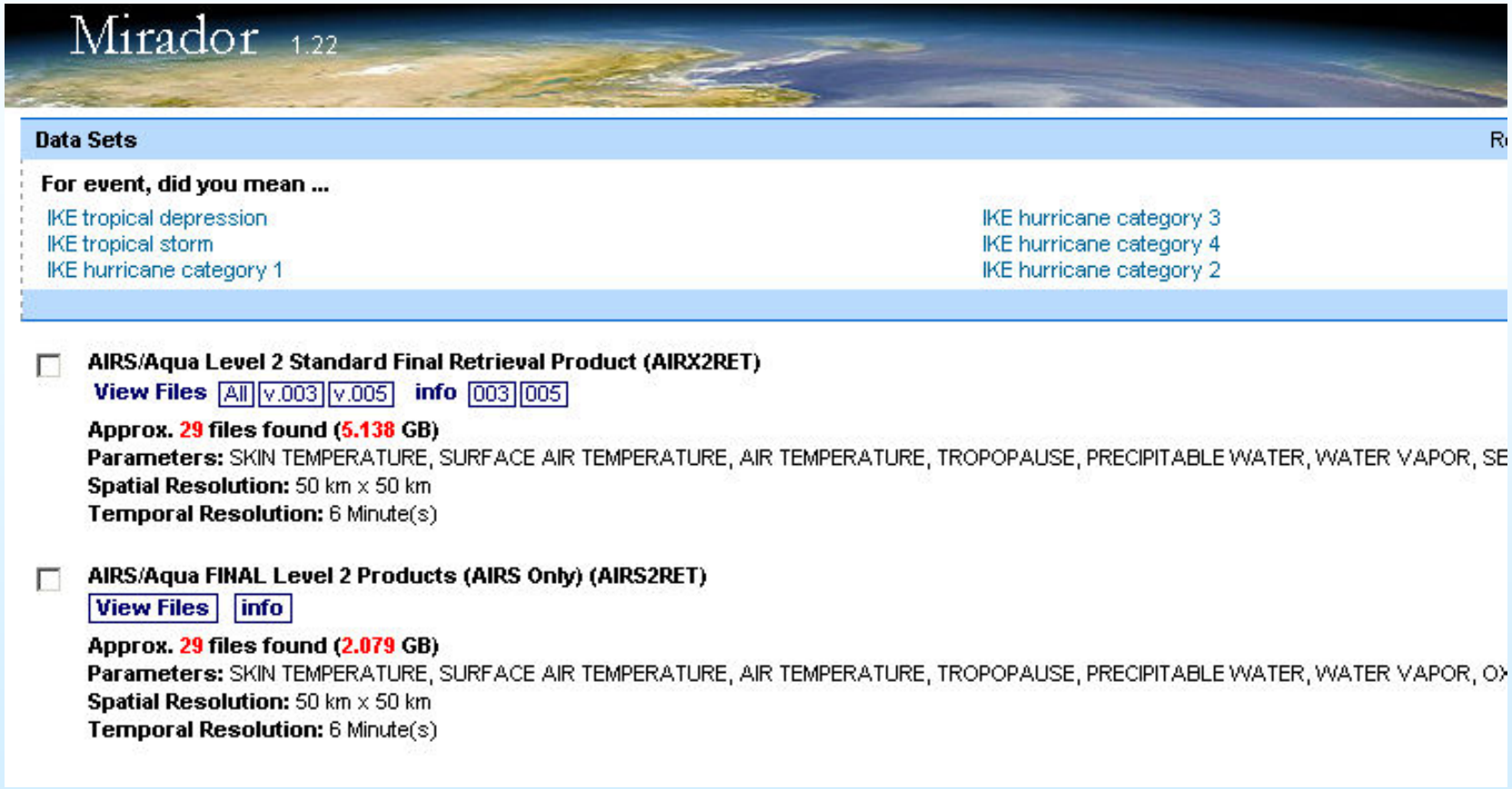
- New data access features
- A-Train applications
- Deep convection and upper tropospheric humidity
- Variability in the middle atmosphere in response to QBO and solar activity

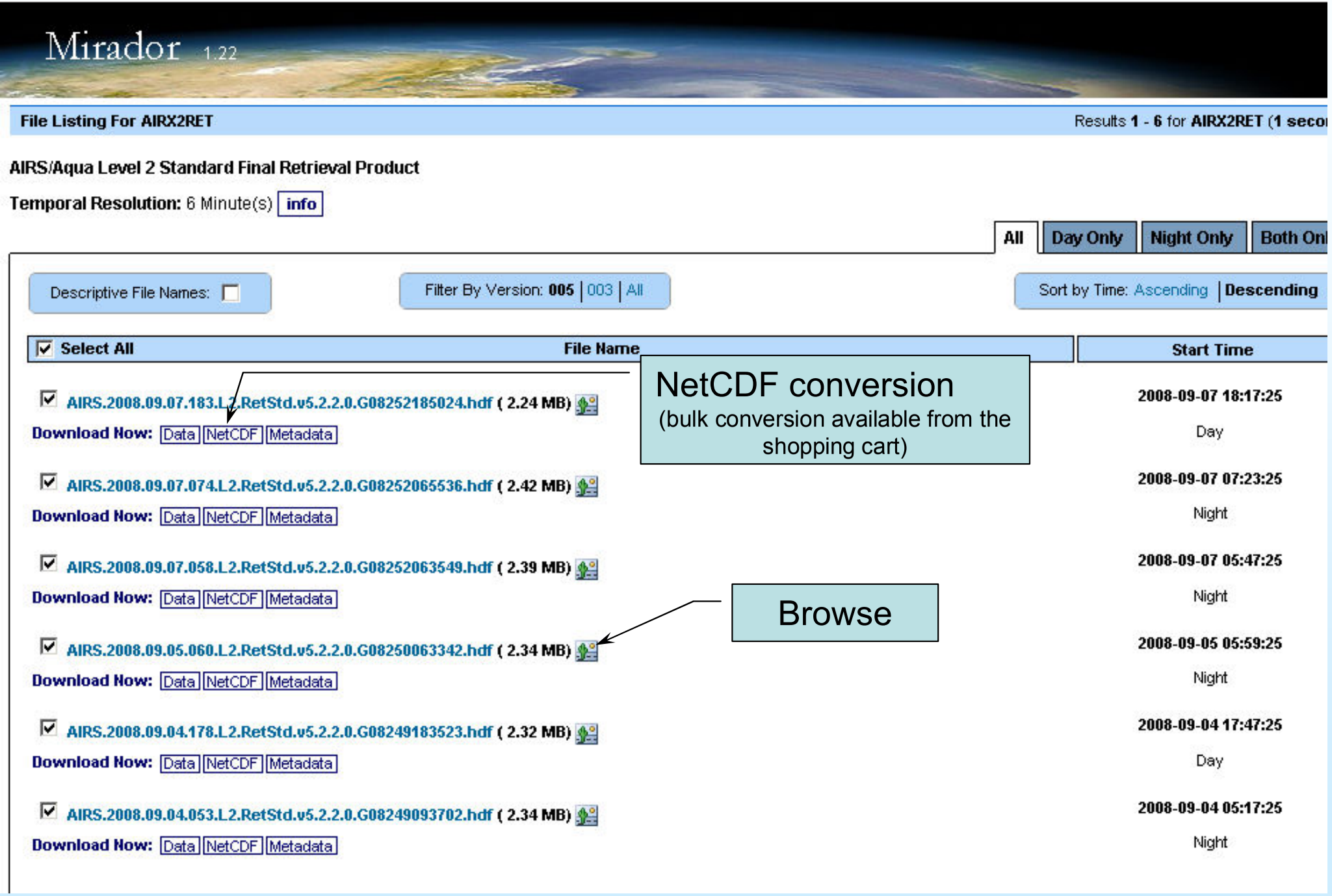
- New data access features in Mirador
  - Conversion to NetCDF
  - Standard Retrieval browse imagery
  - Web Map Service
  - Web Coverage Service

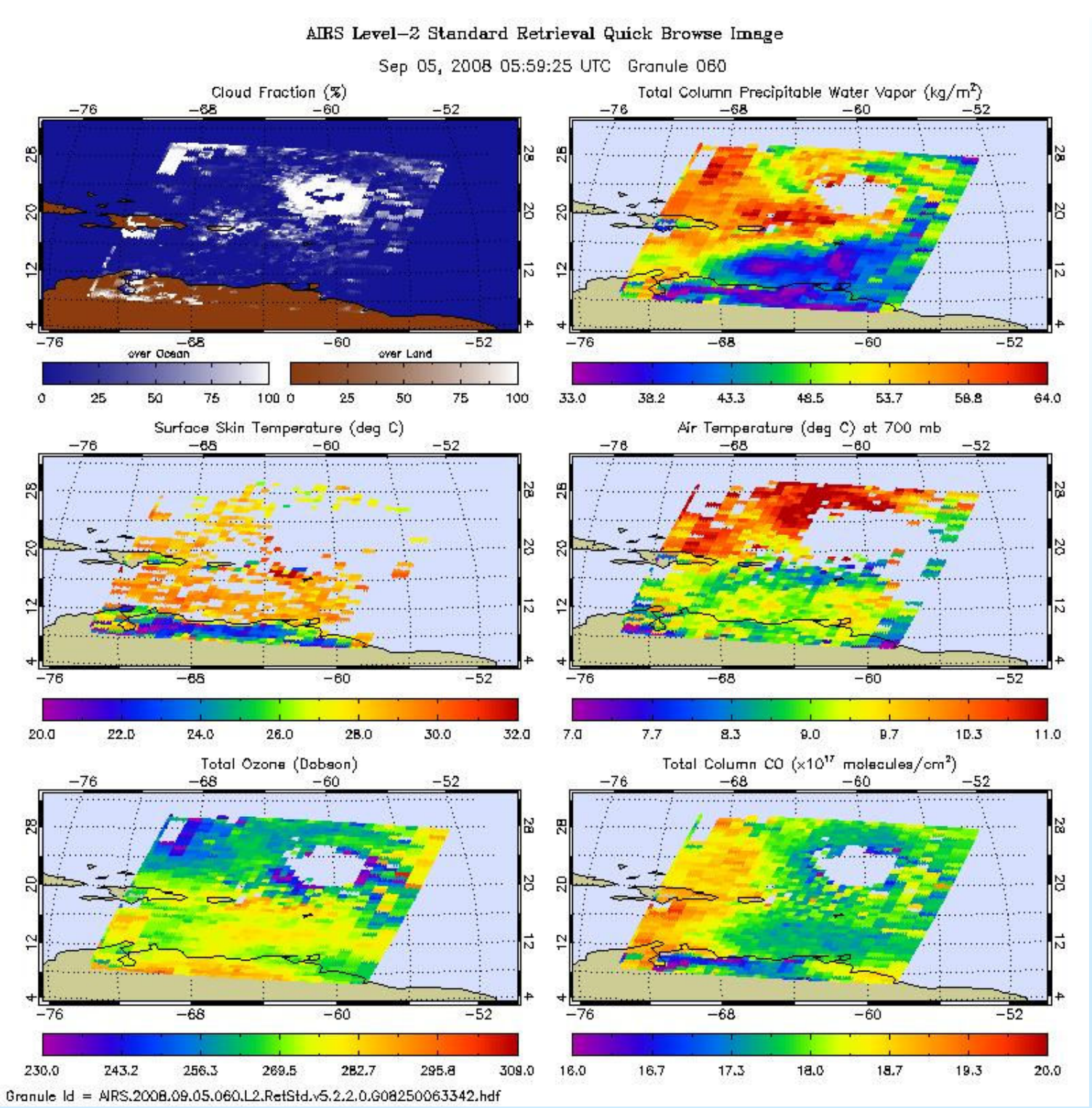
Conversion to NetCDF, standard retrieval browse, and other services in **Mirador,** **http://mirador.gsfc.nasa.gov**



Conversion to NetCDF, standard retrieval browse, and other services in **Mirador, http://mirador.gsfc.nasa.gov**




Mirador 1.22
File Listing For AIRX2RET
Results 1 - 6 for AIRX2RET (1 seco
AIRS/Aqua Level 2 Standard Final Retrieval Product
Temporal Resolution: 6 Minute(s) info
All
Day Only
Night Only
Both On
Descriptive File Names:
Filter By Version: 005 | 003 | All
Sort by Time: Ascending | Descending
Select All
File Name
Start Time
AIRS.2008.09.07.183.L2.RetStd.v5.2.2.0.G08252185024.hdf (2.24 MB)
2008-09-07 18:17:25
Download Now: Data NetCDF Metadata
Day
AIRS.2008.09.07.074.L2.RetStd.v5.2.2.0.G08252065536.hdf (2.42 MB)
2008-09-07 07:23:25
Download Now: Data NetCDF Metadata
Night
AIRS.2008.09.07.058.L2.RetStd.v5.2.2.0.G08252063549.hdf (2.39 MB)
2008-09-07 05:47:25
Download Now: Data NetCDF Metadata
Night
AIRS.2008.09.05.060.L2.RetStd.v5.2.2.0.G08250063342.hdf (2.34 MB)
2008-09-05 05:59:25
Download Now: Data NetCDF Metadata
Night
AIRS.2008.09.04.178.L2.RetStd.v5.2.2.0.G08249183523.hdf (2.32 MB)
2008-09-04 17:47:25
Download Now: Data NetCDF Metadata
Day
AIRS.2008.09.04.053.L2.RetStd.v5.2.2.0.G08249093702.hdf (2.34 MB)
2008-09-04 05:17:25
Download Now: Data NetCDF Metadata
Night
NetCDF conversion
(bulk conversion available from the shopping cart)
Browse



The new, six-plate view, adds total column CO, and transparent cloud cover.

Savtchenko et al., AIRS Science Mtng, Oct, 2008

Web Map Service

(should be available by the end October)

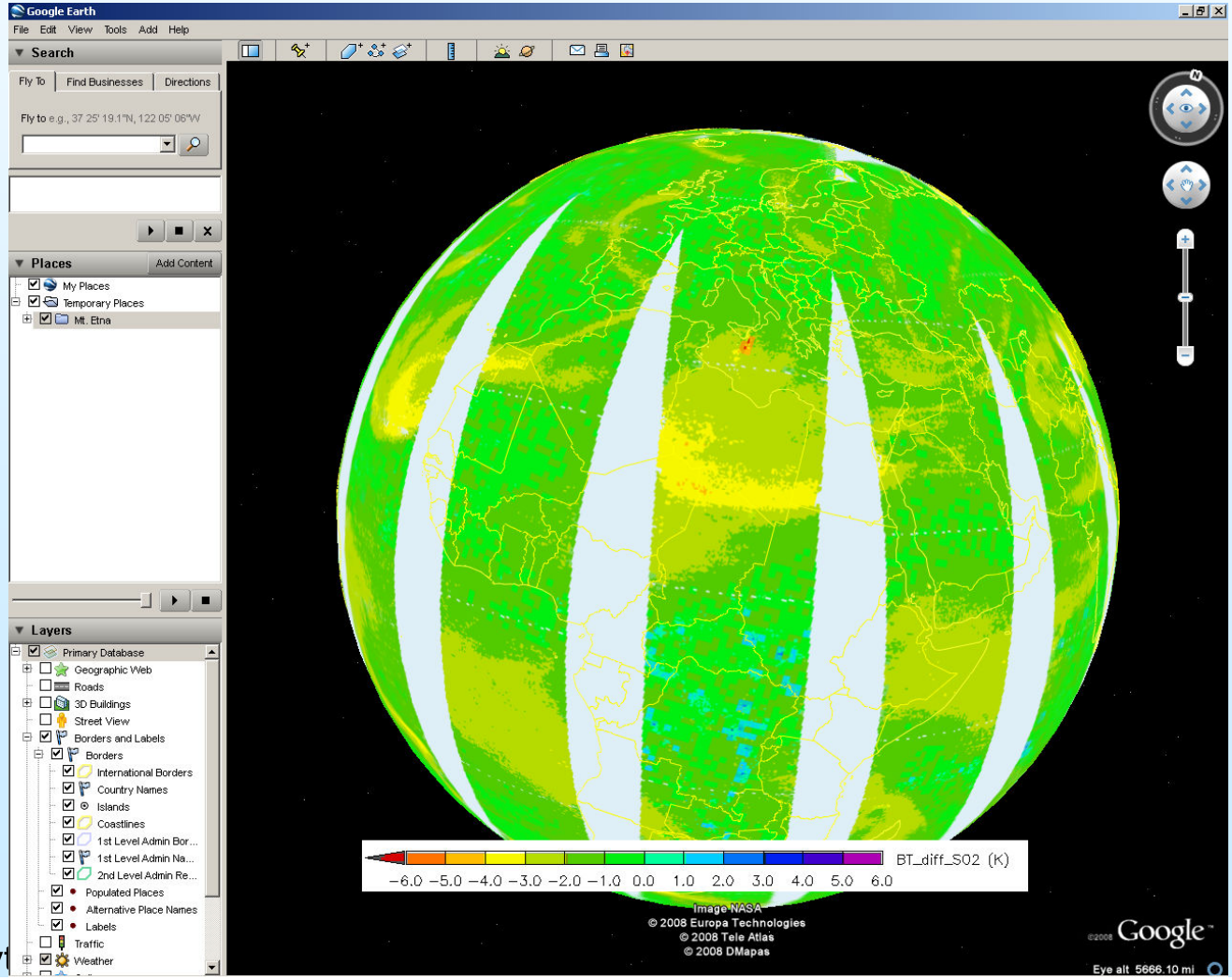
- AIRS images of BT_diff_SO2 from the Near-Real-Time flow are utilized in a new Web Map service.
- It is an experimental "quick-look" for scientists working on volcanic eruptions
- Possible interest from NOAA Satellite Analysis Branch
- Web Map Service access
  - Clients: IDV 2.6, McIDAS-V*, GoogleEarth*, Q-GIS, et al.
  - Web Browser: Users can bookmark any region for repeated views
- Web Coverage Service (geotiff) access
  - Clients: Matlab, IDL, …

(*Still working on issues with some clients)

Web Map Service

On-line help: http://disc.sci.gsfc.nasa.gov/services/wxs_ogc.shtml

Example URL: (use in GoogleEarth in “add overlay”, or simply in a browser)
http://g0hep12u.ecs.nasa.gov/mapserv-bin/wms_airsnrt?service=WMS&VERSION=1.1.1&REQUEST=GetMap&SRS=EPSG:4326&WIDTH=1080&HEIGHT=540&LAYERS=AIRS_BT_diff_SO2_A,coastline&TRANSPARENT=TRUE&FORMAT=image/gif&bbox=-180,-90,180,90



GoogleEarth Example of Web Map Service-generated map of BT_diff_SO2.

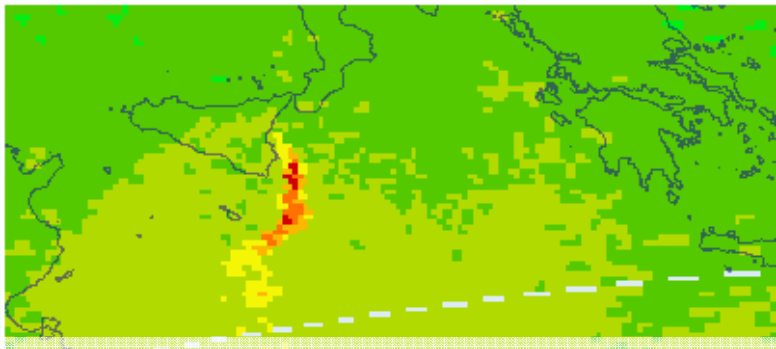
(Mt. Etna eruption; Oct 30, 2002; ascending orbits; original map is built at 10-km pixel size.)

Savt

Web Map Service

Browser example, Oct 30, 2002.

Both views can be just two bookmarks.



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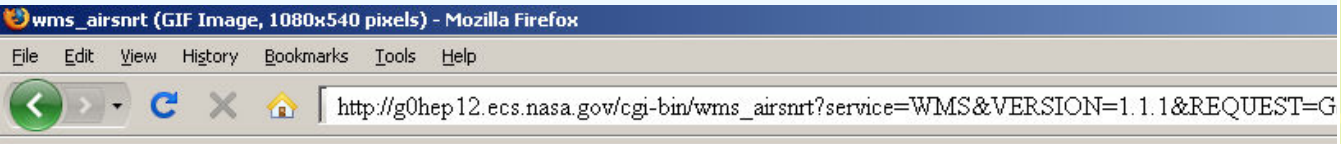
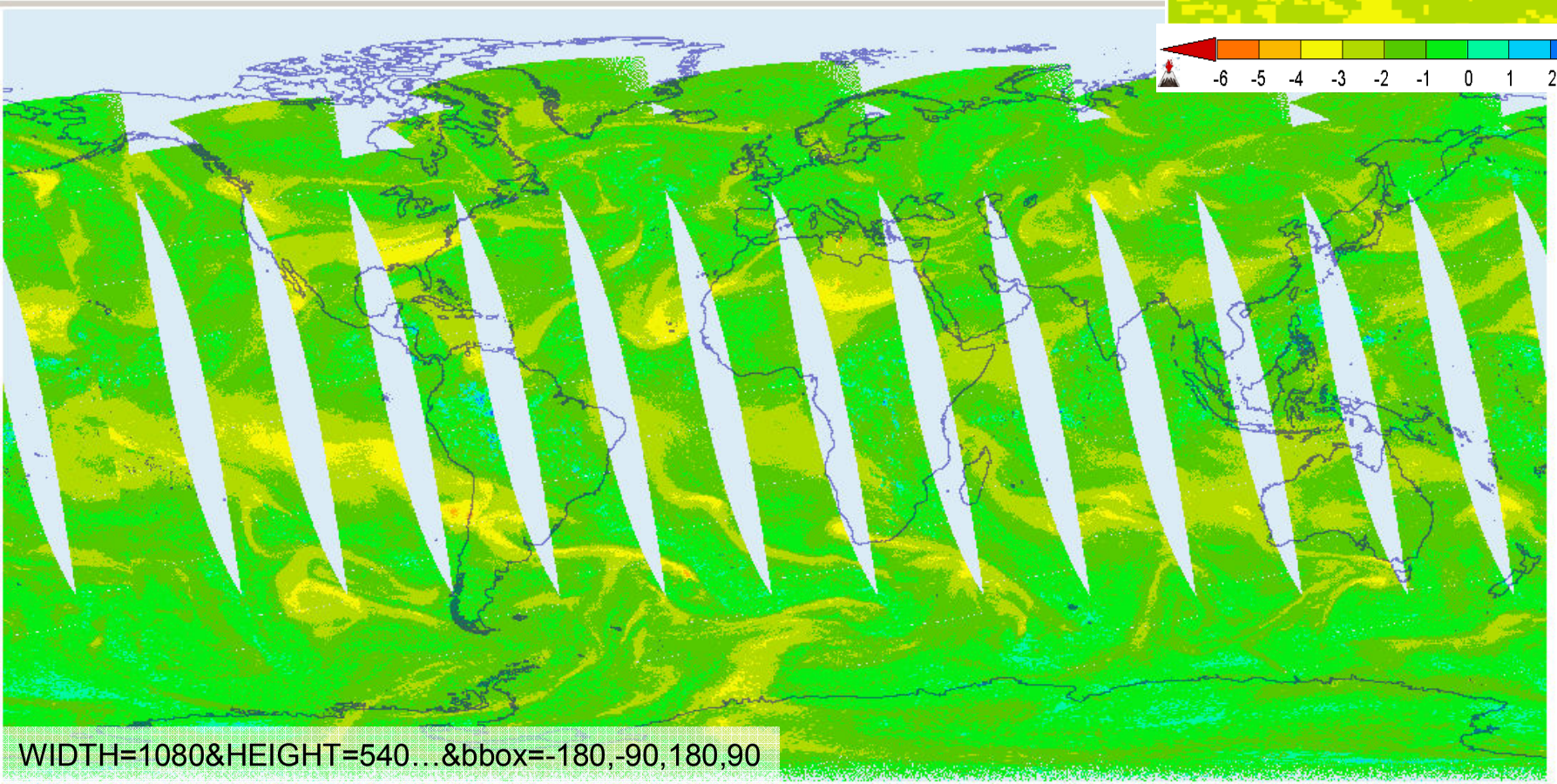
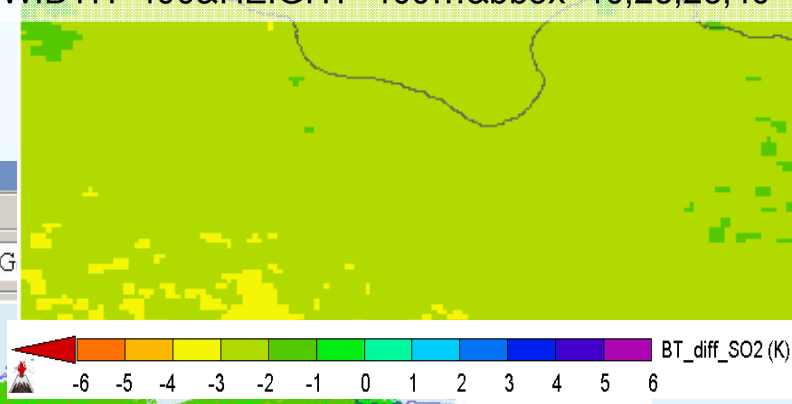






WIDTH=1080&HEIGHT=540…&bbox=-180,-90,180,90

➢A-Train applications

- A-Train Data Depot, incepted in 2005:

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

- Supported by NASA HQ under ROSES 2005 NNH05ZDA001N-ACCESS

- Objectives:
  - ✓Support CloudSat with MODIS/Aqua collocated subsets
  - ✓Provide other collocated subsets: POLDER/PARASOL, OMI/Aura, and AIRS/Aqua.
  - ✓Provide previews of collocated data from CloudSat, CALIPSO, MODIS, AIRS, POLDER, OMI, MLS, and ECMWF, through “Giovanni”.

(*IEEE Trans. Geosci. Remote Sensing*, vol. 46, pp. 2788-2795, 2008)

A-Train Data Depot: CloudSat-collocated Datasets (6/26/08) http://disc.gsfc.nasa.gov/atdd/

Archived On-line A-Train Subsets

- **Mirador** search:**http://mirador.gsfc.nasa.gov/**
- **FTP**: **ftp://atrain.sci.gsfc.nasa.gov/s4pa**

MODIS/Aqua, Level 1B, radiances

- **MAC021**S* ; 1-km radiances
- **MAC02Q**S* ; 250-m radiances

MODIS/Aqua, Level 2, atmospheric products

- **MAC04**S* ; Aerosol Optical Depth Land and Ocean, Aerosol Type over Land, Angstrom Exponent, Mass Concentration, Fine Mode Fraction
- **MAC05**S* ; Water Vapor IR and near IR retrievals
- **MAC06**S* ; Cloud Top Parameters: Pressure, Temperature, Effective Emissivity, Spectral Forcing, Cloud Phase; Cloud Optical Parameters: Cloud Optical Thickness, Effective Particle Radius; Cirrus Detection: Cirrus Reflectance.
- **MAC07**S* ; Temperature and Moisture (dew point temperature) profiles.
- **MAC35**S* ; Cloud Mask: IR, NIR, and CO2 tests; Visible test at 250-m.

OMI/Aura, Level 2, Cloud Pressure, Ozone, and UV index

- **OMCLDO2_CPR**; Cloud effective pressure based on O2-O2 absorption
- **OMCLDRR_CPR** ; Cloud effective pressure based on Raman scattering
- **OMTO3_CPR** ; Column amount O3, UV Aerosol Index, UV reflectivity.
- **OMAERUV_CPR** ; UV Aerosol Index, Aerosol Absorption Optical Depth, Surface Albedo, UV Reflectivity.

POLDER/Parasol, Level 2, Radiation Budget processing

- **PARASOLRB_CPR** ; Column Water Vapor, Cloud Pressure from O2 lines, Cloud Optical Thickness, Cloud Phase, Cloud Albedo, Clear Albedo.

Giovanni-Generated Subset Segments

http://gdata1.sci.gsfc.nasa.gov/daacbin/G3/gui.cgi?instance_id=atrain

MODIS/Aqua, Level 2, atmospheric products

- **MAC04**S1 ; Aerosol Total Optical Depth, and Fine Mode fraction.
- **MAC06**S1 ; Cloud Top Pressure and Temperature, Cloud Optical Thickness.
- **MAC07**S1 ; Vertical profiles of Temperature and Moisture (dew point temperature).

OMI/Aura, Level 2, Cloud Pressure, Ozone, and UV index

- **OMCLDO2_CPR**; Effective Cloud Pressure, based on O2-O2 absorption
- **OMCLDRR_CPR** ; Effective Cloud Pressure for O3, based on Raman scattering.
- **OMTO3_CPR** ; Reflectivity at 360 nm, UV Aerosol Index.
- **OMAERUV_CPR** ; Final Aerosol Absorption Optical Depth (352 nm), Lambert Equivalent Reflectivity (352 nm).

POLDER/Parasol, Level 2, Radiation Budget processing

- **PARASOLRB_CPR** ; Clear Albedo, Cloud Cover, Cloud Optical Thickness, Cloud Phase Index, Cloud Pressure (O2), Cloud Pressure (Rayleigh), Cloud Spherical Albedo, Shortwave Albedo, Water Vapor Column

AIRS Level 2 Standard Retrieval

- **AIRX2RET** ; Vertical profiles of Temperature and Mass Mixing Ratio, Cloud Top Temperature and Pressure, Total Cloud Liquid Water.

CloudSat Level 1B Received Echo Powers

- **1B-CPR** ; Vertical profiles of Received Echo Powers, and derived dBZ reflectivity.

CloudSat Level 2 retrievals

- **2B-CLDCLASS** ; Vertical profiles of Cloud Scenario
- **2B-CWC-RO** ; Vertical profiles of Ice and Liquid Water Cloud Content, radar-only retrieval.

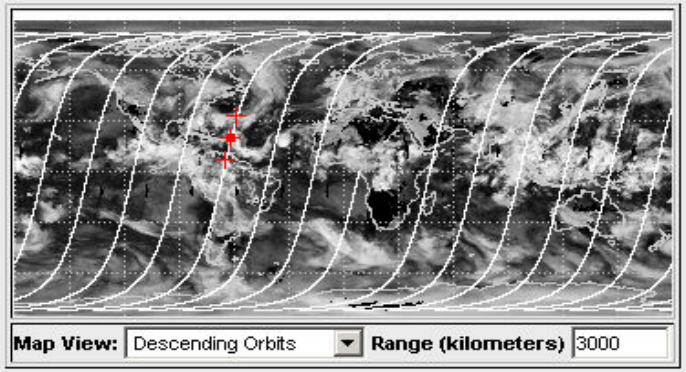
CALIPSO Lidar Level 2 retrievals

- **VFM**; Vertical Feature Mask (profiles) for Cloud/Aerosol types.

These subsets available in **Giovanni** only

*Available in 200- and 10-km swath widths; The rest are 200-km-wide, (+/-100 km) only.

http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=atrain



Temporal

Orbit Date Year 2008 Month Sep Day 5 Update Map *(Range: 02 Jun 2006 - 29 Sep 2008)*

Help with temporal availability.

Parameters

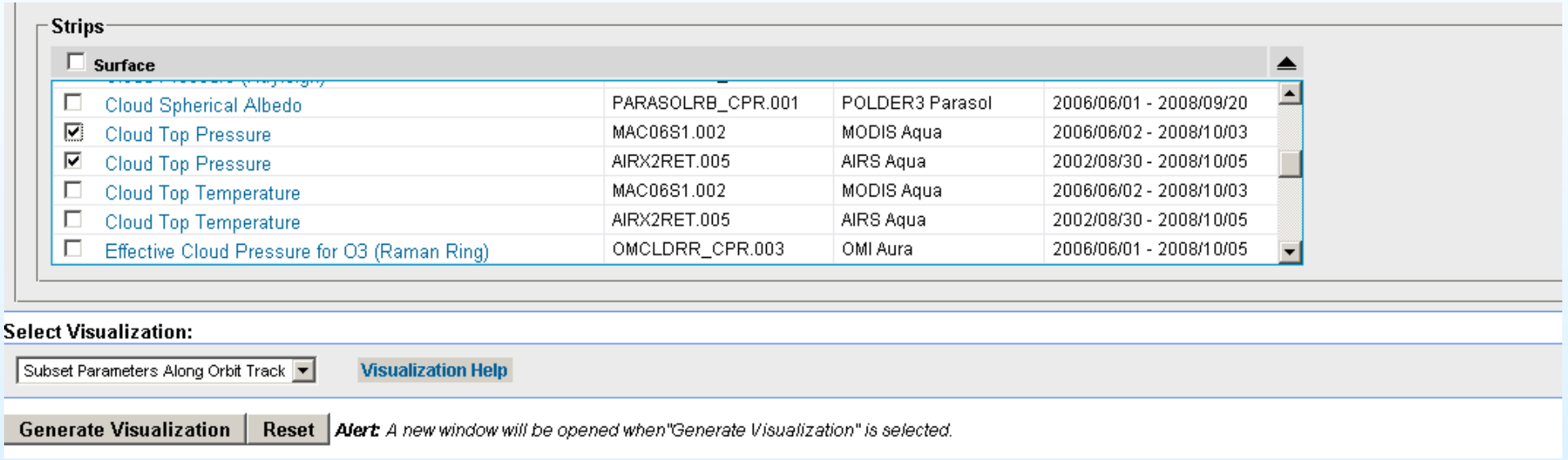
Show Parameter Units

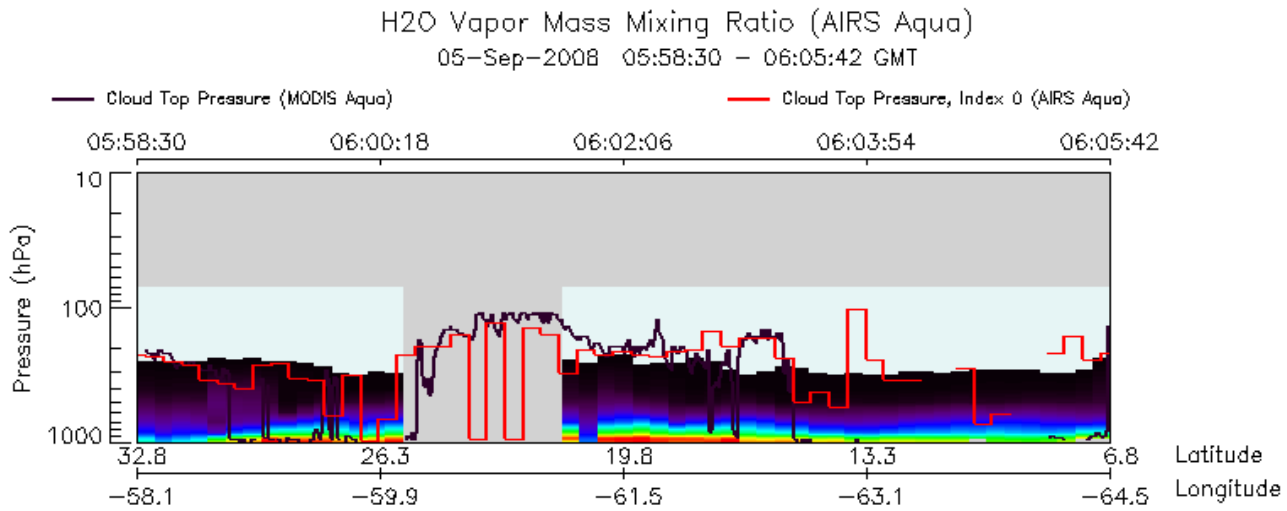
Curtains

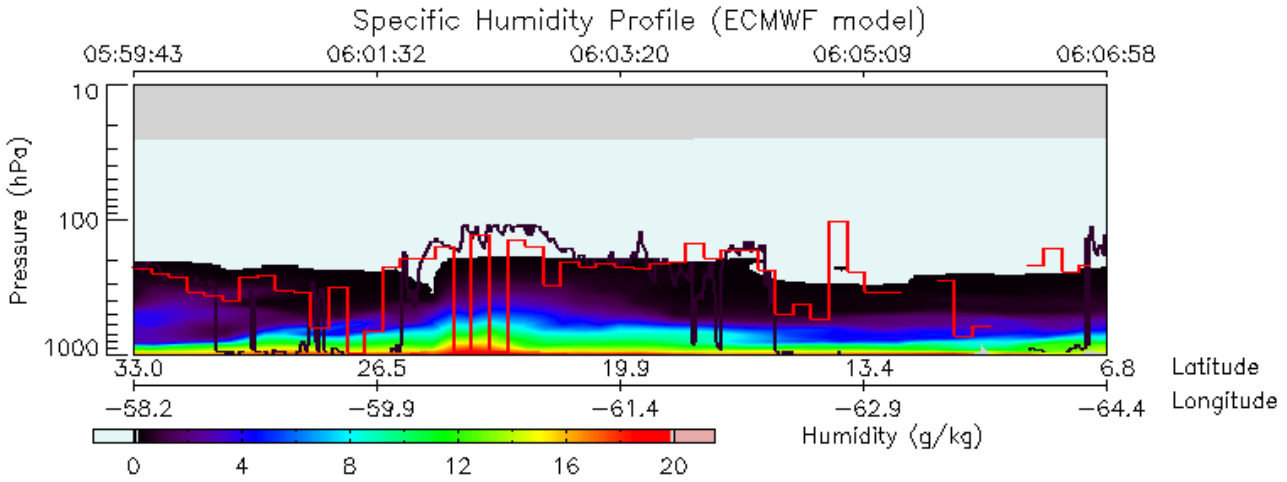
Temperature			
Atmospheric Temperature Profile	ML2T.002	MLS	2004/08/08 - 2008/10/02
Atmospheric Temperature Profile	MAC07S0.002	MODIS Aqua	2006/06/02 - 2008/10/05
Atmospheric Temperature Profile	AIRX2RET.005	AIRS Aqua	2002/08/30 - 2008/10/05
Atmospheric Temperature Profile	ECMWF_AUX.008	ECMWF model	2006/06/15 - 2008/09/29
Water Vapor			
H2O Saturation Mass Mixing Ratio	AIRX2RET.005	AIRS Aqua	2002/08/30 - 2008/10/05
H2O Vapor Mass Mixing Ratio	AIRX2RET.005	AIRS Aqua	2002/08/30 - 2008/10/05
Relative Humidity wrt Ice	ML2RHI.002	MLS	2004/08/08 - 2008/10/02
Retrieved Dew Point Temperature Profile	MAC07S0.002	MODIS Aqua	2006/06/02 - 2008/10/05
Specific Humidity Profile	ECMWF_AUX.008	ECMWF model	2006/06/15 - 2008/09/29
Clouds			
Cloud/Aerosol Classification (Vertical Feature Mask)	VFM.002	Calipso - Lidar	2006/06/13 - 2008/09/28
Cloud Scenario	2B_CLDCLASS.009	CloudSat	2006/06/15 - 2008/09/28
Ice Water Content	ML2IWC.002	MLS	2004/08/08 - 2008/10/02
Ozone Mixing Ratio Profile	ML2O3.002	MLS	2004/08/08 - 2008/10/02
ReceivedEchoPowers	1B_CPR.008	CloudSat	2006/06/02 - 2008/09/29
Reflectivity dBZ	1B_CPR.008	CloudSat	2006/06/02 - 2008/09/29

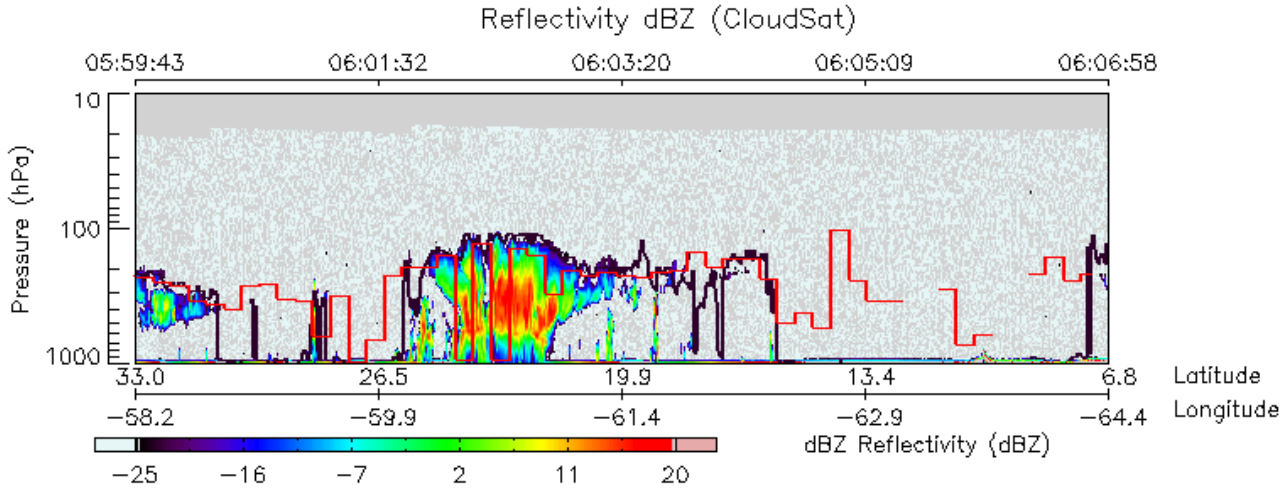
Strips

Surface


Strips
Surface
Cloud Spherical Albedo
PARASOLRB_CPR.001
POLDER3 Parasol
2006/06/01 - 2008/09/20
Cloud Top Pressure
MAC06S1.002
MODIS Aqua
2006/06/02 - 2008/10/03
Cloud Top Pressure
AIRX2RET.005
AIRS Aqua
2002/08/30 - 2008/10/05
Cloud Top Temperature
MAC06S1.002
MODIS Aqua
2006/06/02 - 2008/10/03
Cloud Top Temperature
AIRX2RET.005
AIRS Aqua
2002/08/30 - 2008/10/05
Effective Cloud Pressure for O3 (Raman Ring)
OMCLDRR_CPR.003
OMI Aura
2006/06/01 - 2008/10/05
Select Visualization:
Subset Parameters Along Orbit Track
Visualization Help
Generate Visualization
Reset
Alert: A new window will be opened when"Generate Visualization" is selected.



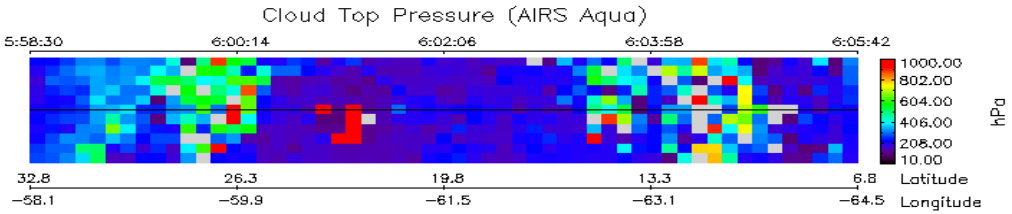


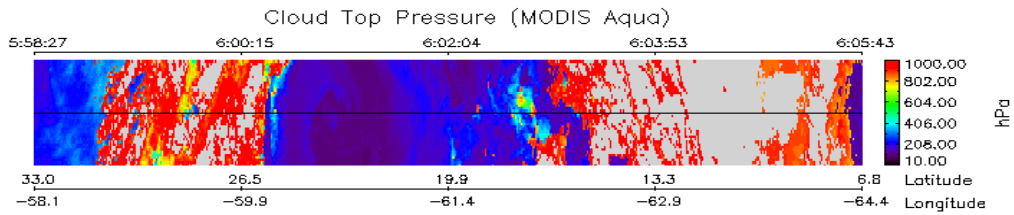


Collocated with CloudSat vertical profiles of AIRS and ECMWF humidity;

line overplots of collocated cloud top pressures from AIRS and MODIS.

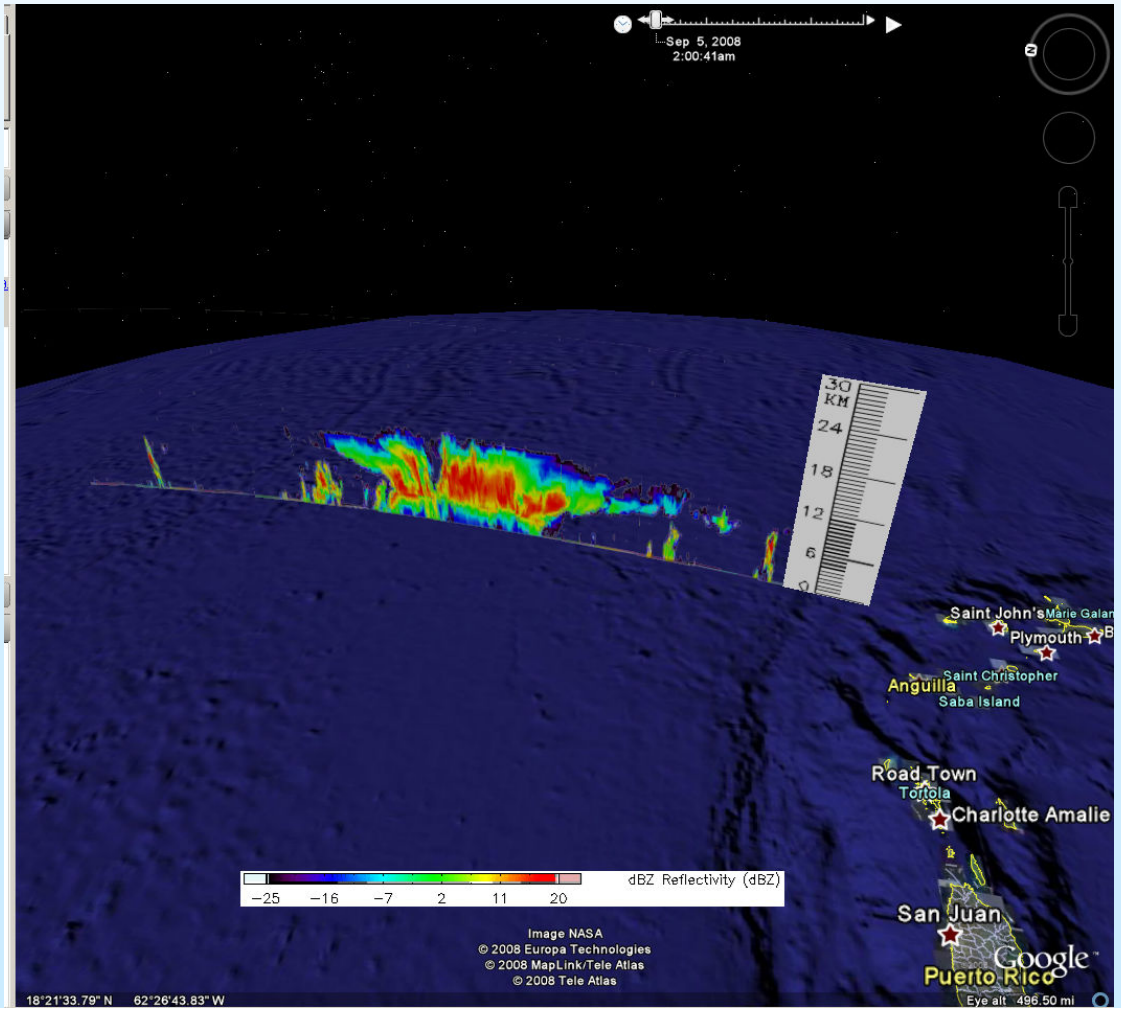
(Hurricane Ike)





CloudSat-collocated strip plots from Giovanni

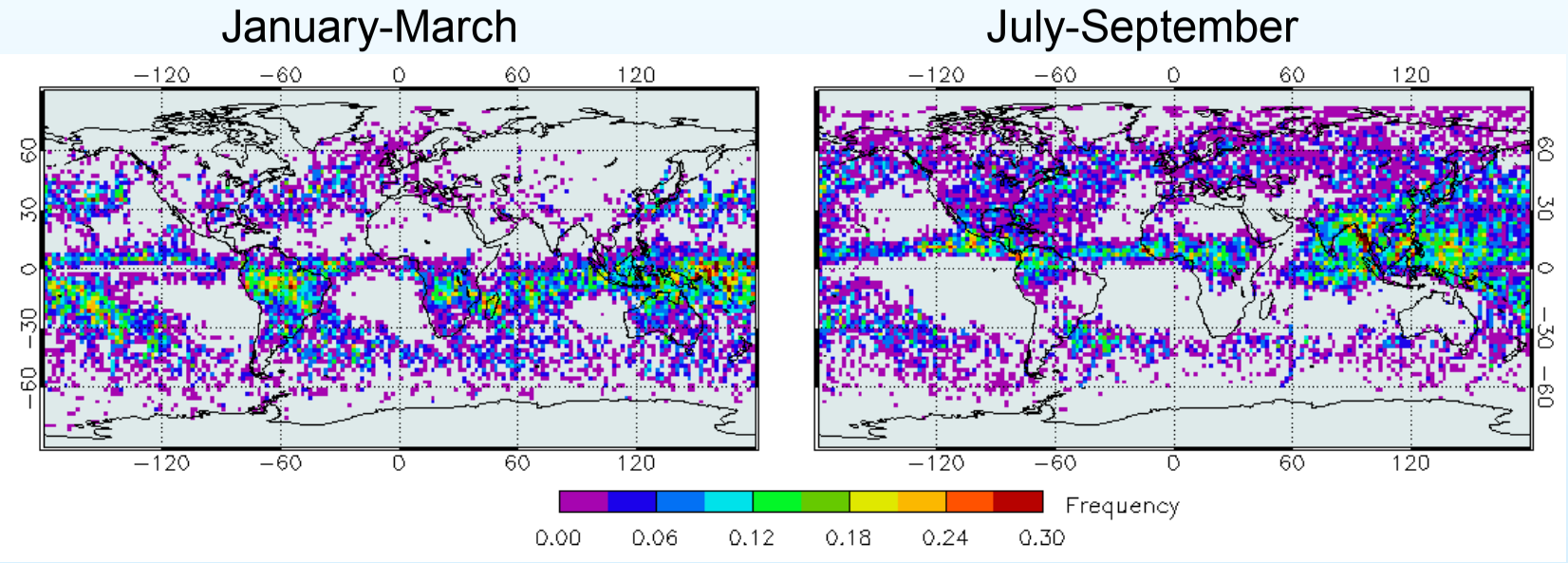
KMZ-format file, produced by Giovanni, containing CloudSat reflectivities and displayed in GoogleEarth.



Savtchenko et al., AIRS Science Mtng, Oct, 2008

➢ Deep convection and upper tropospheric humidity – a look from the A-Train

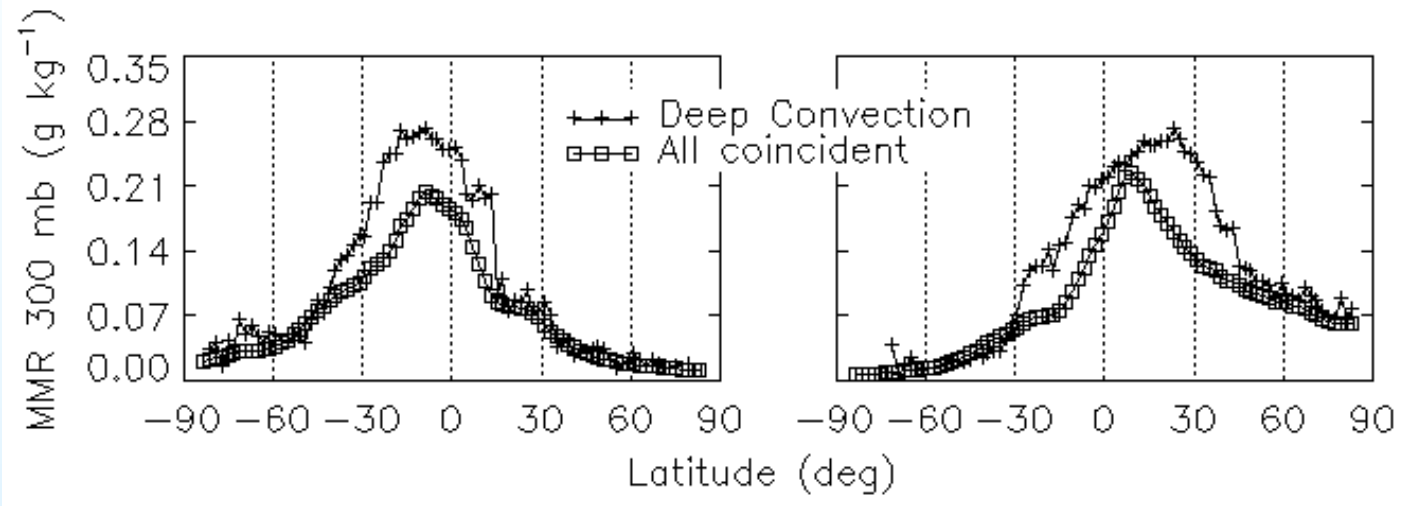
(*Submitted to GRL*)



Frequency of Deep Convection derived from the CloudSat cloud scenario, from 2007

January-March

July-September

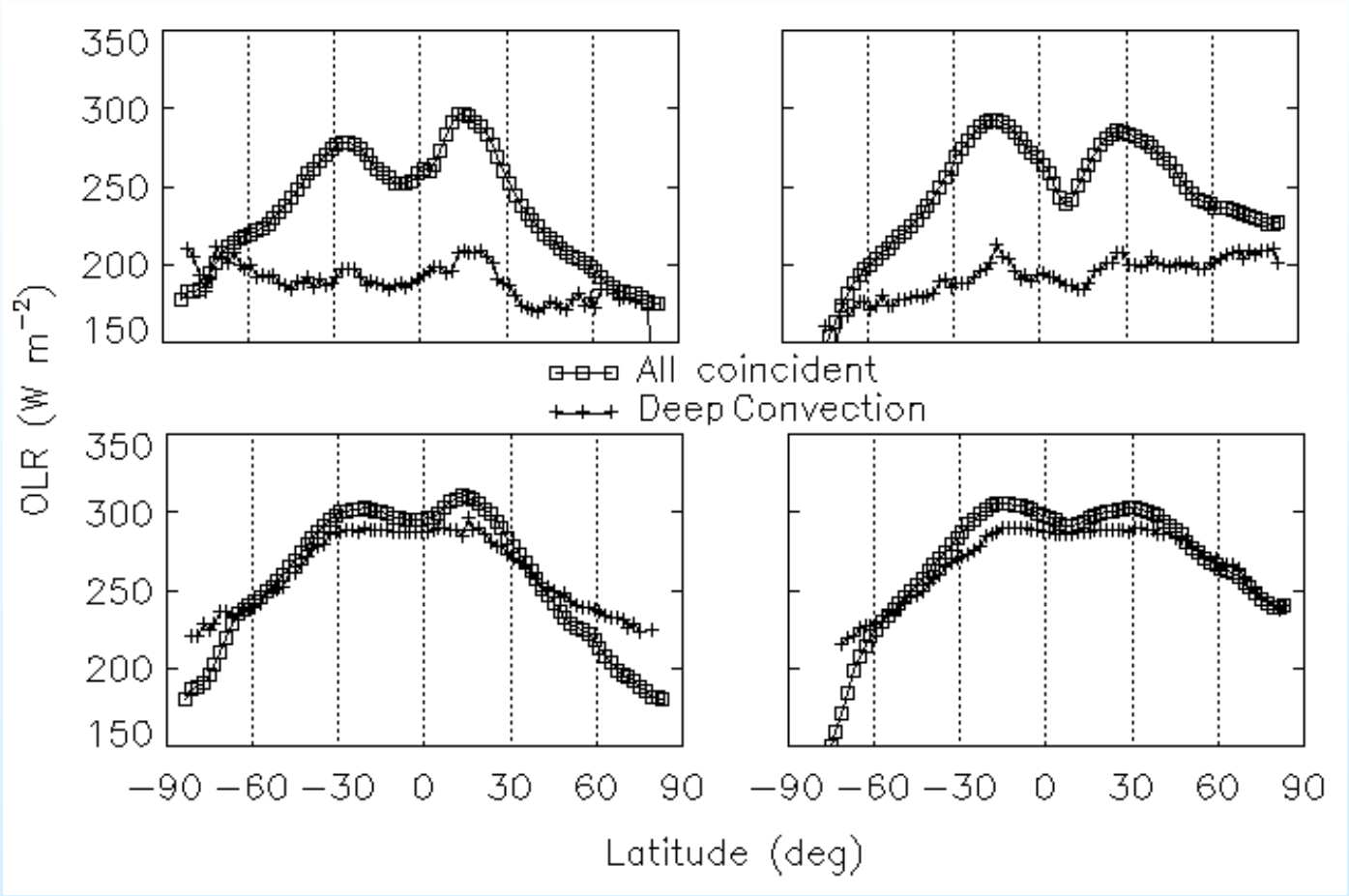


Zonal averages of AIRS MMR at 300 mb, from all coincident with CPR pixels, and from those collocated with deep convective events only

Savtchenko et al., AIRS Science Mtng, Oct, 2008

January-March

July-September

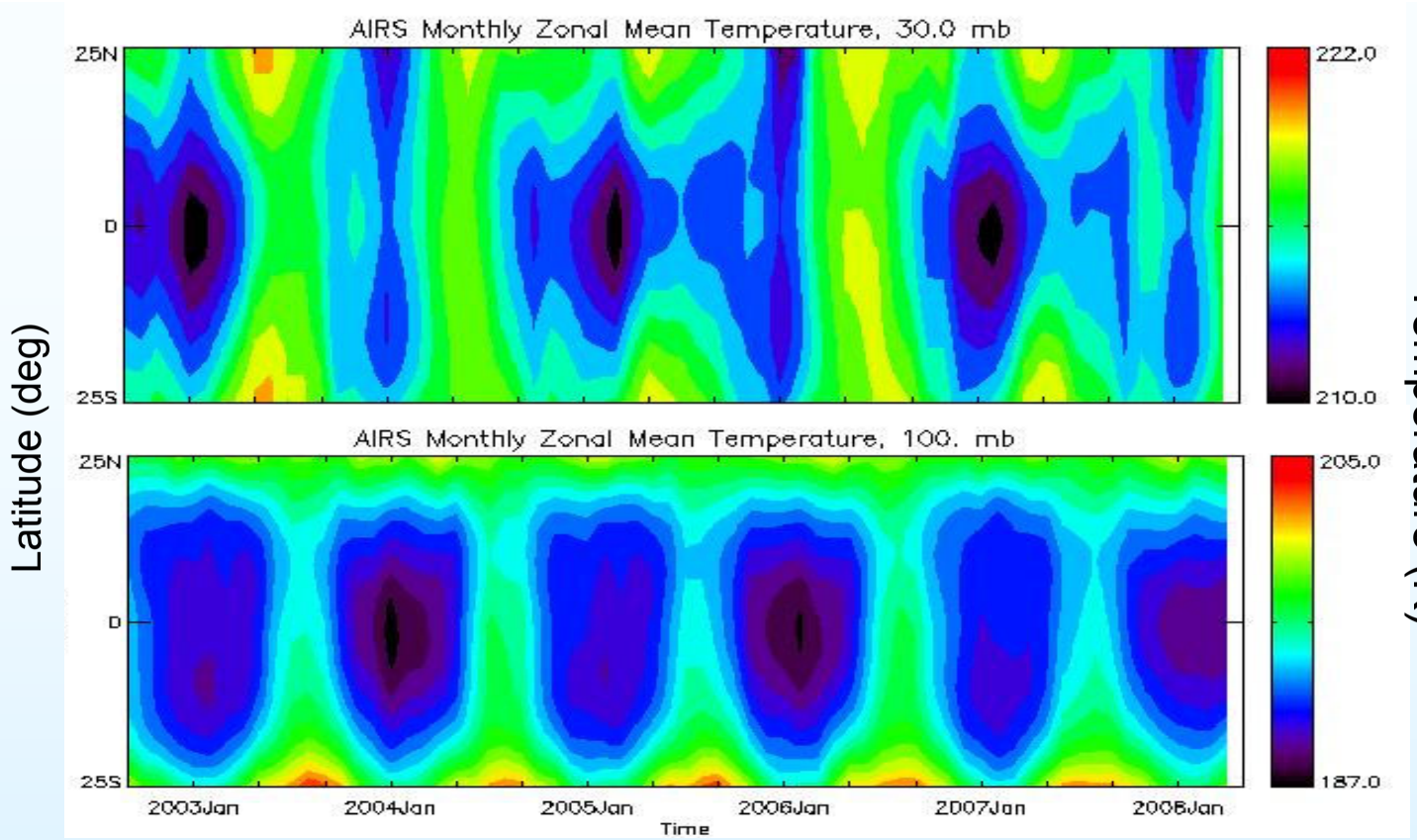


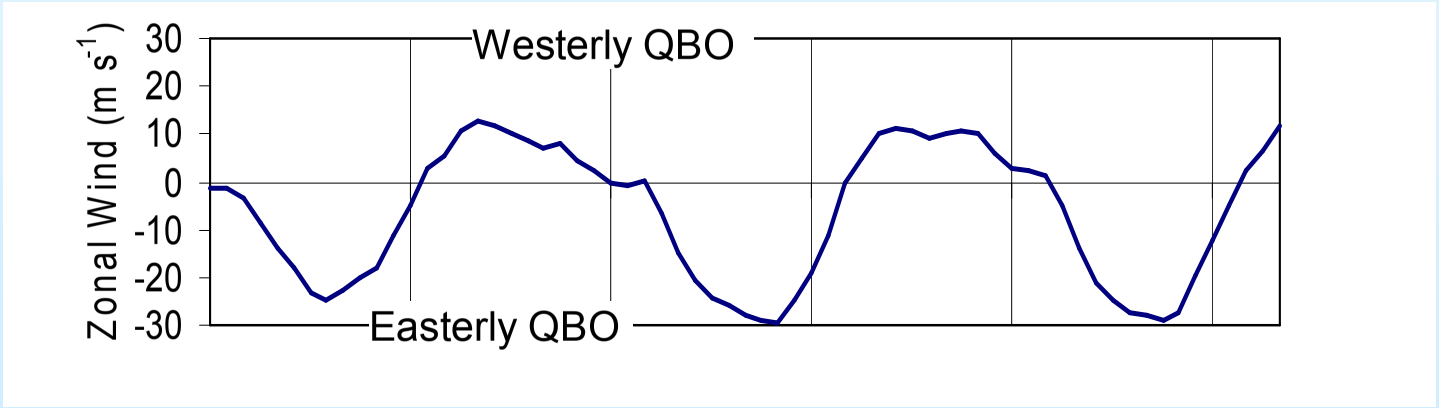
Zonal averages of AIRS all-sky (top), and clear-sky (bottom), OLR from all coincident with CPR pixels, and from those collocated with deep convective events only.

➢ Variability in the middle atmosphere in response to Quasi-Biennial Oscillation (QBO) and solar activity

(Proposal submitted to NASA ROSES, PI Young-In Won)

- Changes in the middle atmosphere (stratosphere and mesosphere) are good indicators of climate change.
- Among the variability components are the temperature changes related to solar activity and QBO.
- The proposed work includes utilization of data from AIRS, MLS, and SORCE.



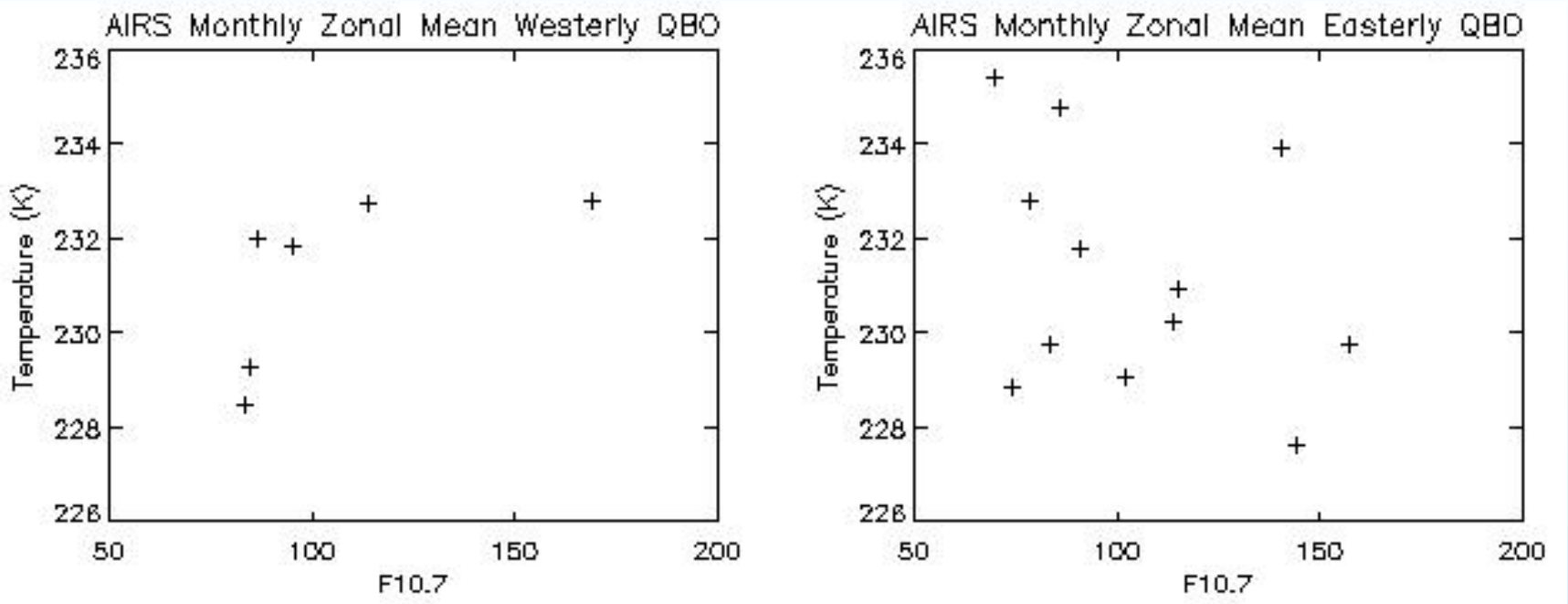


AIRS reveals well the QBO, e.g. in the 30 and 100 mb temperatures (top).

30 mb zonal wind at the Equator (bottom).

Savtchenko et al., AIRS Science Mtng, Oct, 2008

AIRS 10 mb Temperatures at the Equator, November-January, 2002-2008

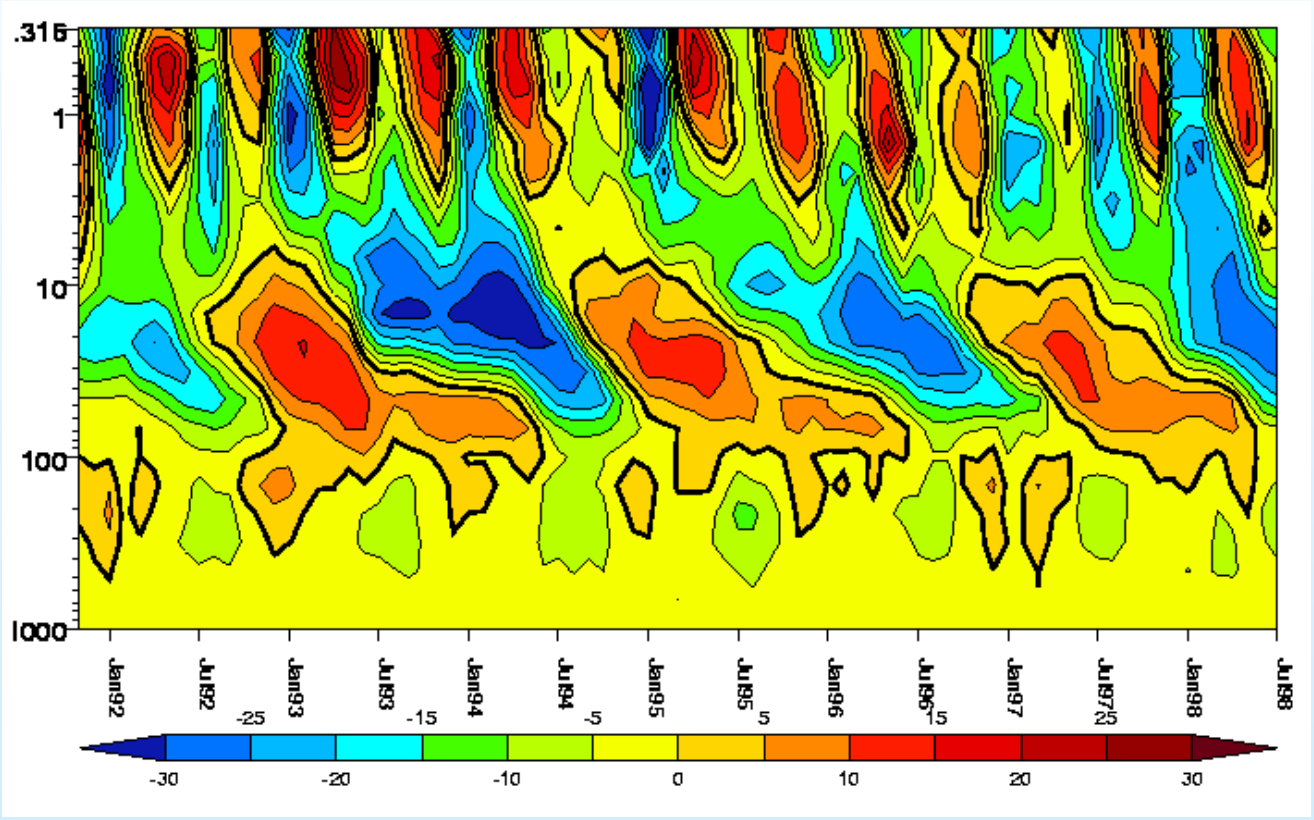


10 mb Temperatures tend to be better related with the solar activity factor F10.7 during the Westerly QBO.

Extra slides

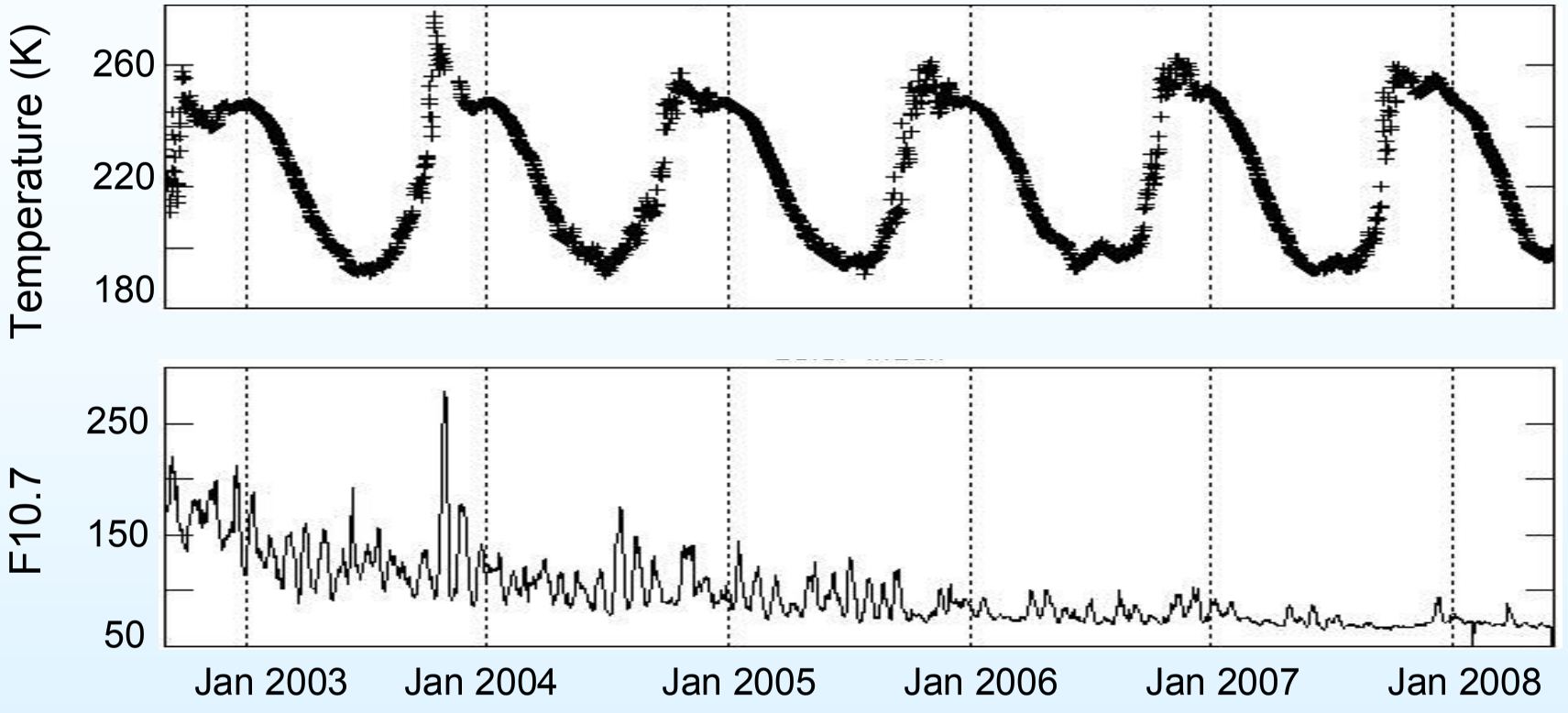
Quasi-Biennial Oscillation (QBO) Feature

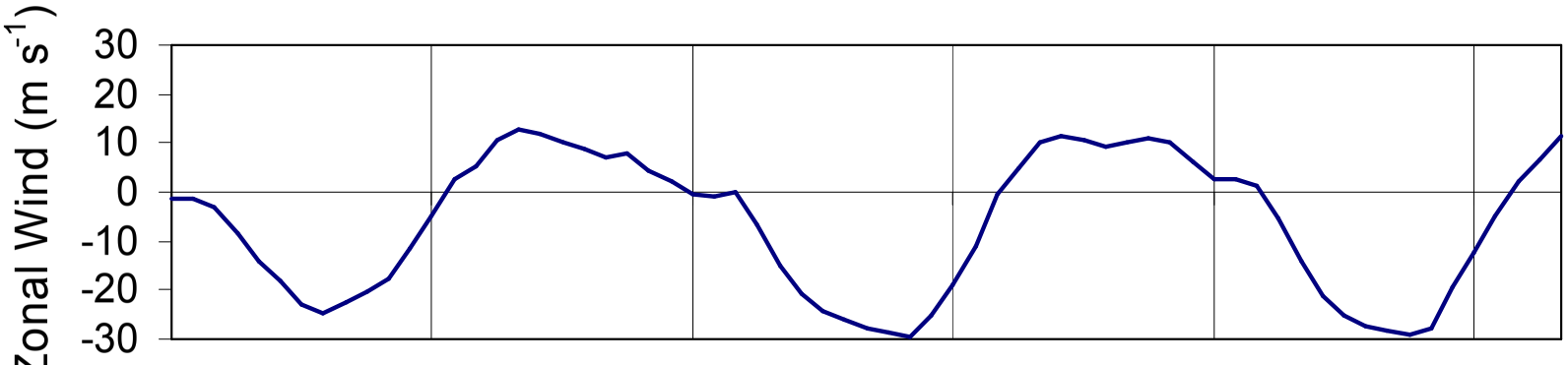
QBO: The wind above the equator changes direction on average every ~ 26 months.



- related to upward propagating waves and consequent momentum deposition changes
- solar cycle signature can be identified in connection with the phase of QBO.

Savtchenko et al., AIRS Science Mtng, Oct, 2008





30 mb zonal wind at the Equator.