

The Use of the **RGB** Products at the HPC, OPC, NHC, and SAB Proving Grounds During the 2011 Atlantic Hurricane Season

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04/17/12

30th AMS Conference on Hurricanes and Tropical Meteorology

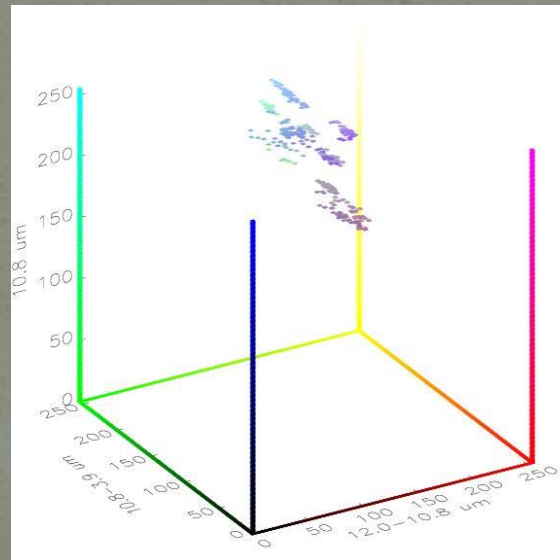
RGB Applications

RGB Applications		
<p>General Land and Atmospheric Features Interpreting surface and atmospheric features, such as vegetated areas, deserts, clouds, snow, ocean</p>	-----	True Color, Natural Color, False Color
<p>Cloud and Fog Cloud analysis Distinguishing clouds from snow cover during daytime Viewing low clouds at night (given sufficient moonlight) Helping to classify clouds & detecting fog/low cloud during day & night Distinguishing between high and low clouds</p>	----- ----- ----- ----- -----	Day Microphysics Cloud Over Snow Nighttime Visible Fog & Stratus Visible/Infrared
<p>Volcanic Ash: Detecting ash, sulphur dioxide, and ice crystals from volcanic eruptions and tracking plumes for long distances downstream of an eruption</p>	---	Volcanic Ash Dust
<p>Dust: Monitoring the evolution of dust clouds day and night</p>	-----	Dust
<p>Fires Viewing fires Detecting fires</p>	----- -----	Nighttime Visible Fog & Stratus Day Microphysics
<p>Snow Viewing low clouds & snow cover at night given moonlight Distinguishing clouds from snow cover during daytime</p>	----- -----	Nighttime Visible Cloud Over Snow Day Microphysics
<p>Cyclones and Air Masses Monitoring the evolution of cyclones during both day and night (in particular, rapid cyclogenesis, jet streaks, and PV anomalies), and obtaining information about the middle and upper levels of the troposphere</p>	-----	Air Mass
<p>Convection: Identifying microphysical trends in convection during day and obtaining information about the middle and upper levels of the troposphere</p>	---	Day Microphysics Convection

The COMET Program

RGB Imagery

- The colors in RGB images have direct physical correlations.
- A channel or channel difference is assigned to a color (red, green, or blue).
- The contribution of each color to a pixel in the image is proportional to the contribution of its assigned channel/channel difference.
- EUMETSAT has developed RGB techniques for use with SEVIRI which have been adapted to MODIS by SPoRT.



Hayden Oswald and Andrew Molthan

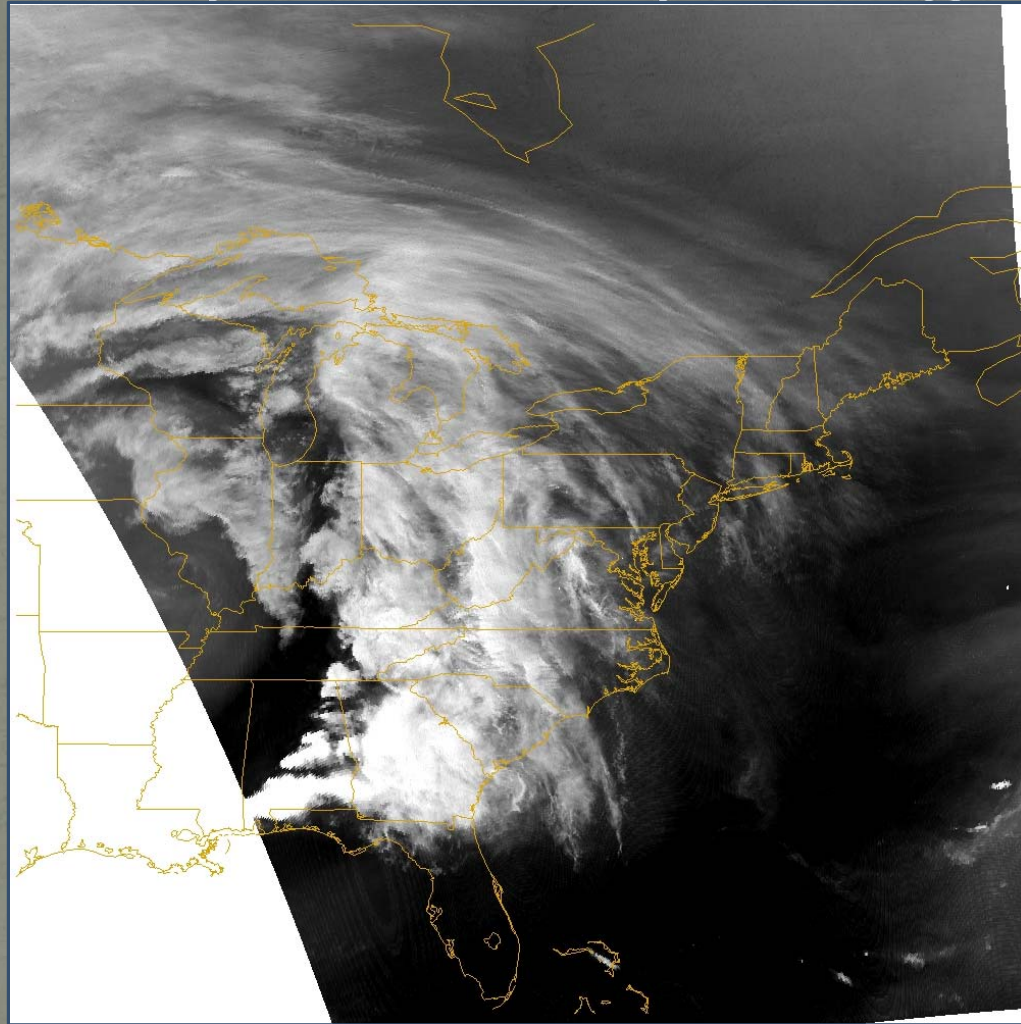
Air Mass

- Air mass product helps to distinguish among synoptic-scale features, such as fronts and jets.
- Utilizes MODIS channels/channel differences:
 - 6.2 μm -7.3 μm
 - 9.7 μm -10.8 μm
 - 6.2 μm (inverted)
- Current techniques
 - Single channel water vapor imagery (GOES 6.7 μm)
- GOES-Sounder Channels
 - The recipe uses channels 8 (11.03 μm), 9 (9.71 μm), 10(7.43 μm), and 12 (6.51 μm) as follows:
 - RED Ch12 - Ch10 -25C to 0C
 - GREEN Ch9 - Ch8 -40C to 5C
 - BLUE Ch12 243K to 208K

Hayden Oswald, Andrew Molthan, John Knaff

Case Study: 16 April 2011, 0315Z

6.8 μm Water Vapor Image



Hayden Oswald and Andrew Molthan

Case Study: 16 April 2011, 0315Z

Air Mass Multispectral Image

Interpretation of Colors

Cloudy Skies

Clear Skies



Thick, high-level cloud



Jet (high PV)



Thick, mid-level cloud



Cold air mass



Low-level cloud
(Cold air mass)



Warm air mass
(High Upper Tropospheric
Humidity)

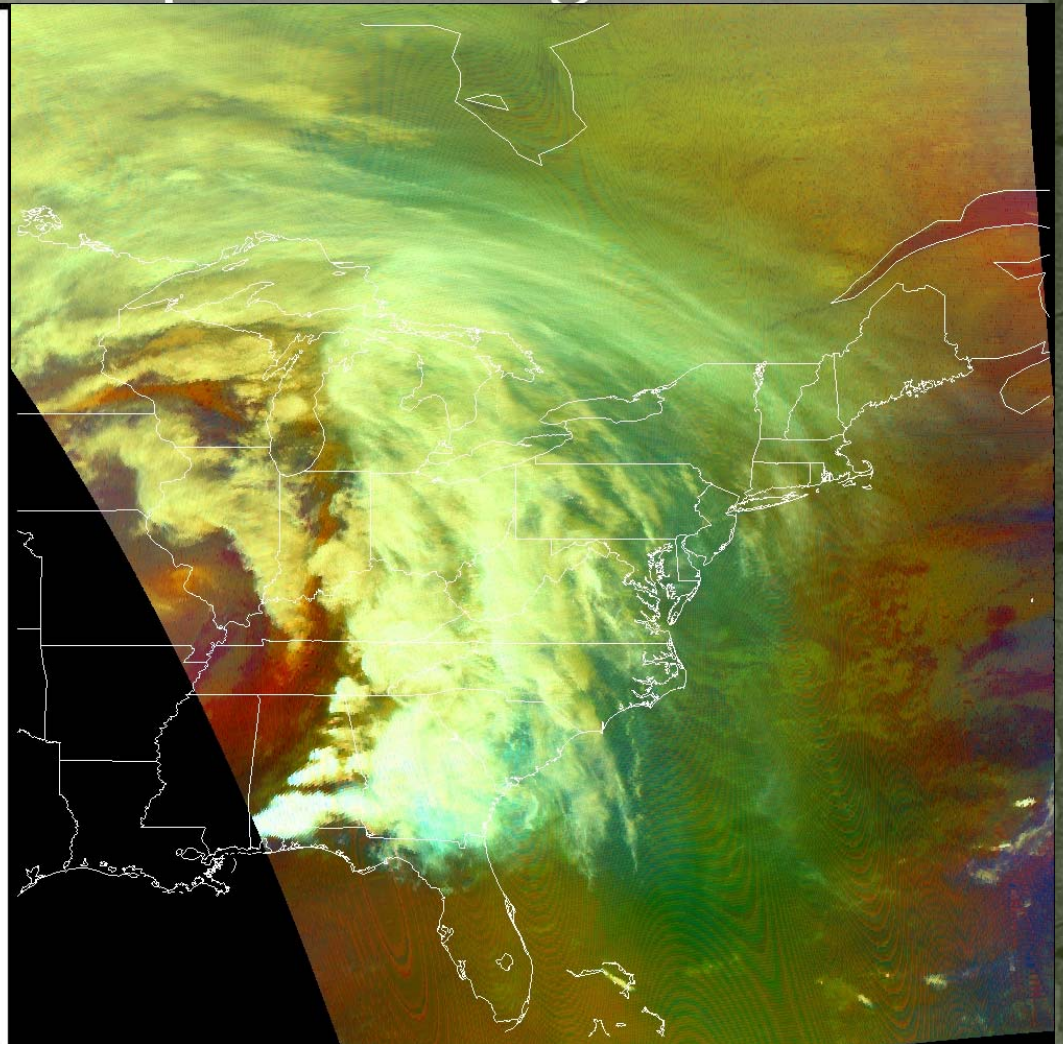


Low-level cloud
(Warm air mass)



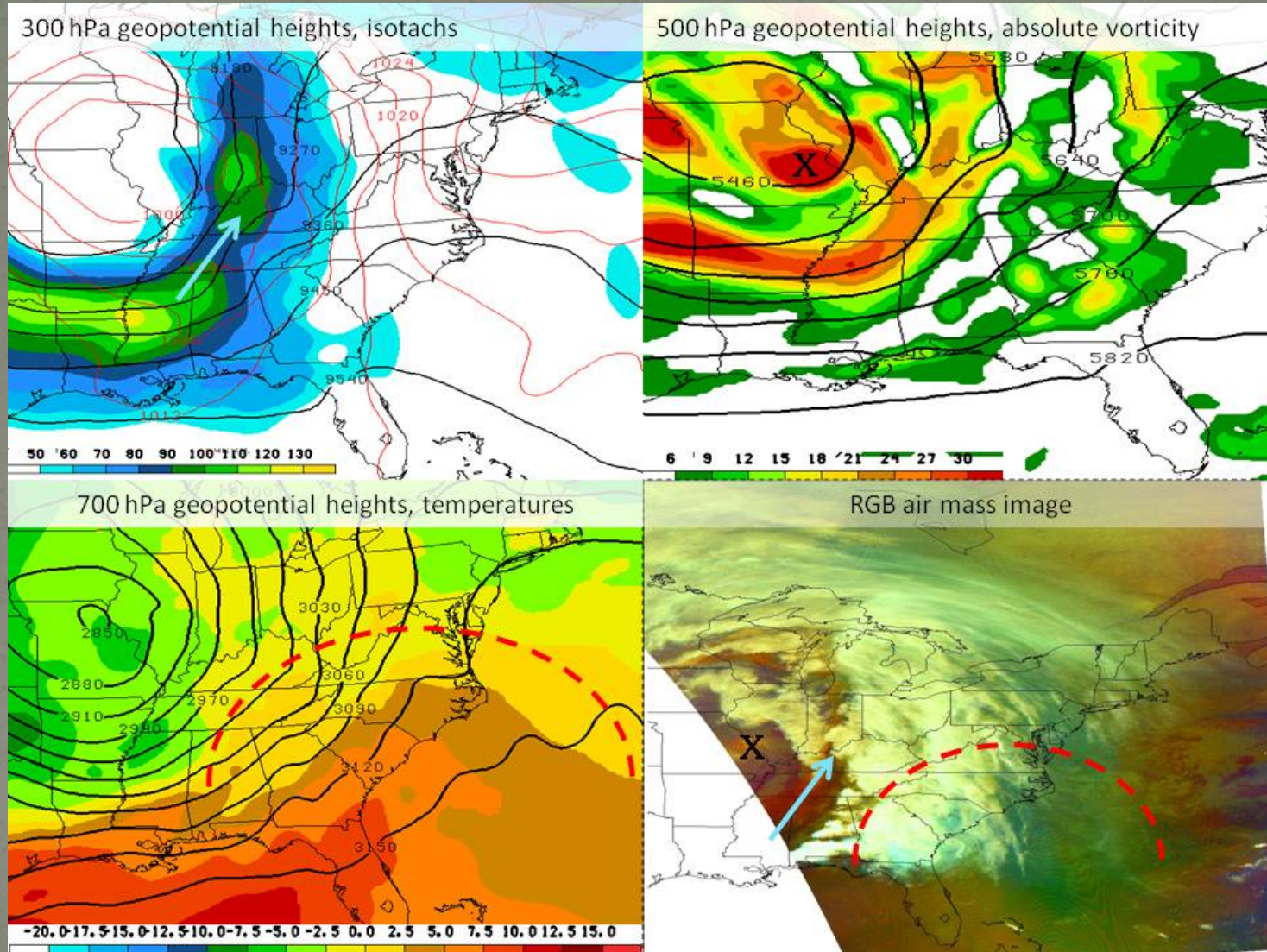
Warm air mass
(Low Upper Tropospheric
Humidity)

Adapted from EUMETSAT



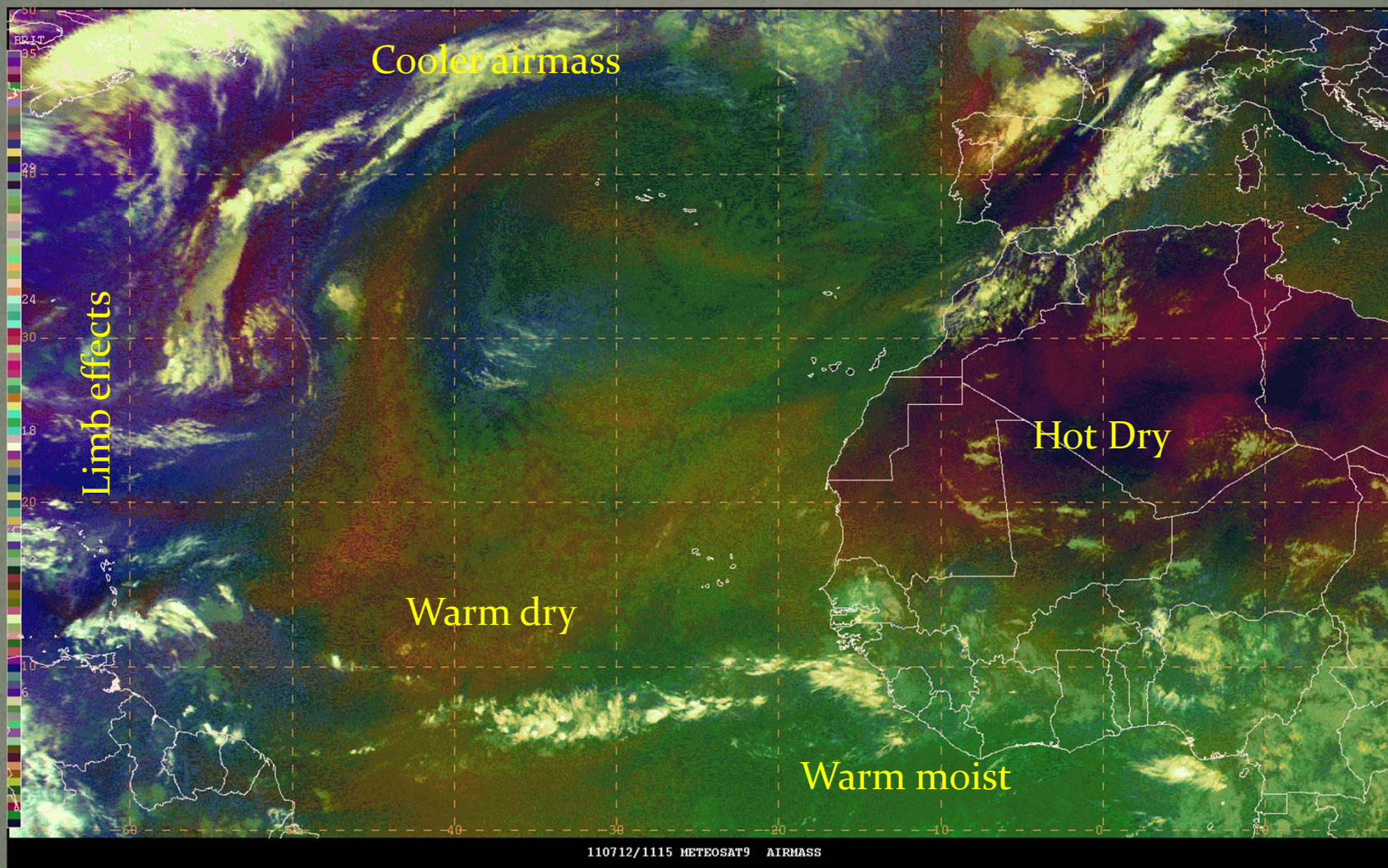
Hayden Oswald and Andrew Molthan

RUC Analysis Comparison



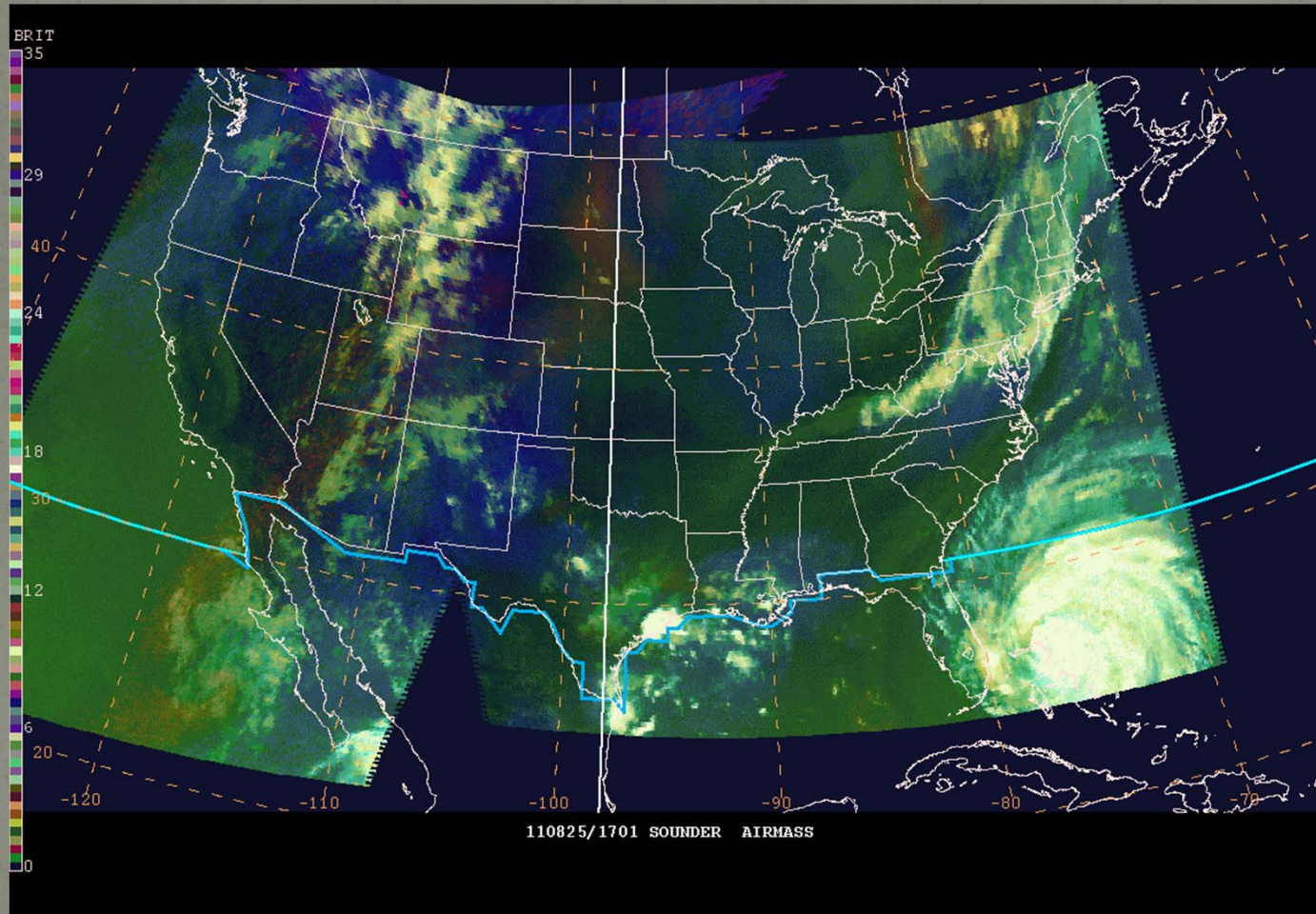
Hayden Oswald and Andrew Molthan

RGB Air Mass Product from SEVIRI



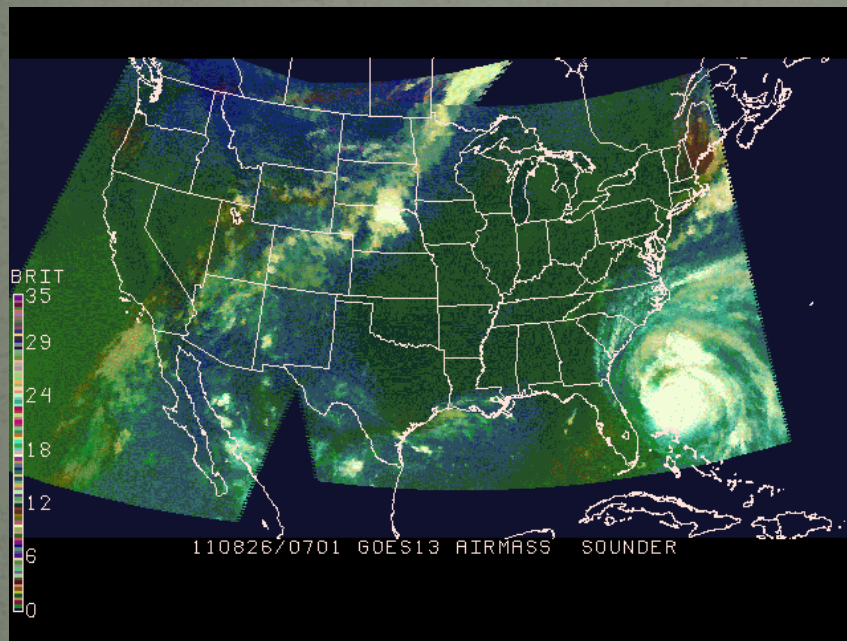
Hurricane Irene 2011

GOES-Sounder RGB Product

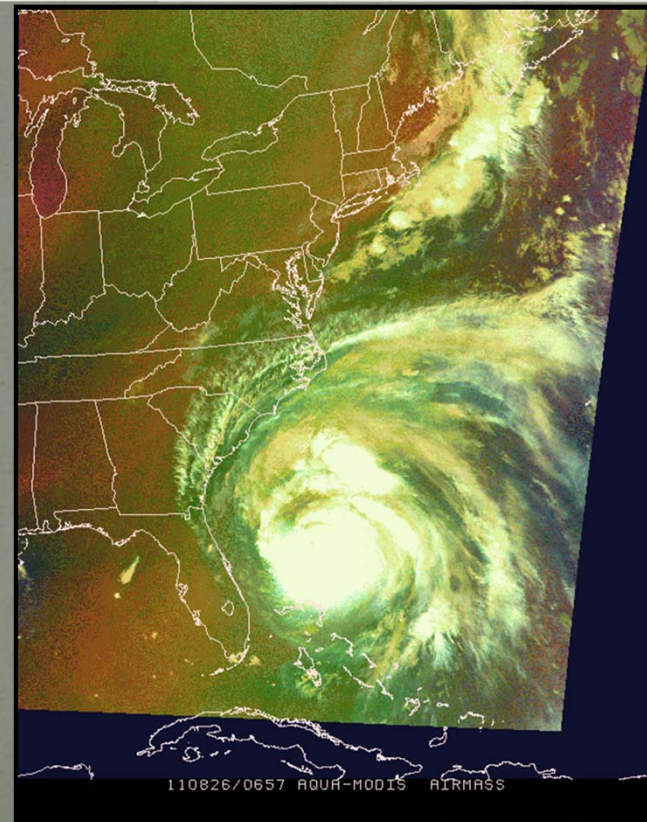


Hurricane Irene 2011

AIRS Ozone Retrieval

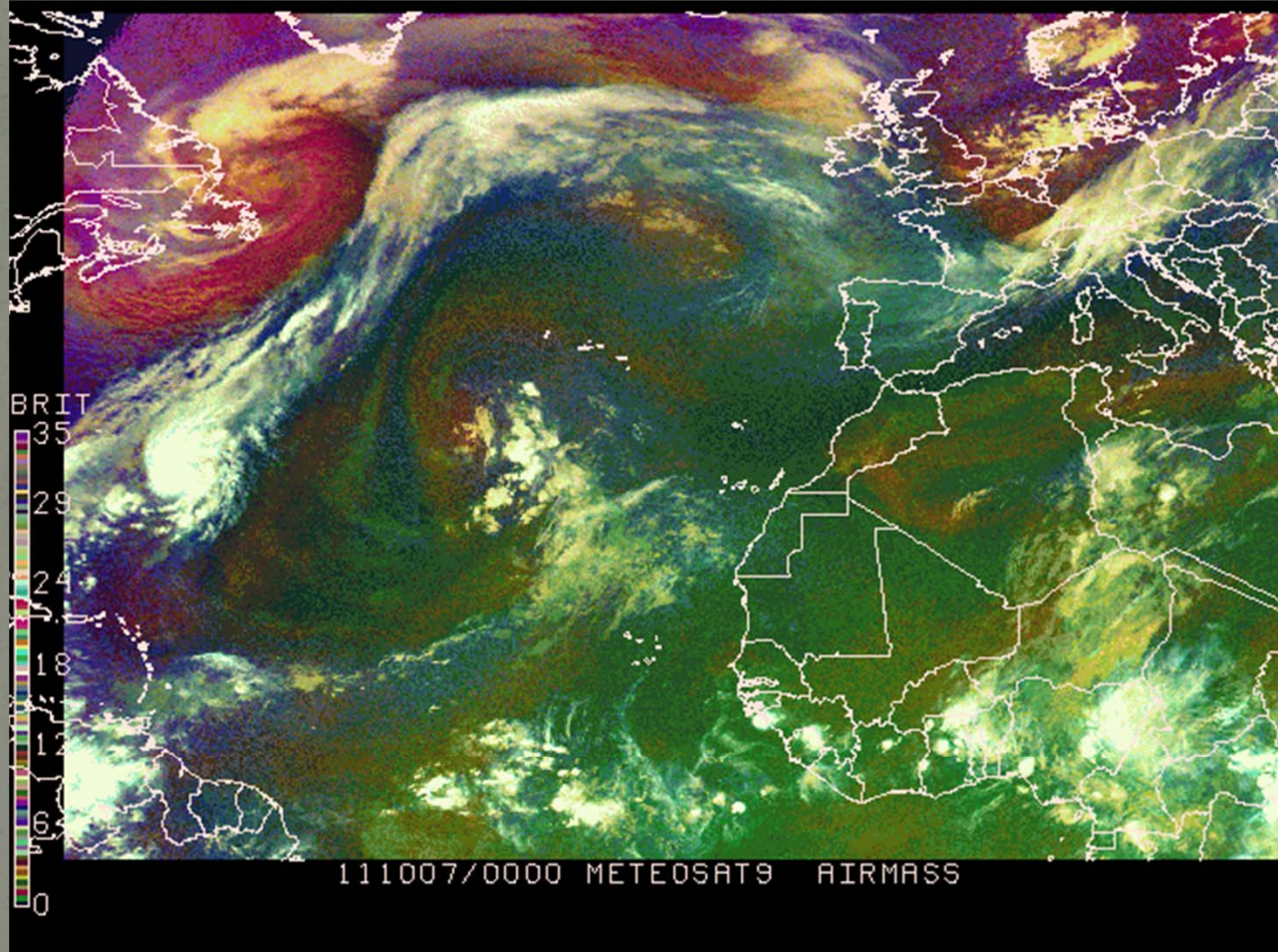


SEVIRI RGB Airmass



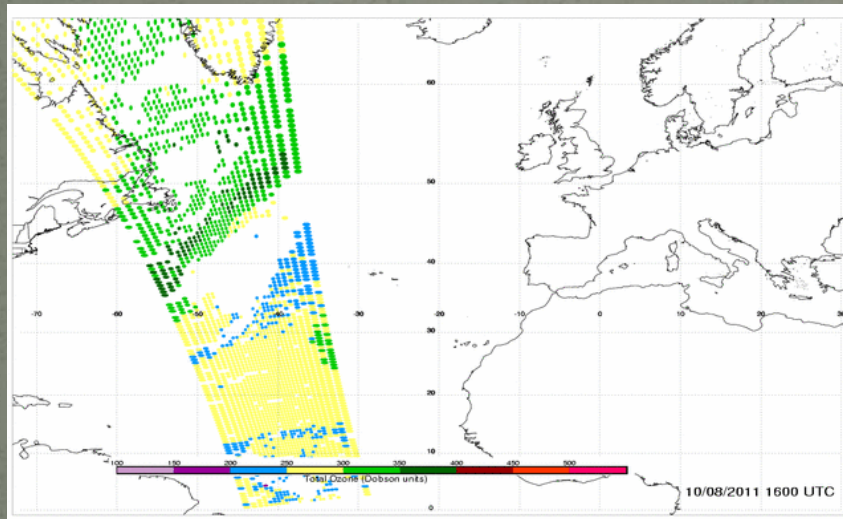
Hurricane Philippe 2011

SEVIRI (MSG) RGB Airmass Product

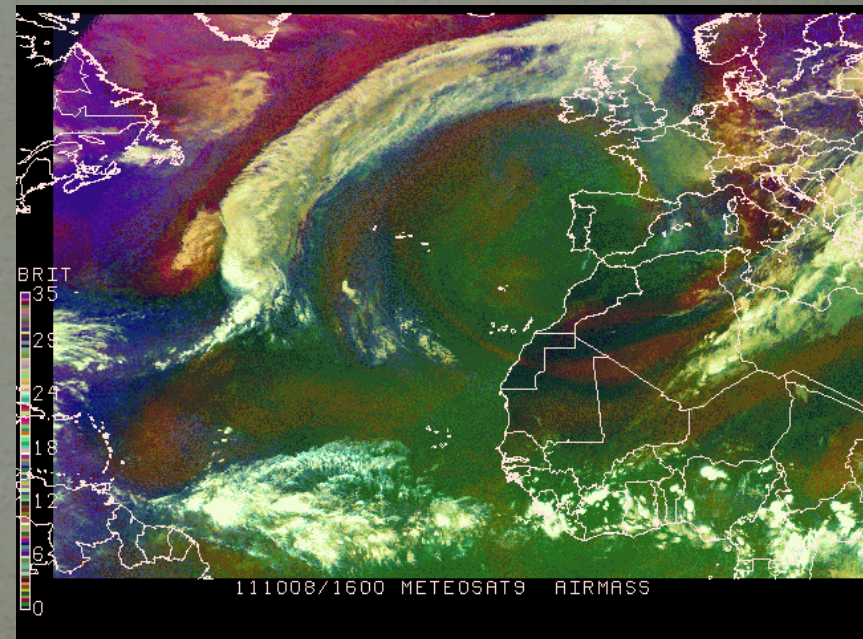


Hurricane Philippe 2011

AIRS Ozone Retrieval

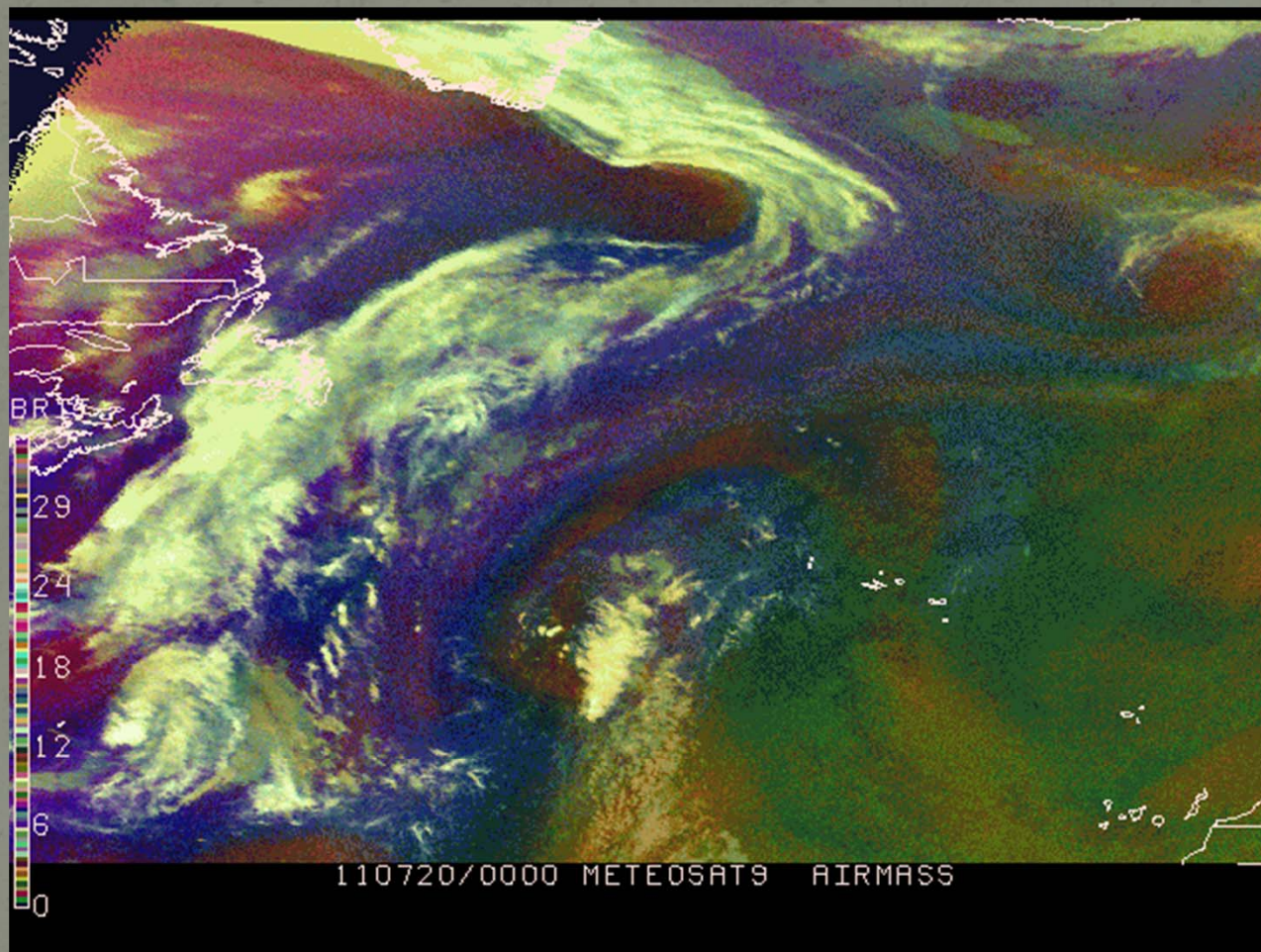


SEVIRI RGB Airmass



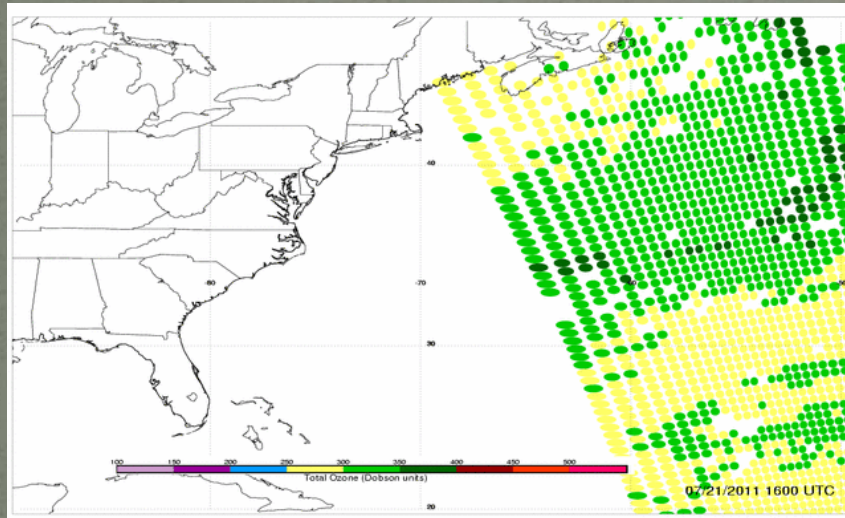
Tropical Storm Cindy 2011

SEVIRI (MSG) RGB Airmass Product

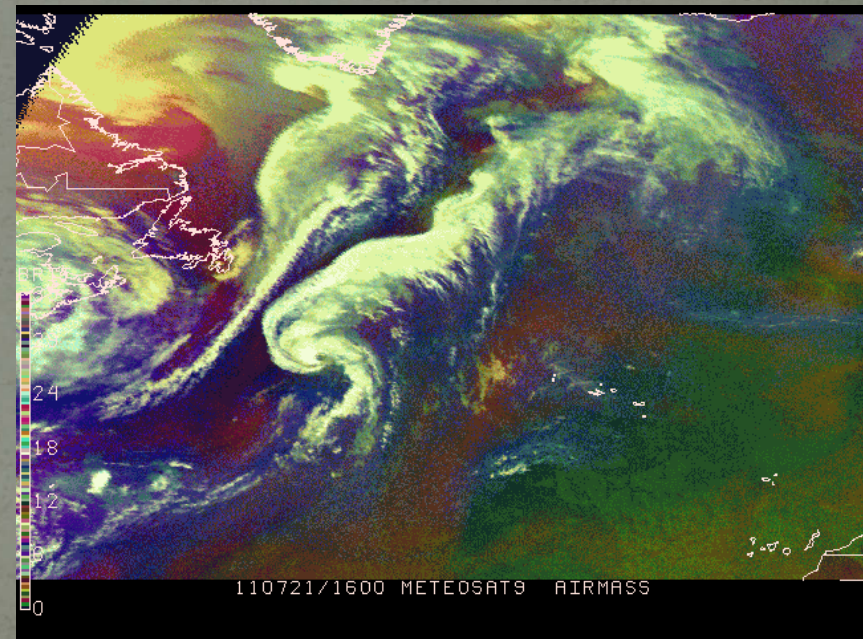


Tropical Storm Cindy 2011

AIRS Ozone Retrieval

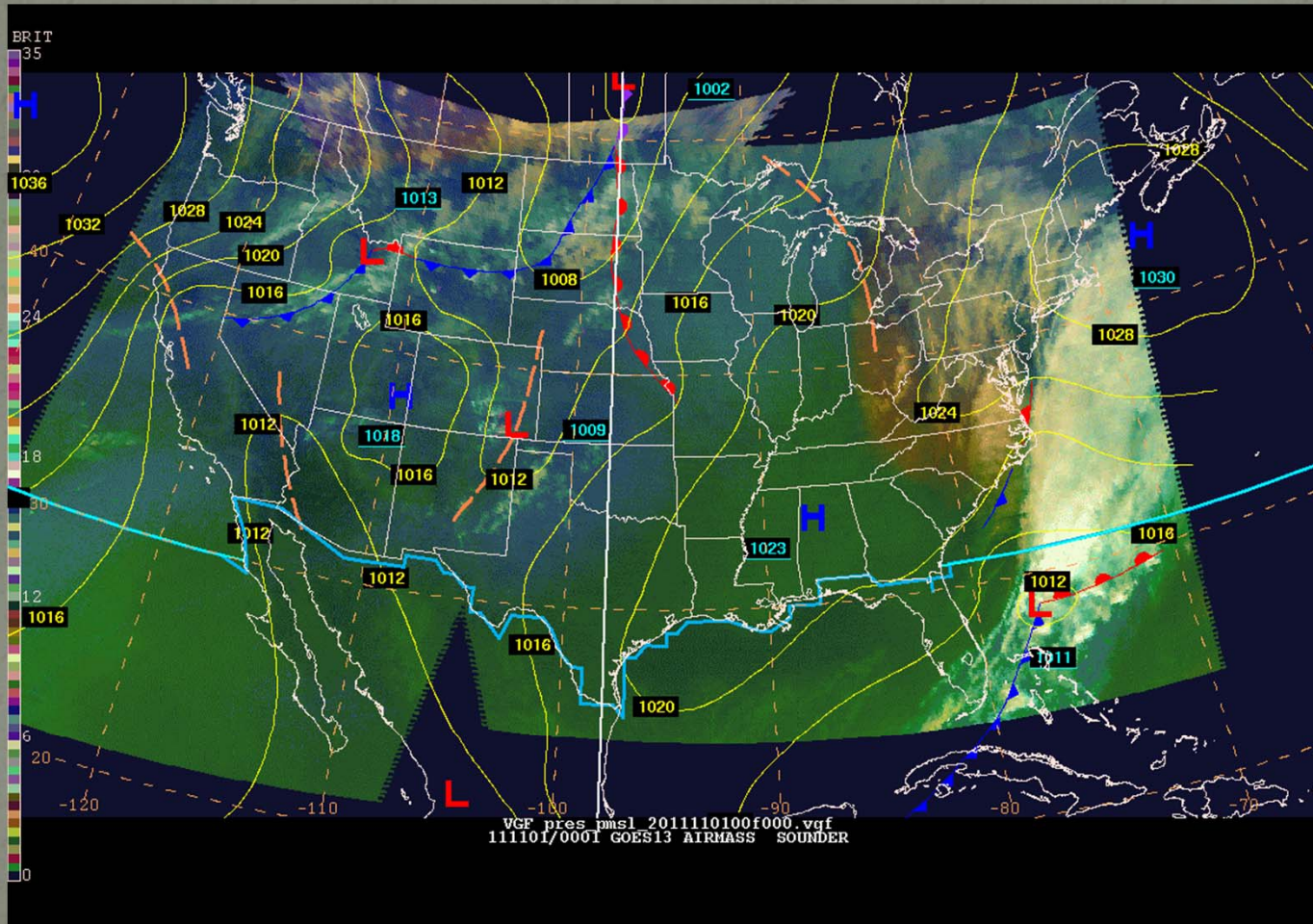


SEVIRI RGB Airmass



Tropical Storm Sean 2011

GOES-Sounder RGB Airmass Product



Tropical Storm Sean 2011

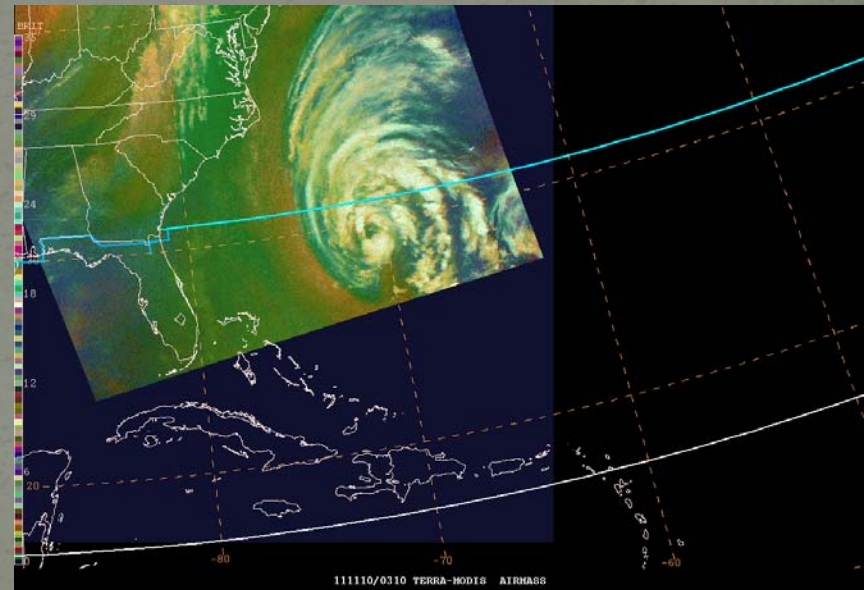
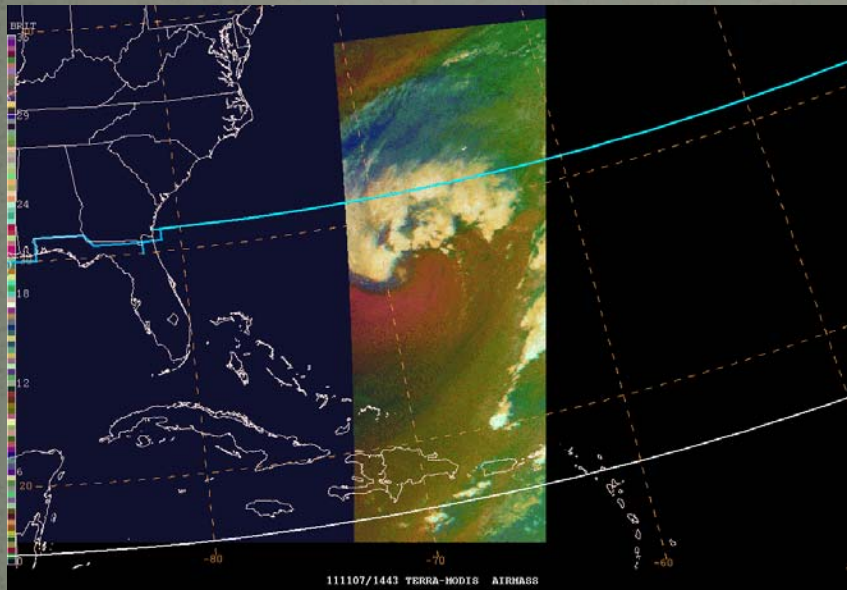
MODIS RGB Airmass Products

ET Phase

1443Z on 11/07/11

TS Phase

0310Z 11/10/11


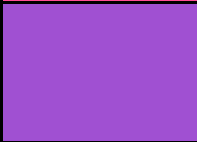
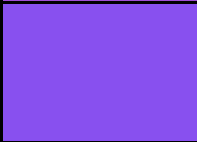


RGB Dust Imagery

- **Why is the Dust RGB imagery important?**
 - Dust can be hard to see in visible and IR imagery because it is optically thin, or because it appears similar to other cloud types such as cirrus. The RGB product is able to contrast airborne dust from clouds using channel differencing and the IR thermal channel. The resulting combination of colors results in a pink/magenta color in the imagery for dust.
- **What are the things to watch out for?**
 - Dust obscured from view: High level clouds may obscure dust plumes closer to the surface
 - Dust or low clouds?: Low-level clouds over oceans in a warm atmosphere are light purple during the day and can look similar to areas of dust.
 - Height of dust: The height of the dust is difficult to infer from daytime imagery as the color does not vary much from magenta; however, variations of color at night can provide some information about the height level. Near-surface visibility could be okay if the plume is aloft.
 - High, thin clouds can be black or green: Thin, high clouds such as cirrus or those induced on the lee side of a mountain range will appear black (no color contributions). At times these clouds do not easily show up on Natural or True color RGB imagery. Note that the 10.7um channel's larger emissivity over deserts than the 8.7um channel, results in high cirrus clouds as green.

Courtesy of Kevin Fuell

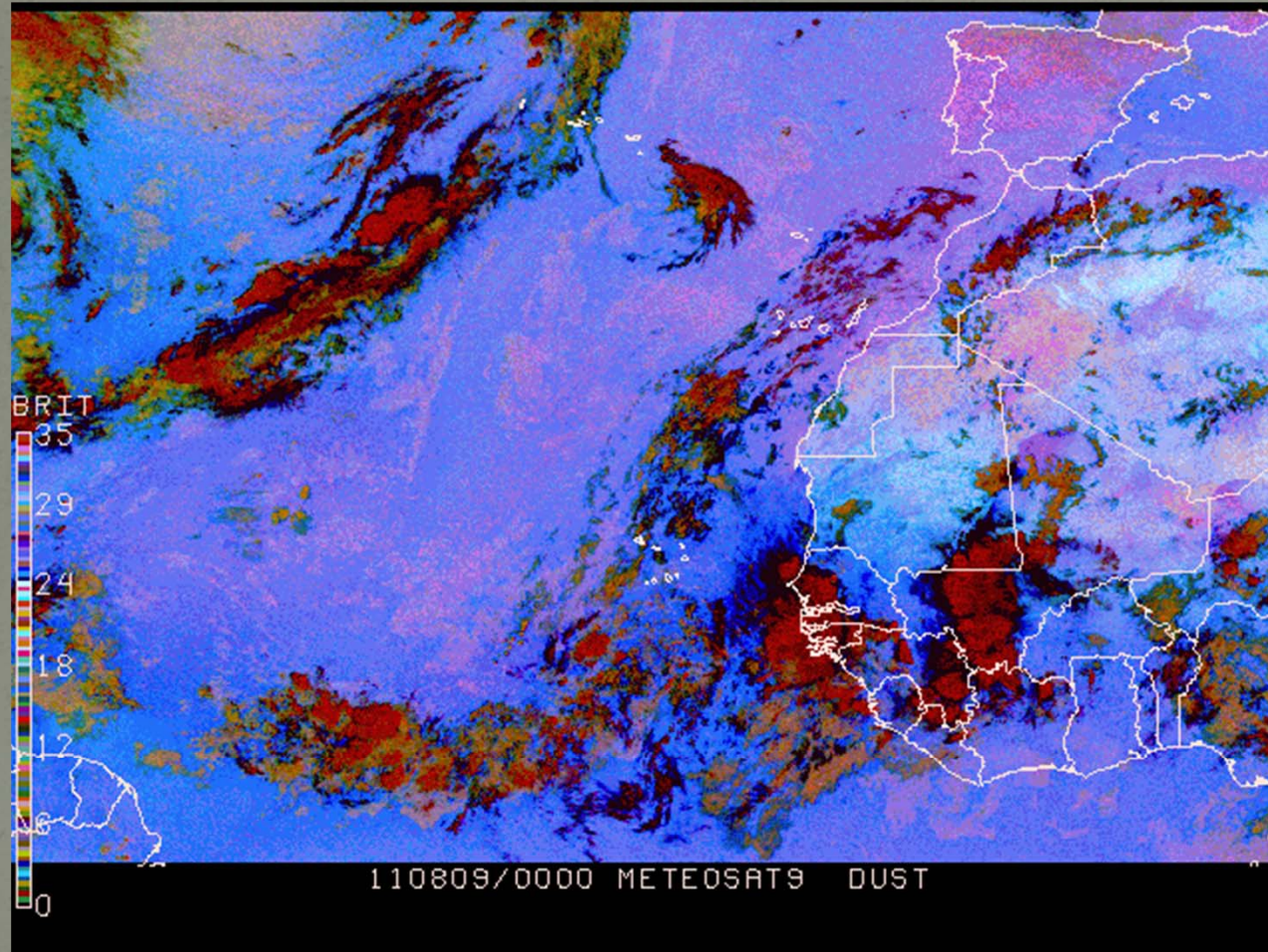
RGB Dust Definition

Color	Physical Meaning	Red	Green	Blue
	Dust at 400mb at night	255	79	150
	Dust at 700mb at night	160	80	210
	Dust at 900mb at night	136	80	239

Courtesy of Kevin Fuell

Saharan Air Layer Oubreak

August 9-13, 2011



RGB Usage Summary

- Lessons learned? – (input from NHC to be included with our PG)

Additional Case Studies

NASA SPoRT Blog


The screenshot shows a web browser window displaying the NASA SPoRT Blog. The browser's address bar shows the URL `nasasport.wordpress.com`. The page features a navigation menu with "Home" and "Mission Statement" tabs, and a search box. The main content area is titled "THE WIDE WORLD OF SPoRT" with the tagline "Fostering interaction between product developers and end users". Below this is a large banner image with the SPoRT logo and the same tagline. The main article is titled "Another Valuable Use of the RGB Airmass Product" and is dated "October 13, 2011 by folmercast". The article text discusses the use of the RGB airmass product with Dave Novak (SOO-HPC) on 10/07/11, mentioning the location of the WAA regime ahead of an amplified trough and possible uses for model diagnostics. Below the text is a small image of a meteorological map showing a trough and associated features. To the right of the article is a "CATEGORIES" sidebar listing various product and service categories with their respective counts. The Windows taskbar at the bottom shows the Start button and several open applications, including "The Wide...", "Hurricane...", "2009atcr...", "WP01_ku...", "8-15_8-1...", and "SSH S...". The system clock in the bottom right corner indicates the time is 12:24 PM.

Home Mission Statement Search

THE WIDE WORLD OF SPoRT

Fostering interaction between product developers and end users

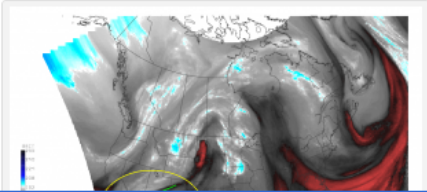
Feeds: Posts Comments



Another Valuable Use of the RGB Airmass Product
October 13, 2011 by folmercast

While perusing the RGB airmass product with Dave Novak (SOO-HPC) on 10/07/11, we noticed another possible use of the RGB airmass product. The location of the WAA regime ahead of an amplified trough and possible uses for model diagnostics.

Model Diagnostics



CATEGORIES

- AIRS (6)
- AMSR-E (15)
- AWIPS II (9)
- CALIPSO (2)
- CIRA Products (5)
- CloudSat (5)
- Data Assimilation (9)
- GOES Products (24)
- GOES-R Proving Ground (26)
- Lightning Mapping Array (15)
- Modeling (23)
- MODIS (91)
- SPoRT ADAS (12)
- Training (5)
- Uncategorized (7)

Follow

start The Wide... Hurricane... 2009atcr... WP01_ku... 8-15_8-1... SSH S... 12:24 PM