Online Visualization and Analysis of Global Half-hourly Pixel-Resolution Infrared Dataset

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Outline

- Data
- System description
- Basic functions and features
- Examples
- Summary
- Future work

Data Description:

The Goddard Earth Sciences Data Information Services Center (GES DISC) is home of Tropical Rainfall Measuring Mission (TRMM) data archive.

The global merged IR product, also known as, the NCEP/CPC 4km Global (60ºN - 60ºS) IR Dataset, is one of TRMM ancillary datasets. They are pixel-resolution IR brightness temperature data (equivalent blackbody temperatures), merged from all available geostationary satellites (GOES-8/10, METEOSAT-7/5 & GMS).

Data Description (cont.):

The GES DISC has collected over 8 years of the data beginning from February of 2000. This high temporal resolution dataset can not only provide additional background information to TRMM and other satellite missions, but also allow observing a wide range of meteorological phenomena from space, such as, mesoscale convective system, tropical cyclones, hurricanes, etc.

In short:

- *4 km IR*
- *Global (60ºN - 60ºS)*
- *30 minutes*
- *Since Feb., 2000*

Data Description (cont.):

Despite that the data can be downloaded via ftp, however, its large volume poses a challenge for many users. A single file occupies about 70 MB disk space and there is a total of ~73,000 files (~4.5 TB) for the past 8 years.

- *Data volume*
- *Software and documentation*
- *Computing resources*

Is there a better way for this?

Data Description (cont.):

In order to facilitate data access, we have developed a web prototype to allow users to conduct online visualization and analysis of this dataset.

With a web browser and few mouse clicks, users can:

- *Have a full access to over 8 year and over 4.5 TB data*
- *Generate black and white IR imagery and animation without downloading any software and data.*

System Description:

- *Performance*
- *Simple and user friendly interface*
- *Features making exploration easy and fun*
- *Simple, easy to maintain*

System Description (cont.):

Performance: Two datasets (original 4 km and 25 km). For large areas, use the coarse resolution dataset. For small areas, use the original. Currently, only the original dataset is used.

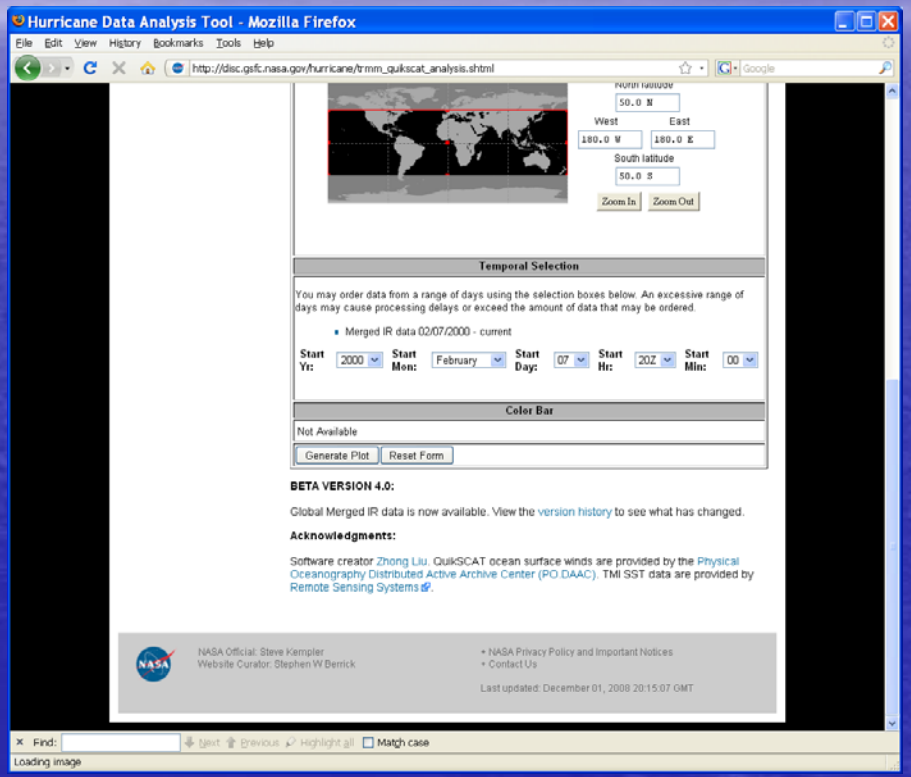
Main components:

- *A web interface (GUI) passing user's selections.*
- *A CGI script that handles the input, generates image and create animation. The script will pass the result to the user's web browser.*
- *A cron job will update the two datasets.*

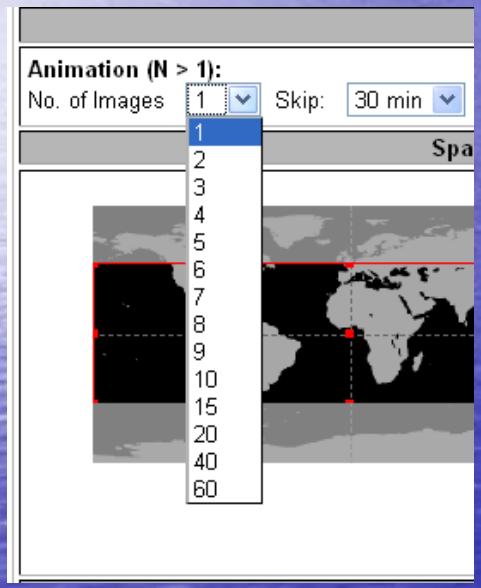
Basic Functions and Features:

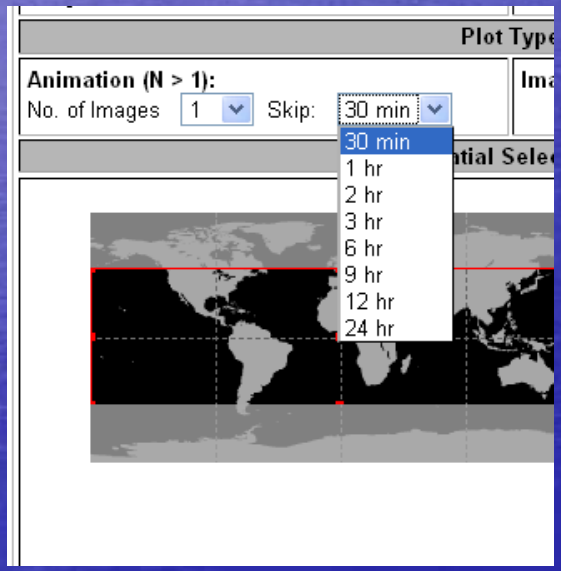
- *Selection of area of interest*
- *Single image or multiple images (animation)*
- *Allow time skipping (1 hr., 2 hr., etc.)*
- *Allow different image sizes*

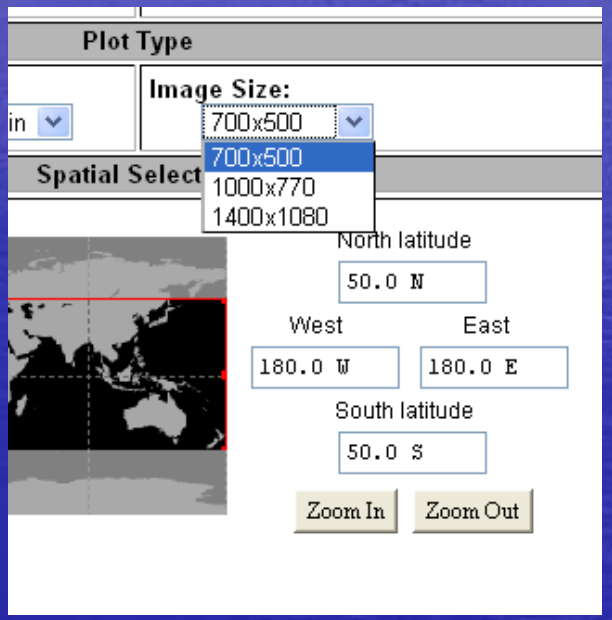
Basic Functions and Features (Cont.):



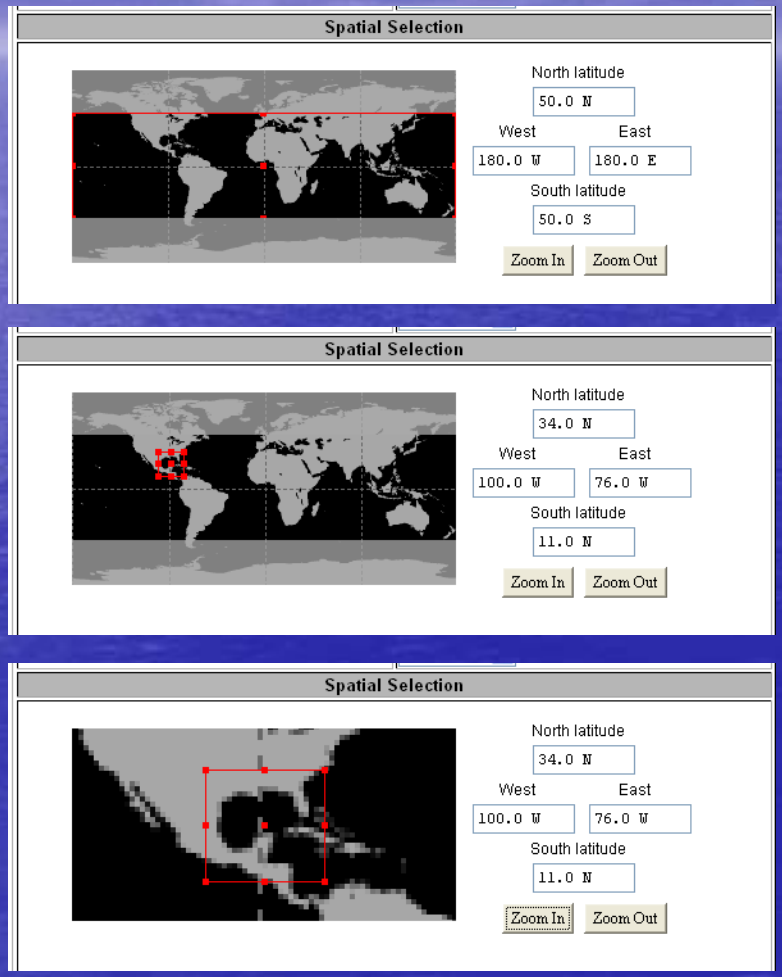
Basic Functions and Features (Cont.):



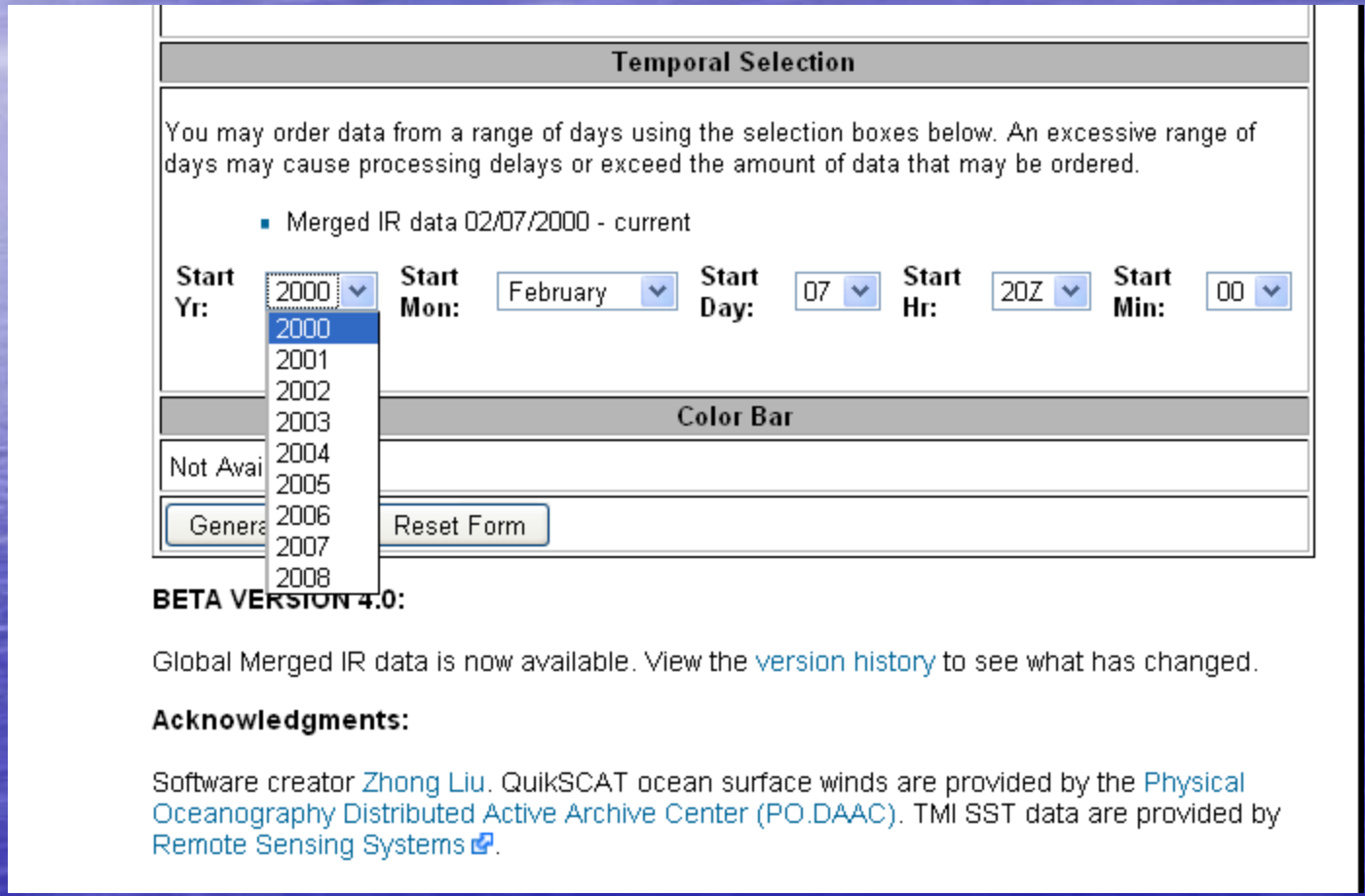




Basic Functions and Features (Cont.):



Basic Functions and Features (Cont.):



Examples:

- *Hurricanes/typhoons and tropical cyclones*
- *Mesoscale convective systems (MCSs)*
- *Precipitation systems*
- *Integrated investigations*

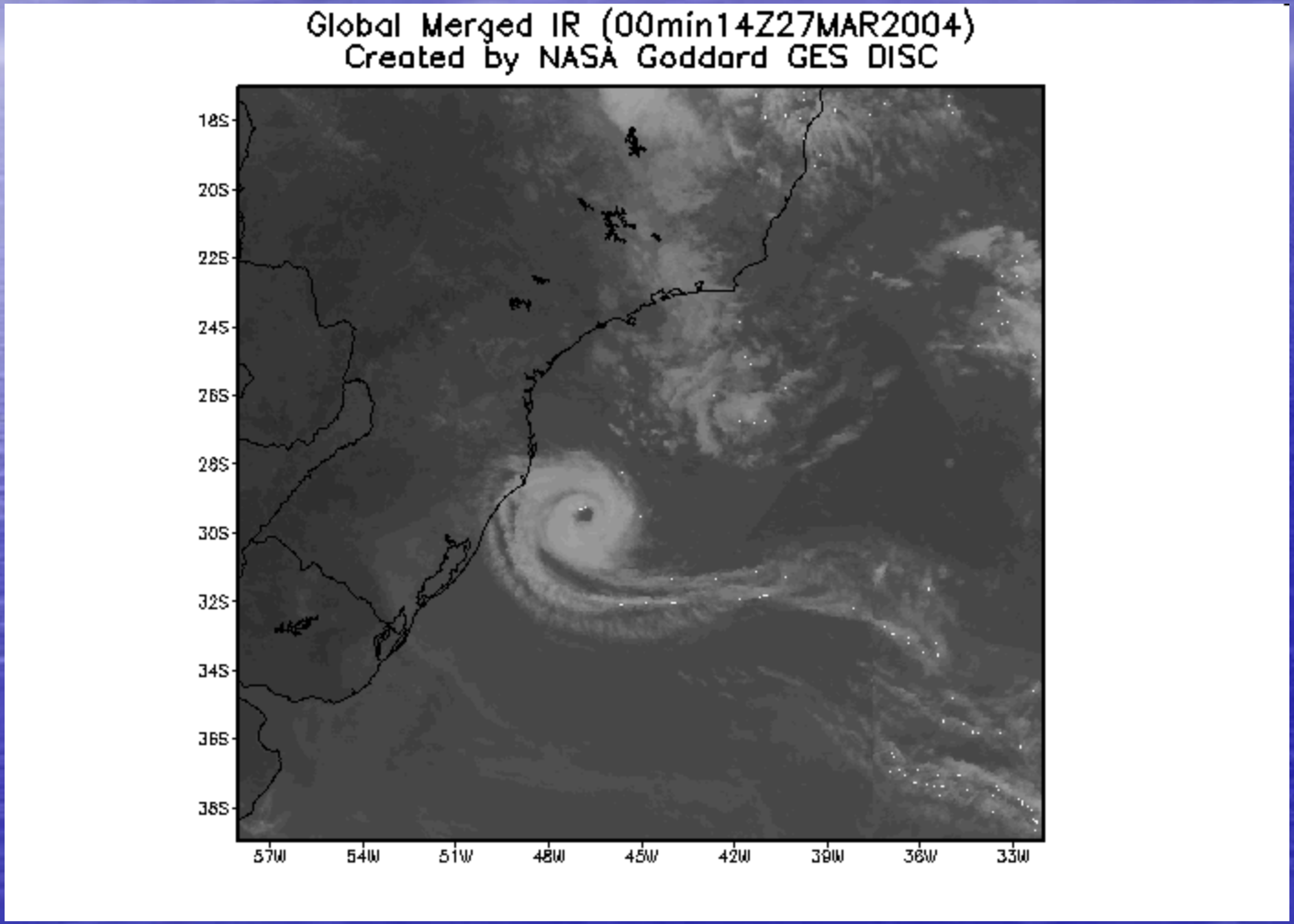
Examples (cont.):

Hurricanes/typhoons and tropical cyclones

***Wiki: Cyclone Catarina** is one of several informal names for a South Atlantic tropical cyclone that hit southeastern Brazil in late March 2004. The storm developed out of a stationary cold-core upper-level trough on March 12. Almost a week later, on March 19, a disturbance developed along the trough and traveled towards the east-southeast until March 22 when a ridge caused the forward motion of the disturbance to cease. The disturbance was in an unusually favorable environment with below average wind shear and above average sea surface temperatures. The combination of the two led to a slow transition from an Extratropical cyclone to a Subtropical cyclone by March 24. The storm continued to obtain tropical characteristics and became a tropical storm the next day while the winds steadily increased. The storm reached winds of 75 mph (120 km/h)—equivalent to a low-end category one hurricane on the Saffir-Simpson Hurricane Scale—on March 26. At this time it was unofficially named Catarina and was also the first hurricane-intensity tropical cyclone ever recorded in the Southern Atlantic Ocean. Unusually favorable conditions persisted and Catarina continued to intensify and was estimated to have peaked with winds of 100 mph (155 km/h) on March 28. The storm made landfall later during the day at that intensity near the town of Torres. Catarina rapidly weakened upon landfall and dissipated the next day.*

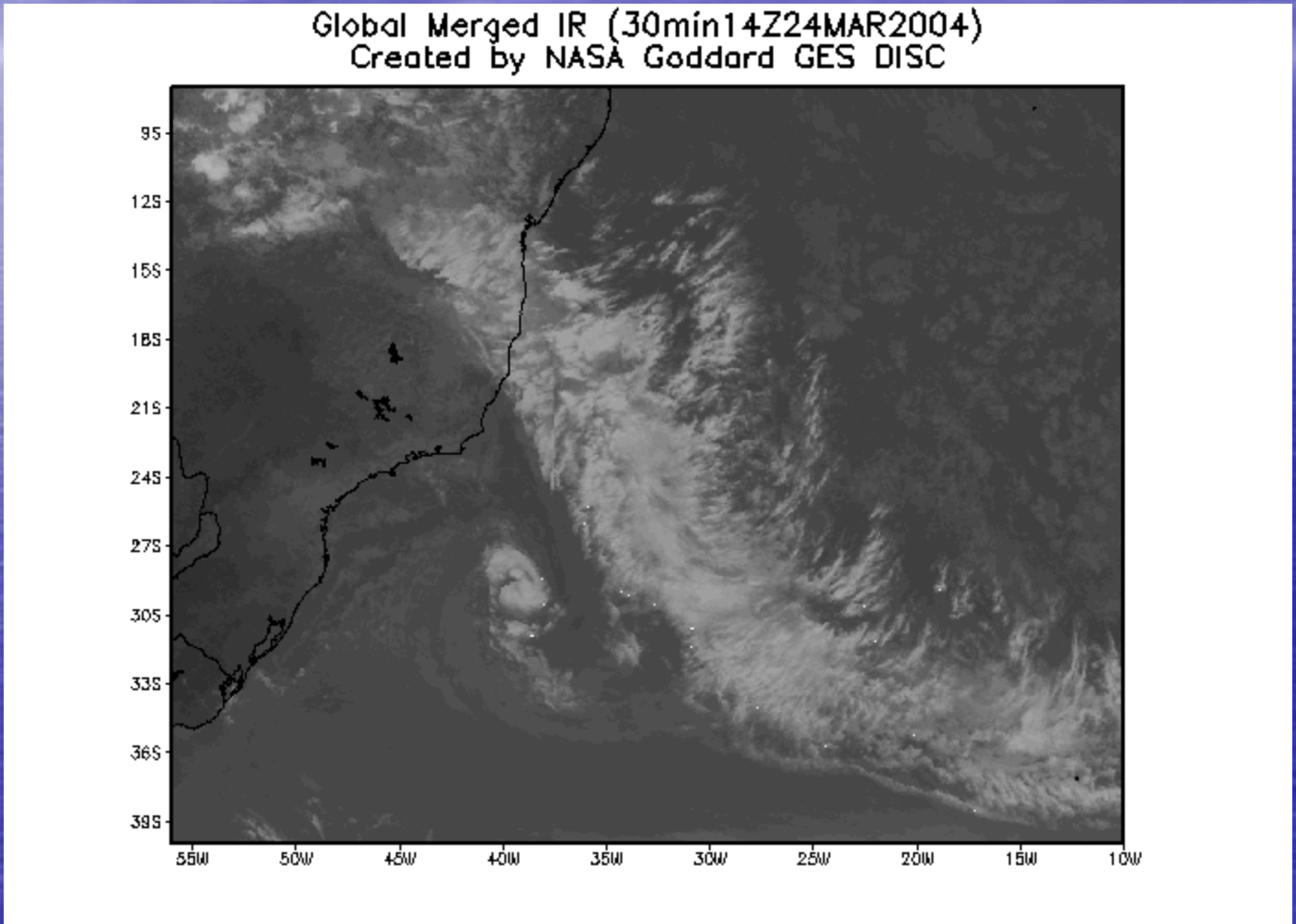
Examples (cont.):

Category 2 cyclone Catarina



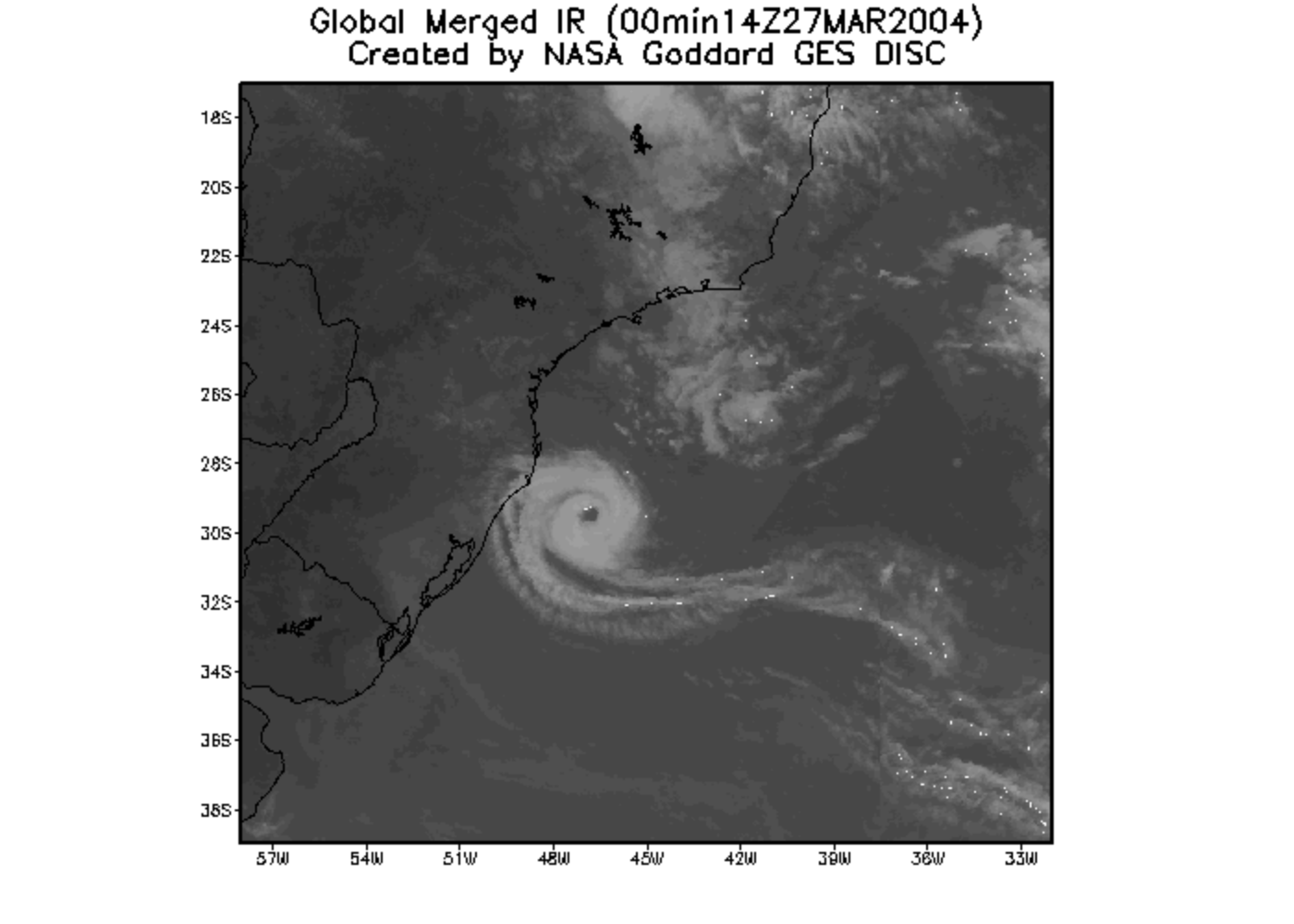
Examples (cont.):

Category 2 cyclone Catarina – Early development



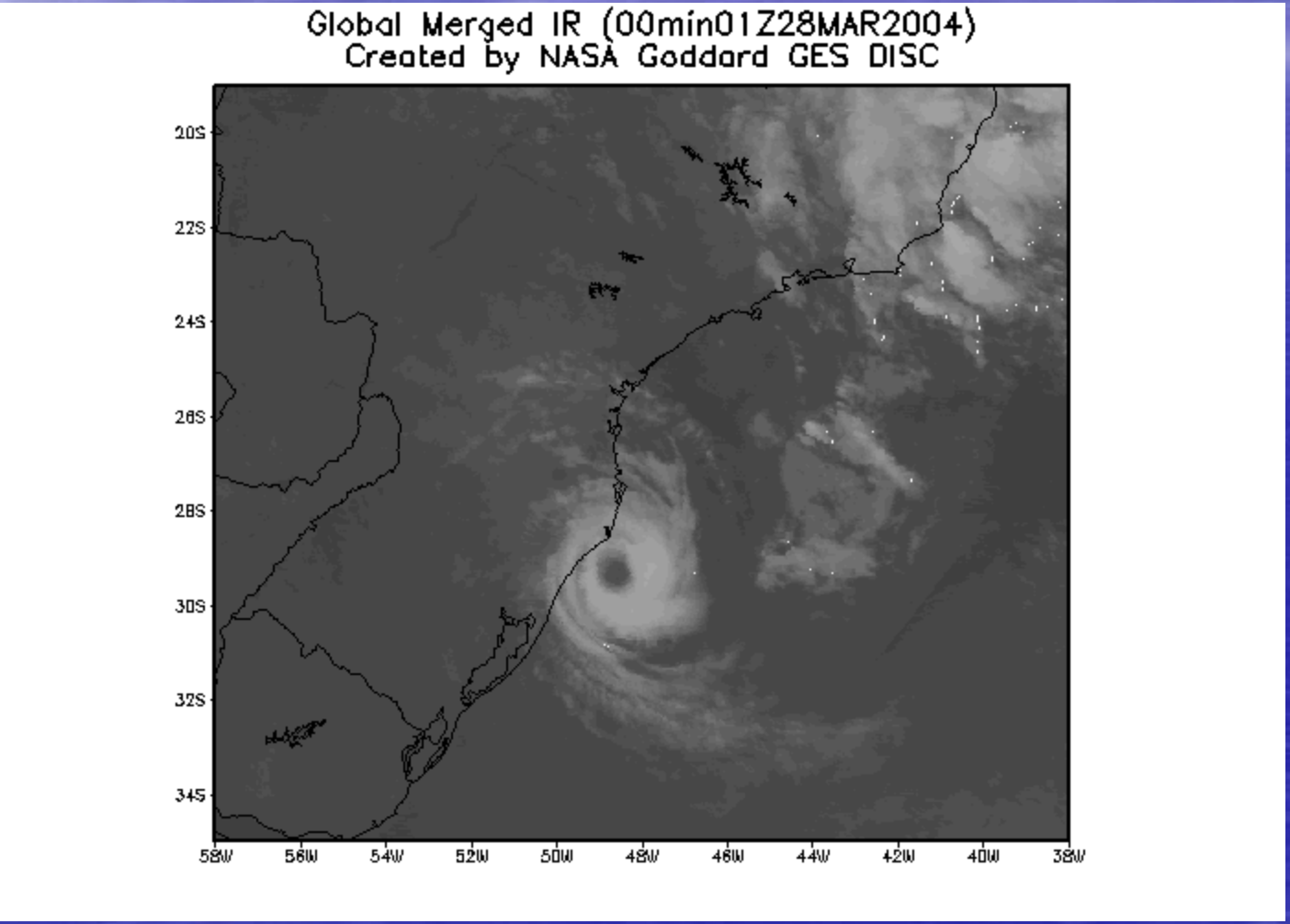
Examples (cont.):

Category 2 cyclone Catarina - Mature



Examples (cont.):

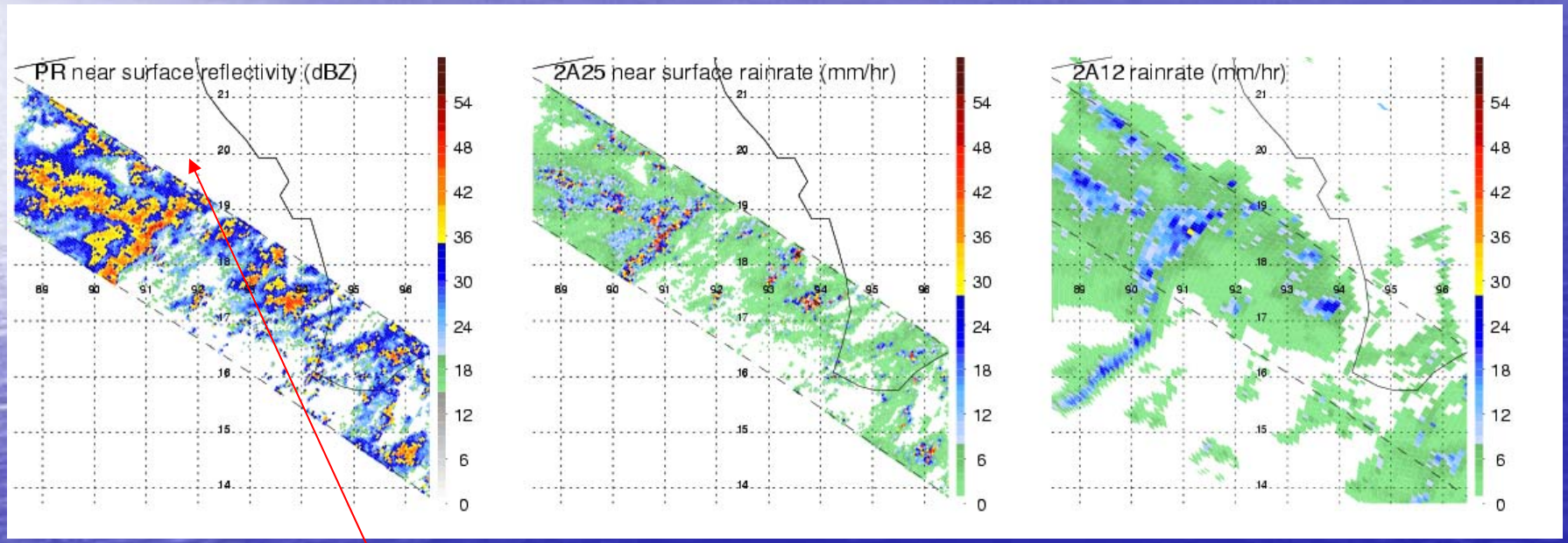
Category 2 cyclone Catarina – Landfall



Examples (cont.):

Courtesy of Uinv. of Utah

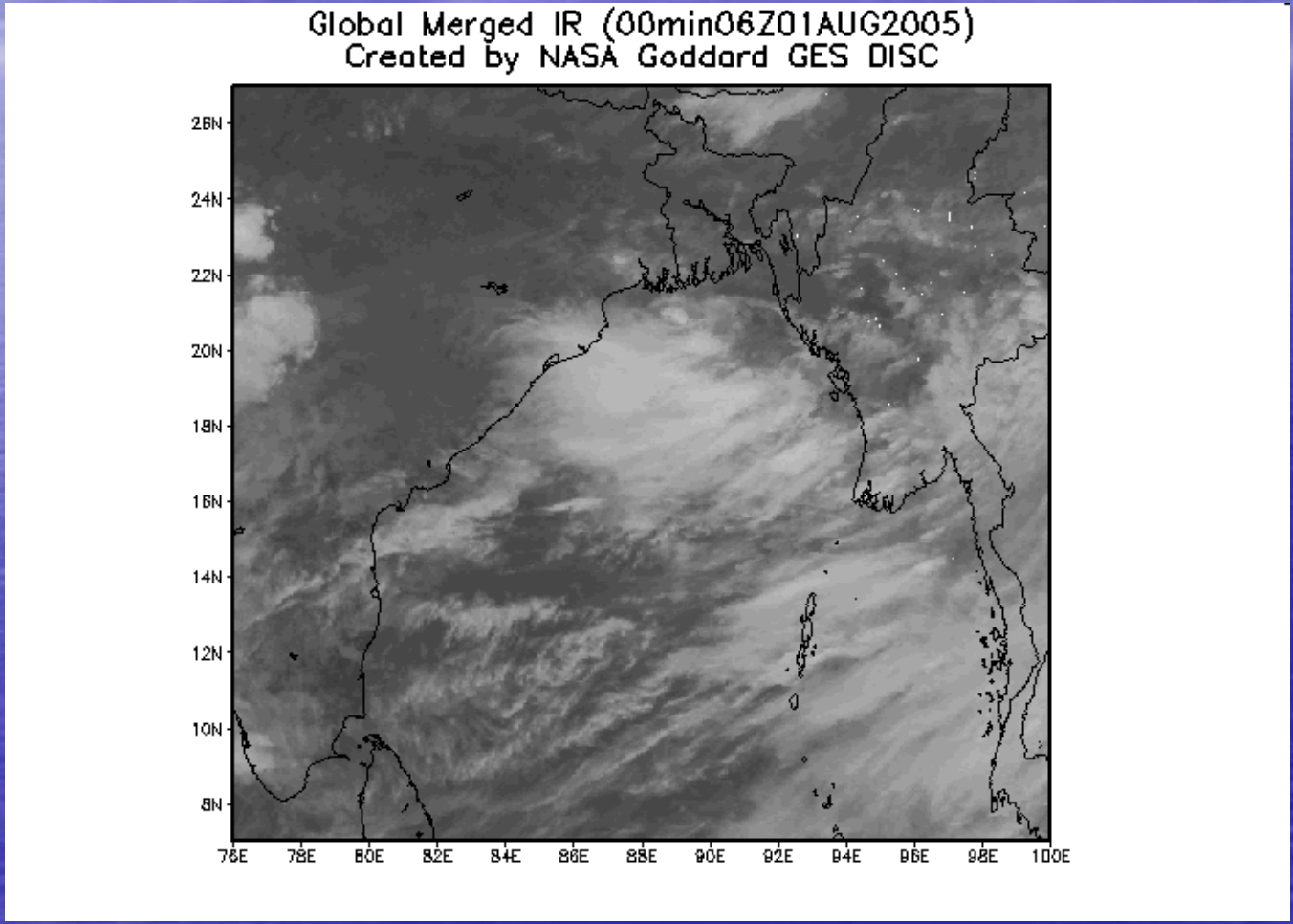
- *Mesoscale convective systems: TRMM Observation*



Bay of Bengal

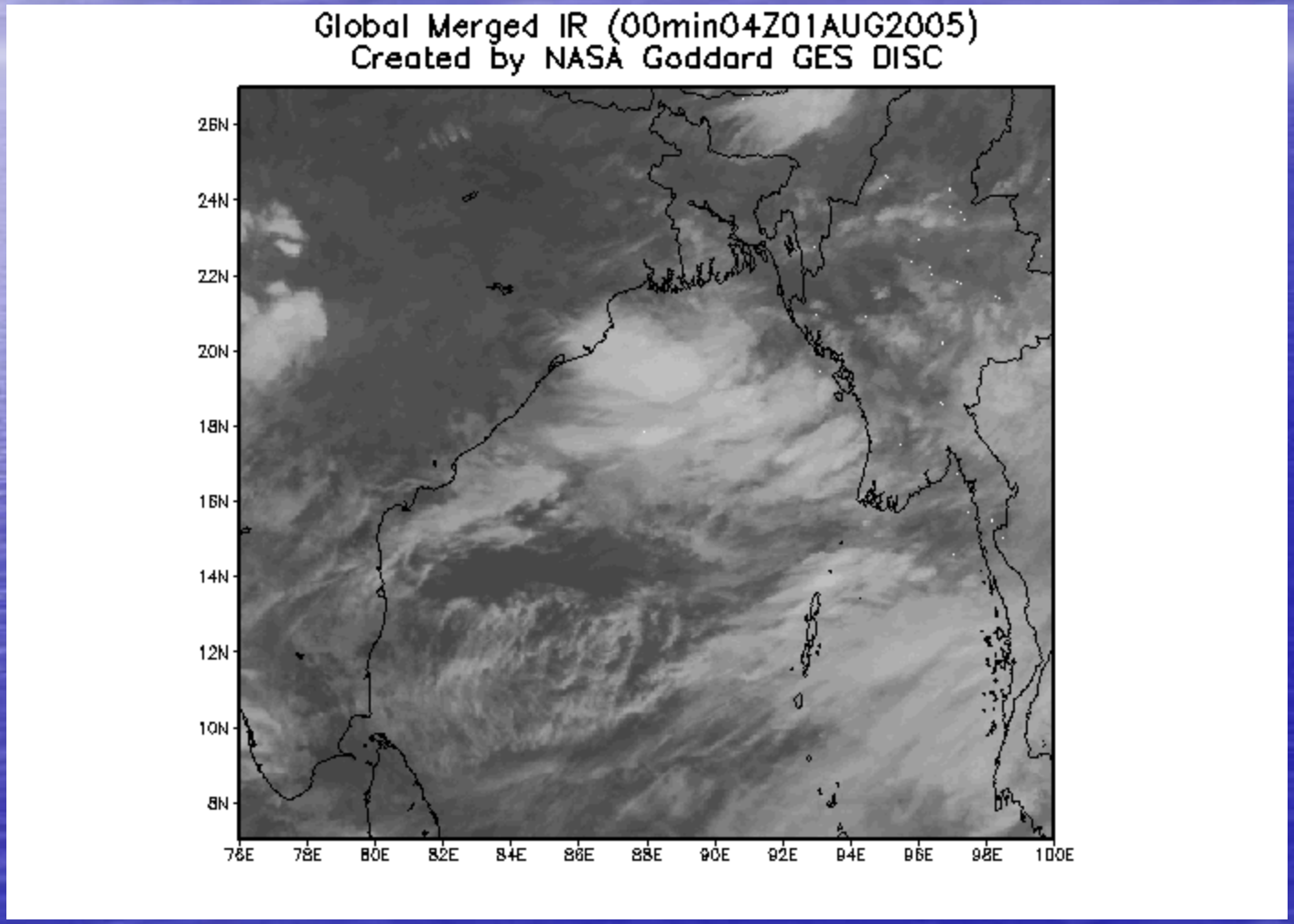
Examples (cont.):

- *Mesoscale convective systems*



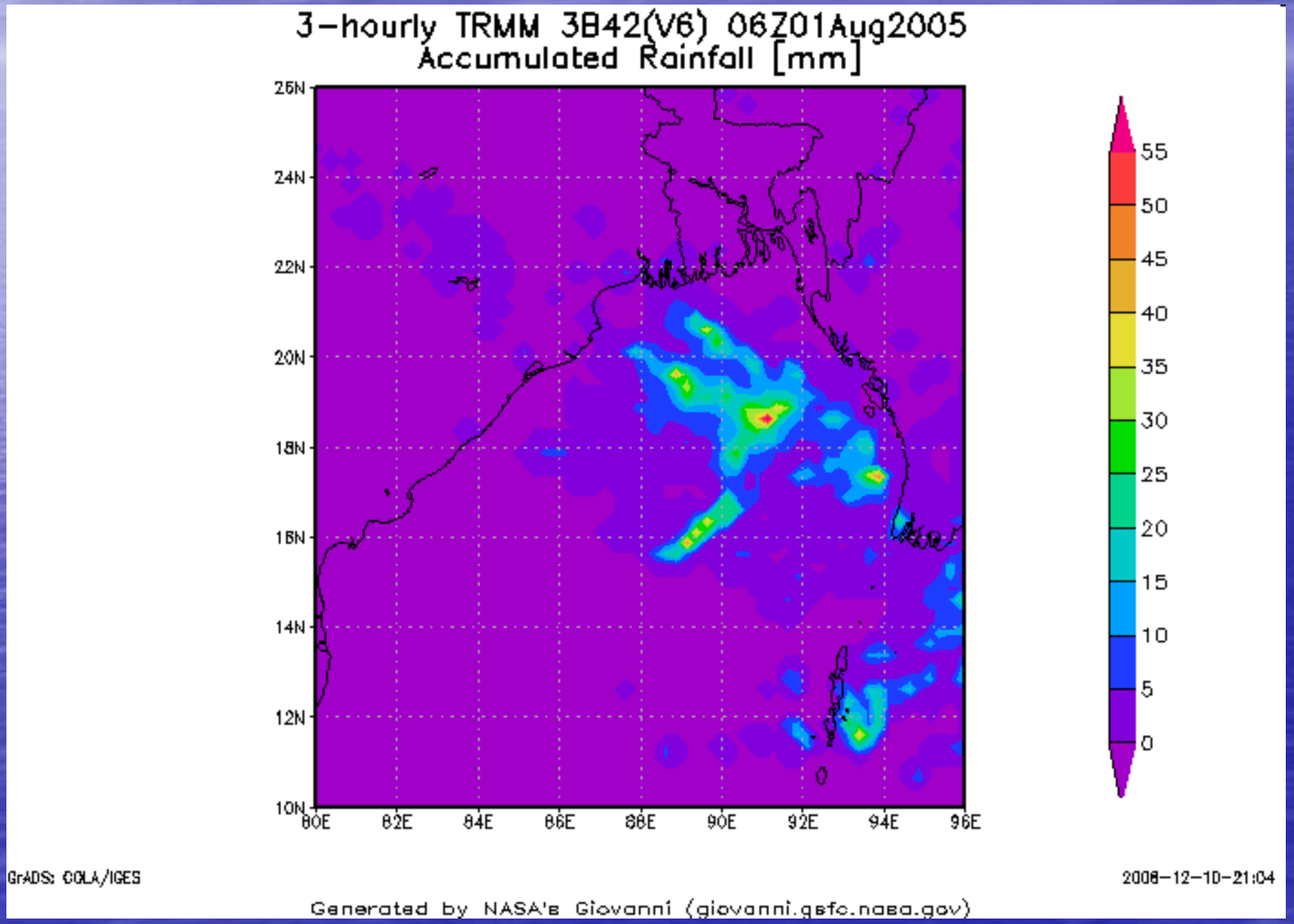
Examples (cont.):

- *Mesoscale convective systems*



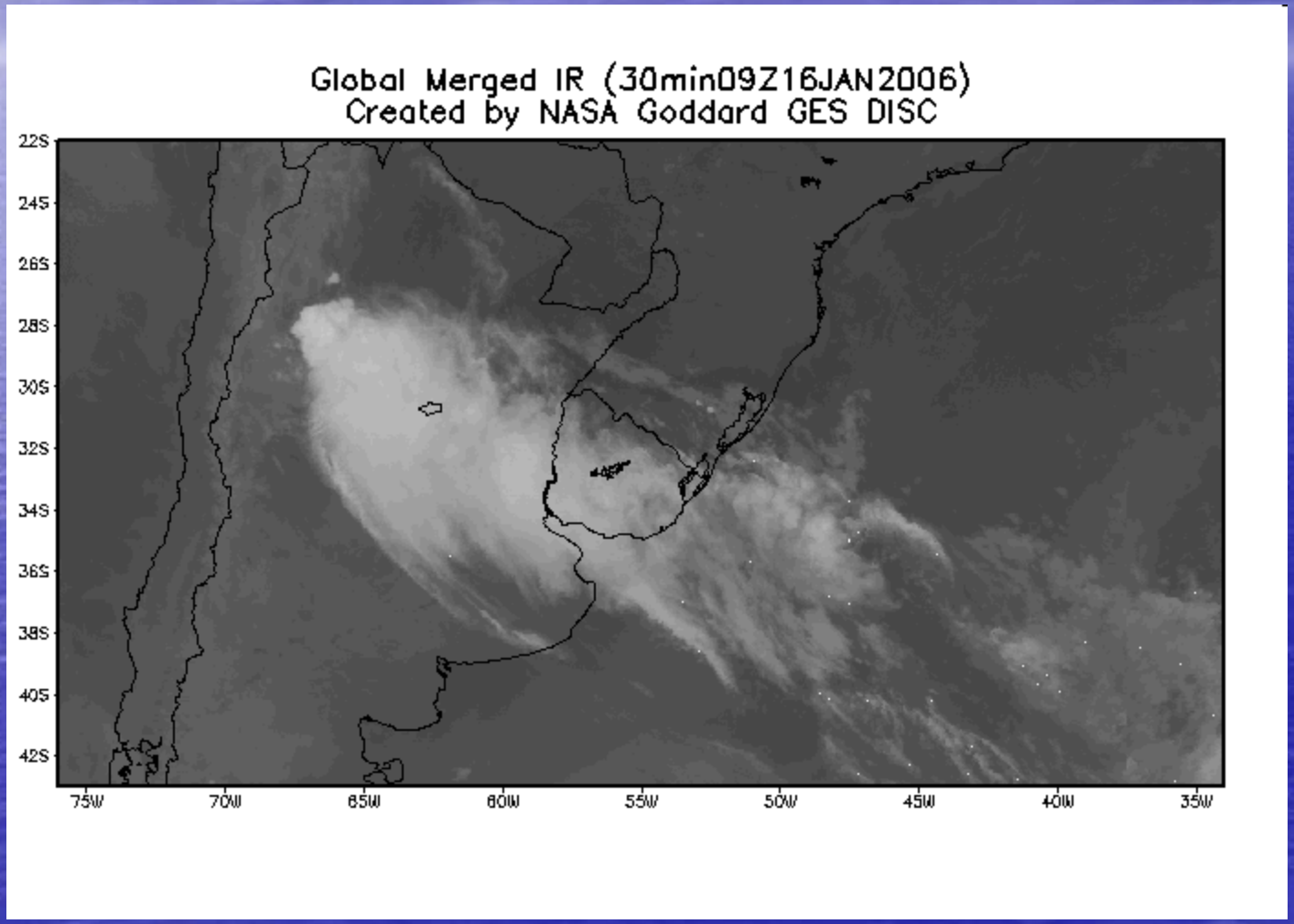
Examples (cont.):

- *Mesoscale convective systems*



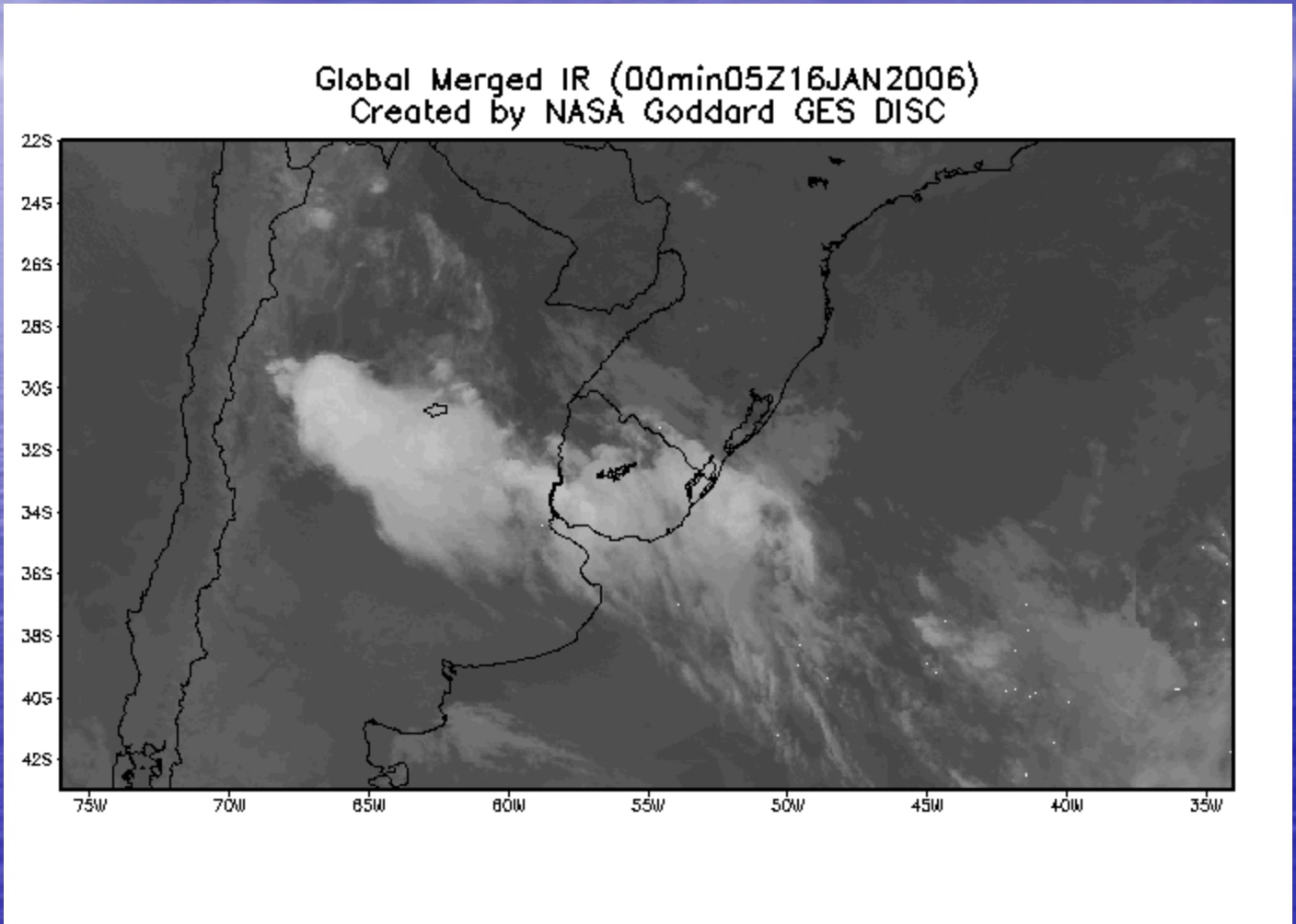
Examples (cont.):

- *Mesoscale convective systems in Argentina*



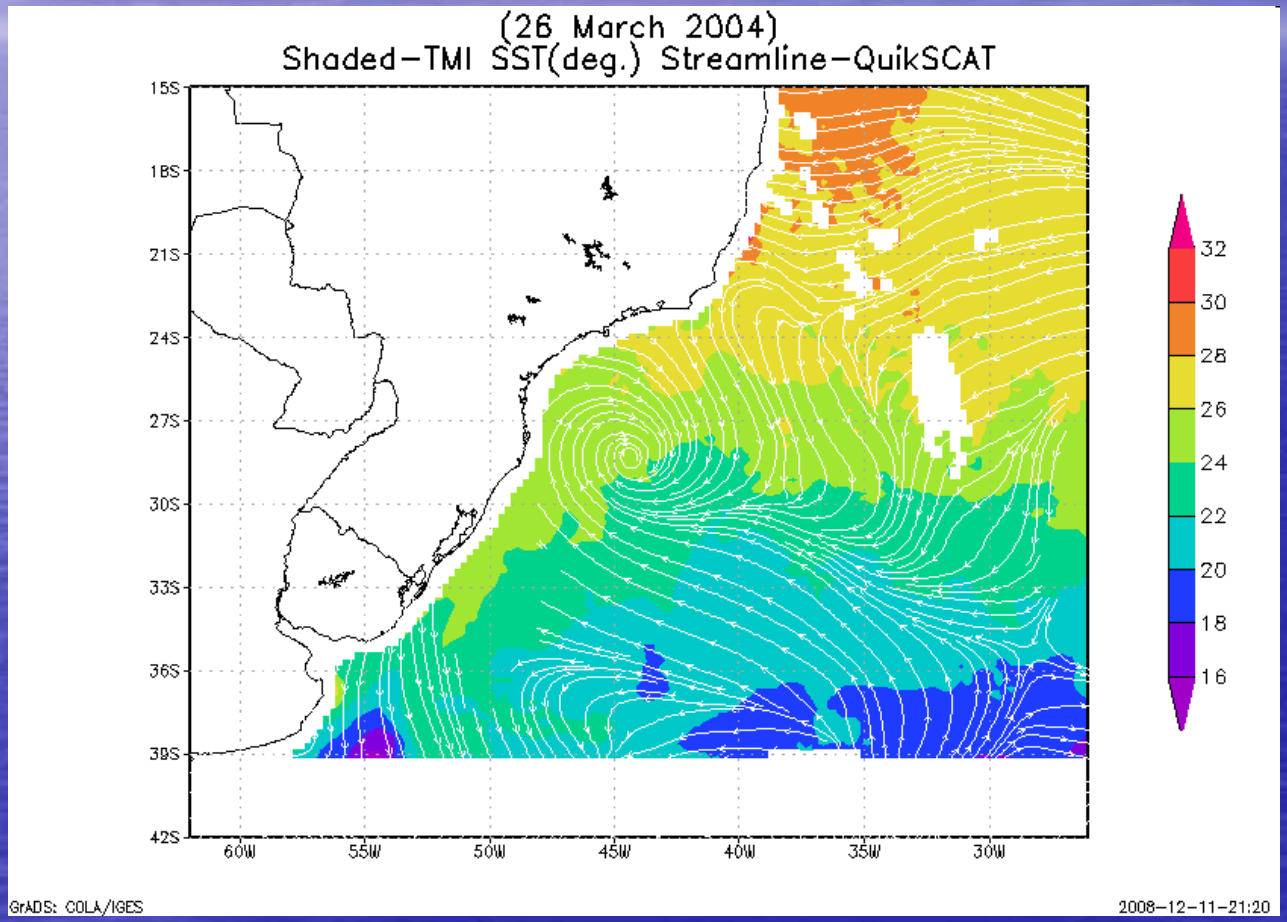
Examples (cont.):

- *Mesoscale convective systems*



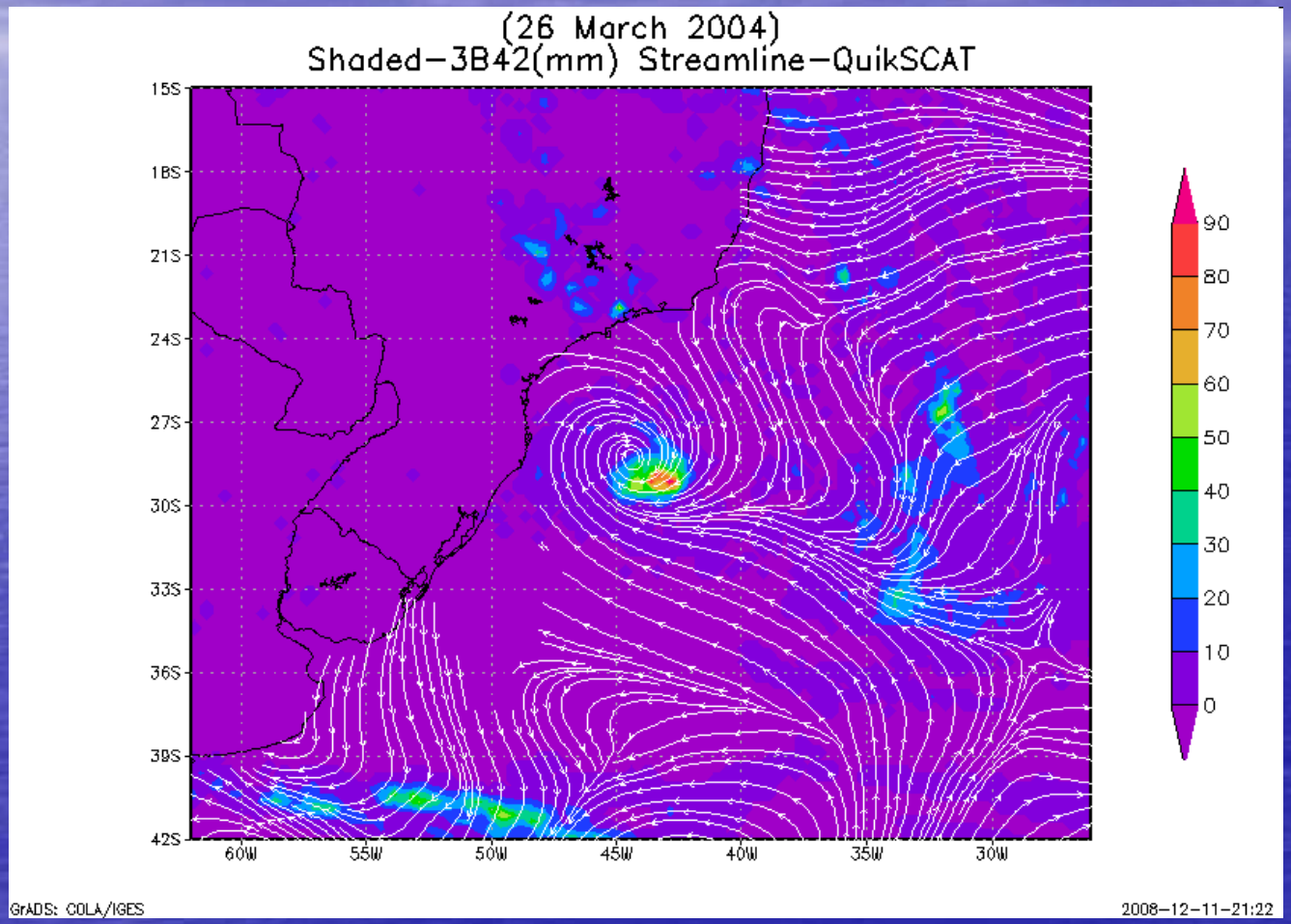
Examples (cont.):

- *Integrated Investigation (Cyclone Catarina)*



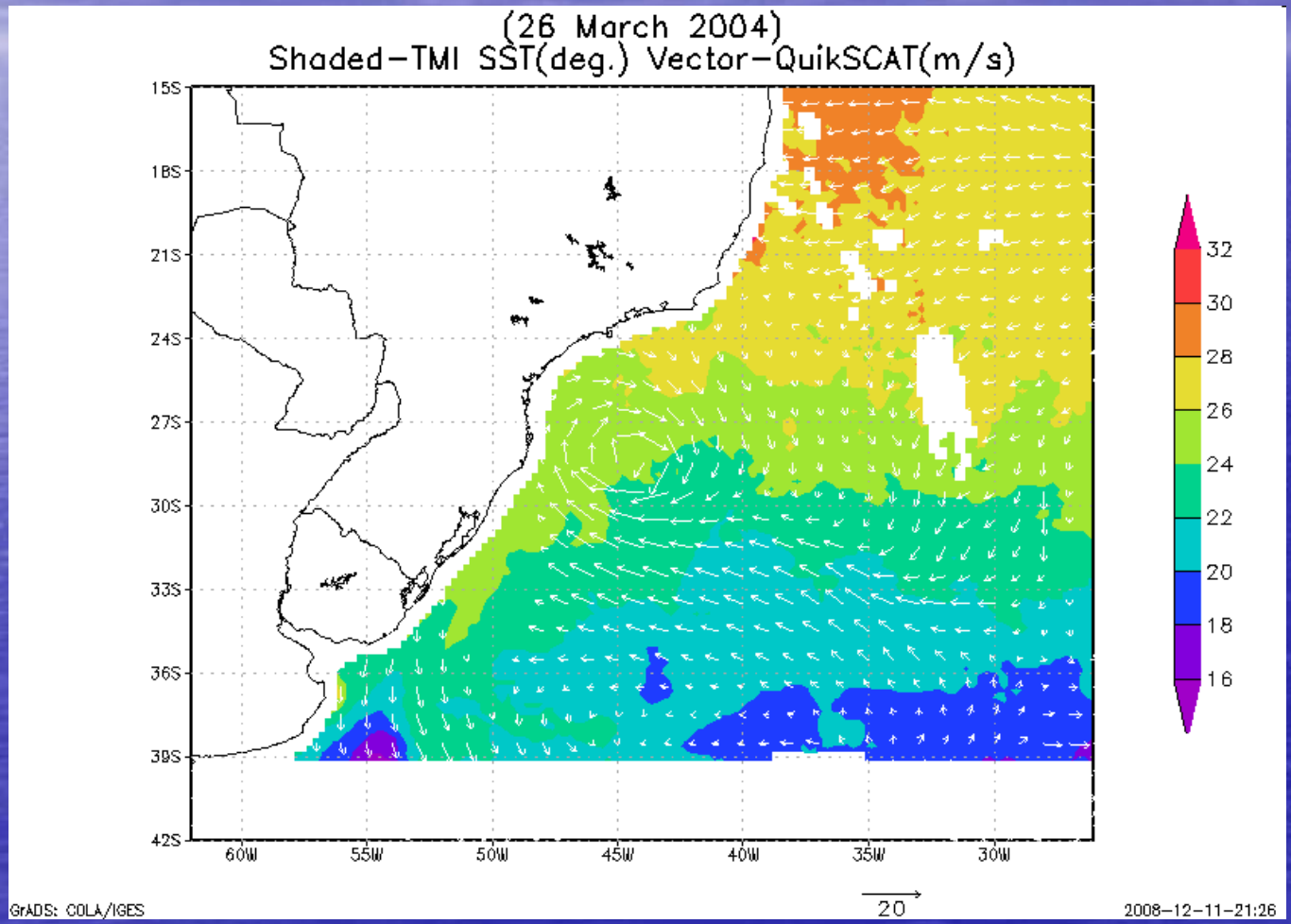
Examples (cont.):

- *Integrated Investigation*



Examples (cont.):

- *Integrated Investigation*

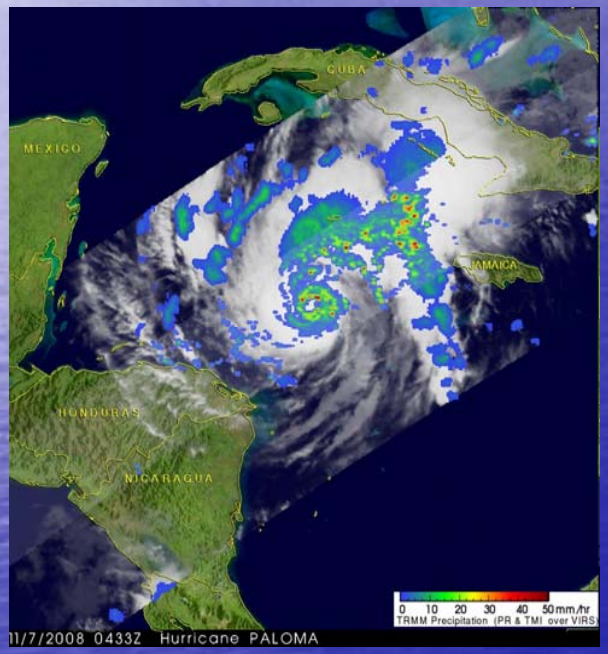


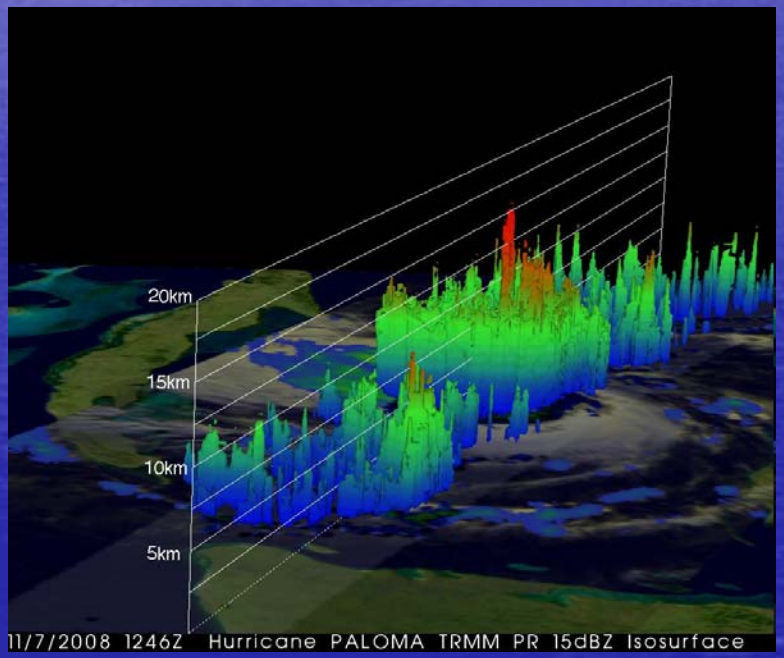
Examples (cont.):

- *Integrated Investigation*
  - *TRMM (PR, TMI,…)*
  - *CloudSat (Reflectivity)*
  - *QuikSCAT (Sea surface wind)*
  - *Merged IR*
  - *AIRS profiles*
  - *Reanalysis*

Examples (cont.):

- *Integrated Investigation*





Hurricane Paloma
observed by TRMM

Summary

- *~73,000 files (~4.5 TB, still growing) for the past 8 years of the global merged IR product is available for exploration*
- *A tool is available for generating b/w images and animations*
- *Allow to select an area of interest, time, time steps, and image sizes*
- *Meteorological case studies, K-12 education*

Future Plans:

- *Improving performance for making animation*
- *Eliminate area selection size limit*
- *Add false colors (see left)*
- *More functions (e.g., Hovmoller)*
- *Integrate other satellite observations and model data*
- *Your inputs*

Thank You!

http://disc.gsfc.nasa.gov/hurricane/trmm_quikscat_analysis.shtml