DEVELOPING AND EVALUATING RGB COMPOSITE MODIS IMAGERY FOR APPLICATIONS IN NATIONAL WEATHER SERVICE FORECAST OFFICES

*Hayden Oswald[1] and **Andrew Molthan[2]***

NASA Summer Intern, University of Missouri, Columbia, Missouri[1]

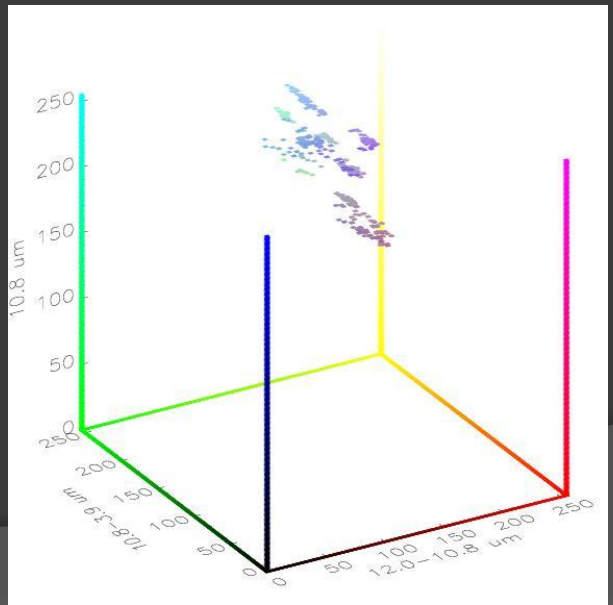
NASA SPoRT Center, NASA/MSFC, Huntsville, Alabama[2]

Motivation

- The volume of satellite data available to forecasters has increased as new instruments and techniques have emerged.
- The GOES-R satellite will provide a significant increase in data.
- RGB compositing is a more effective way to visualize satellite data than single channel products alone.
- RGB compositing can highlight features in the data that may not be visible in single channel products.
- MODIS data was used to provide a preview of GOES-R capabilities.

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.
- We will discuss RGB imagery in the context of two RGB products.

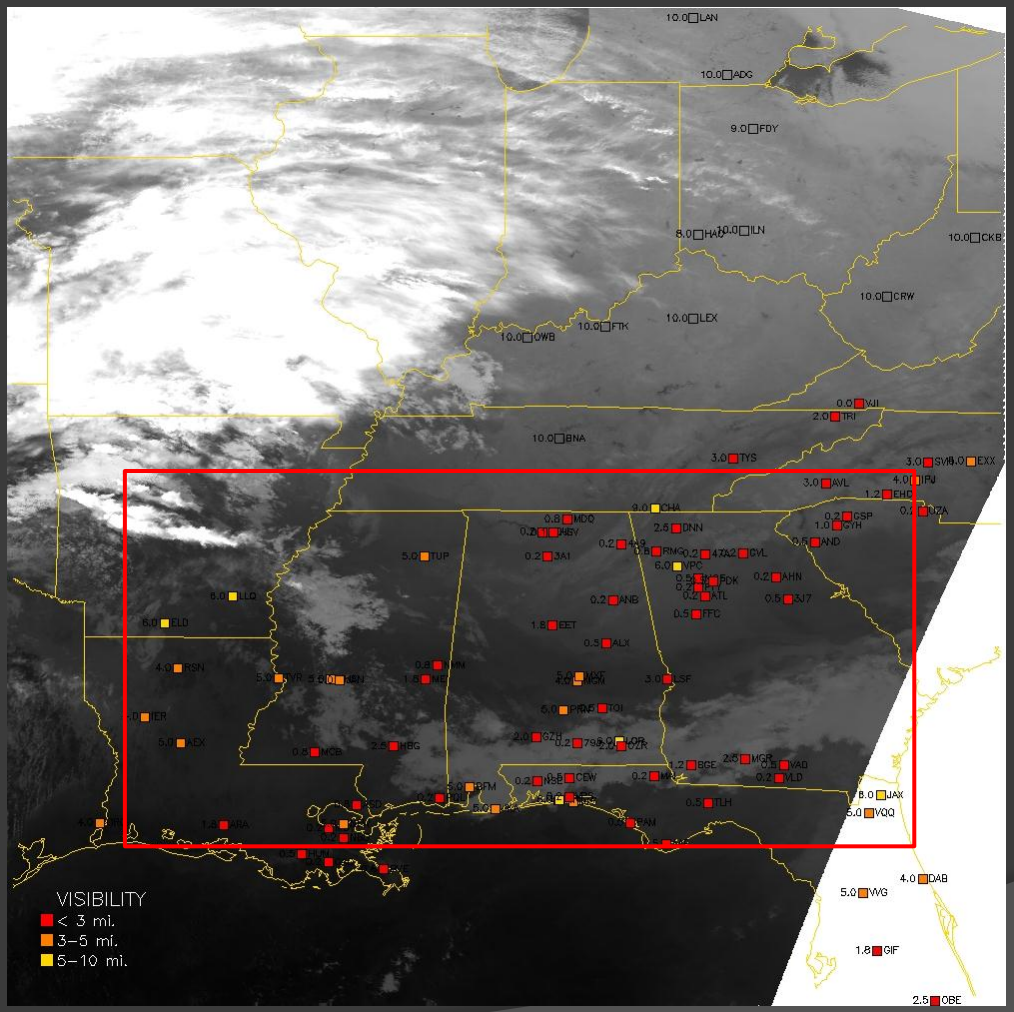


Nighttime Microphysics

- Current observations and satellite products do not resolve nocturnal fog clearly.
- Current satellite techniques
  - Single channel (10.8μm)
  - SPoRT spectral difference (10.8μm-3.9μm)
- Nighttime Microphysics product helps to distinguish among high clouds, low clouds, and fog.
- Utilizes MODIS channels/channel differences
  - 12.0μm-10.8μm
  - 10.8μm-3.9μm
  - 10.8μm

Case Study: 24 November 2010, 0815Z

11 μm Infrared Image

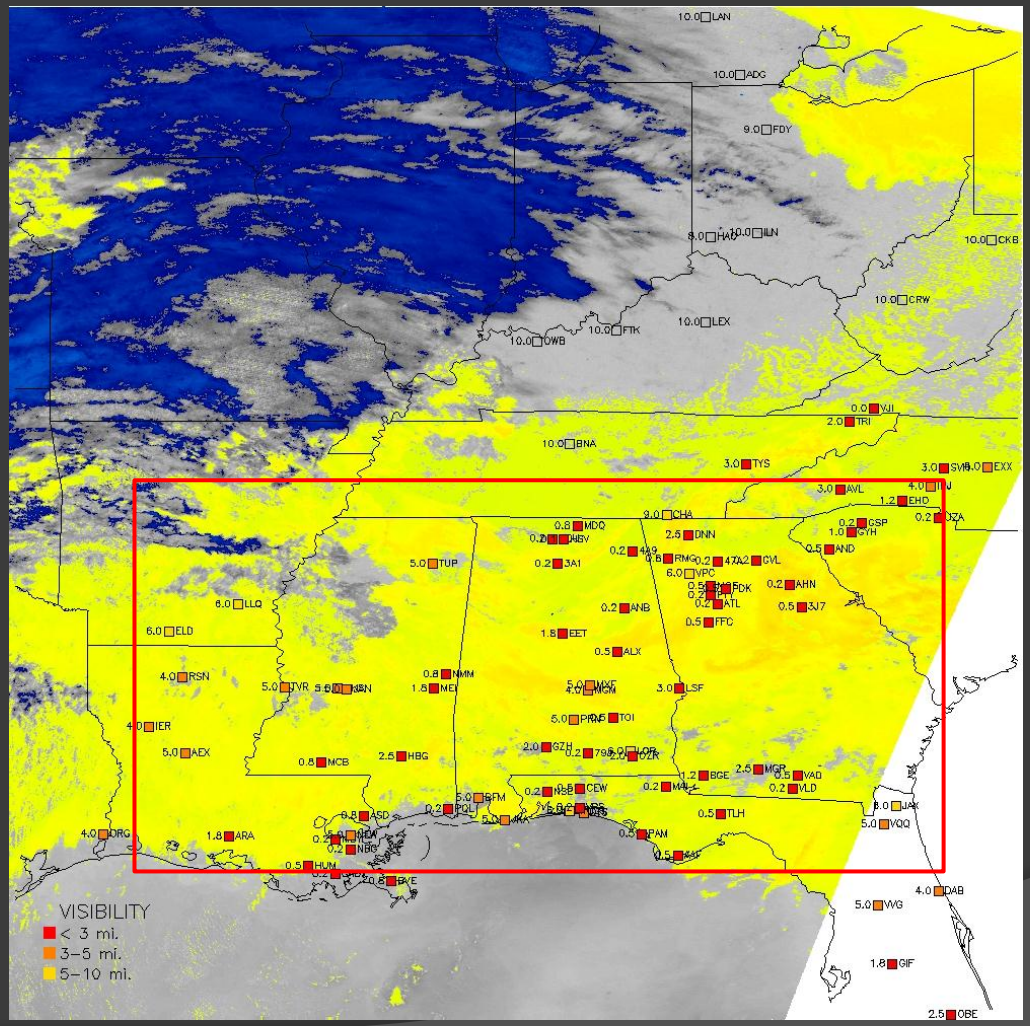


Visibility

- < 3 mi.
- 3 – 5 mi.
- 5 – 10 mi.

Case Study: 24 November 2010, 0815Z

11 μm – 3.9 μm Spectral Difference Image

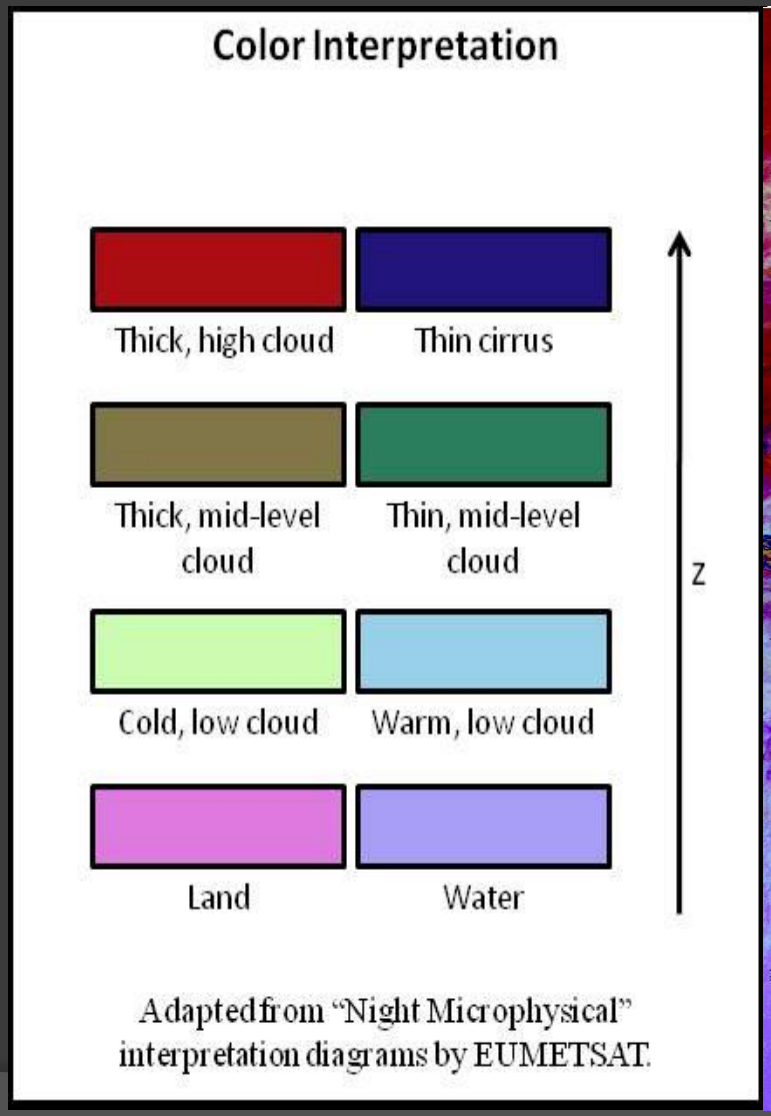


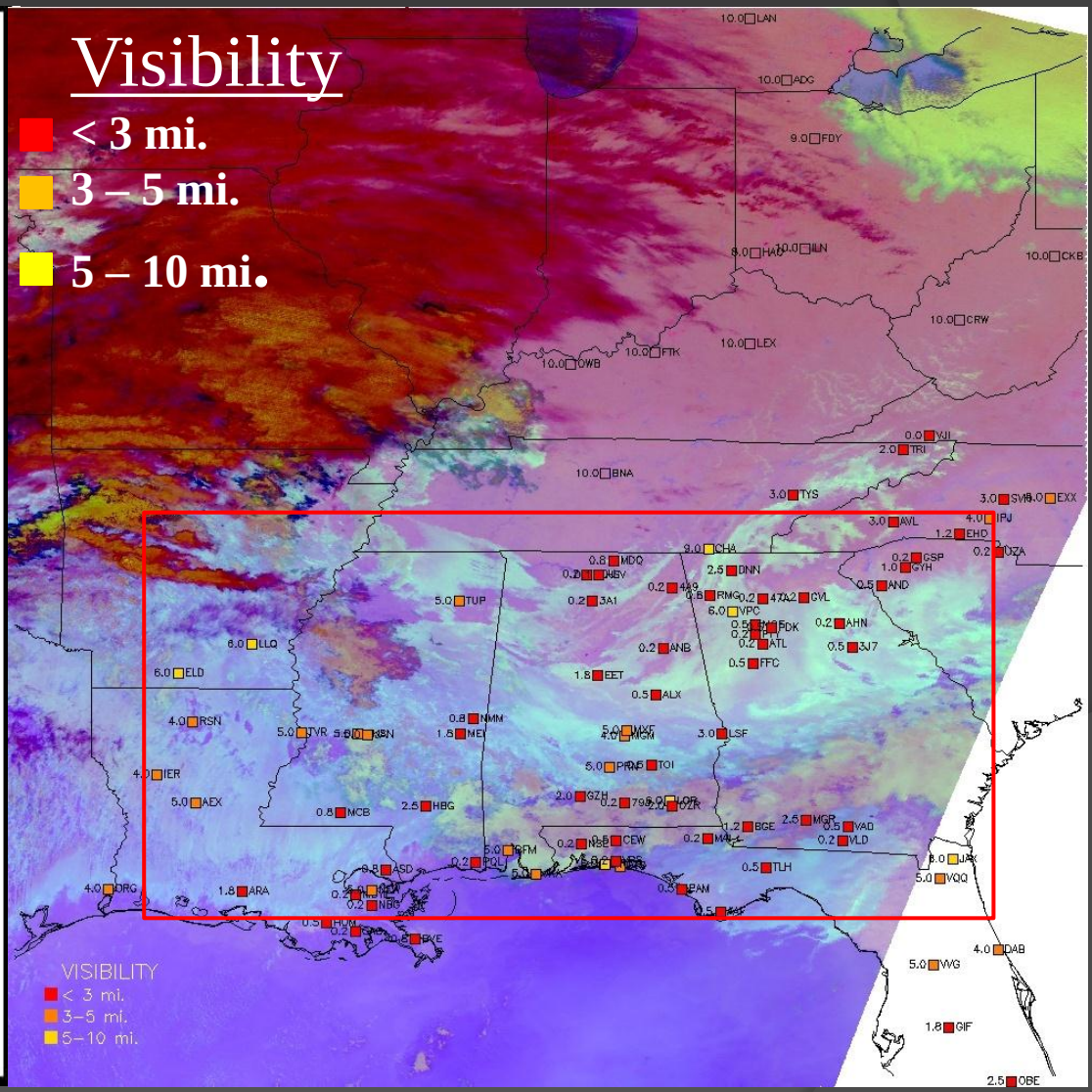
Visibility

- < 3 mi.
- 3 – 5 mi.
- 5 – 10 mi.

Case Study: 24 November 2010, 0815Z

Multispectral Nighttime Microphysics image





Nighttime Microphysics Summary

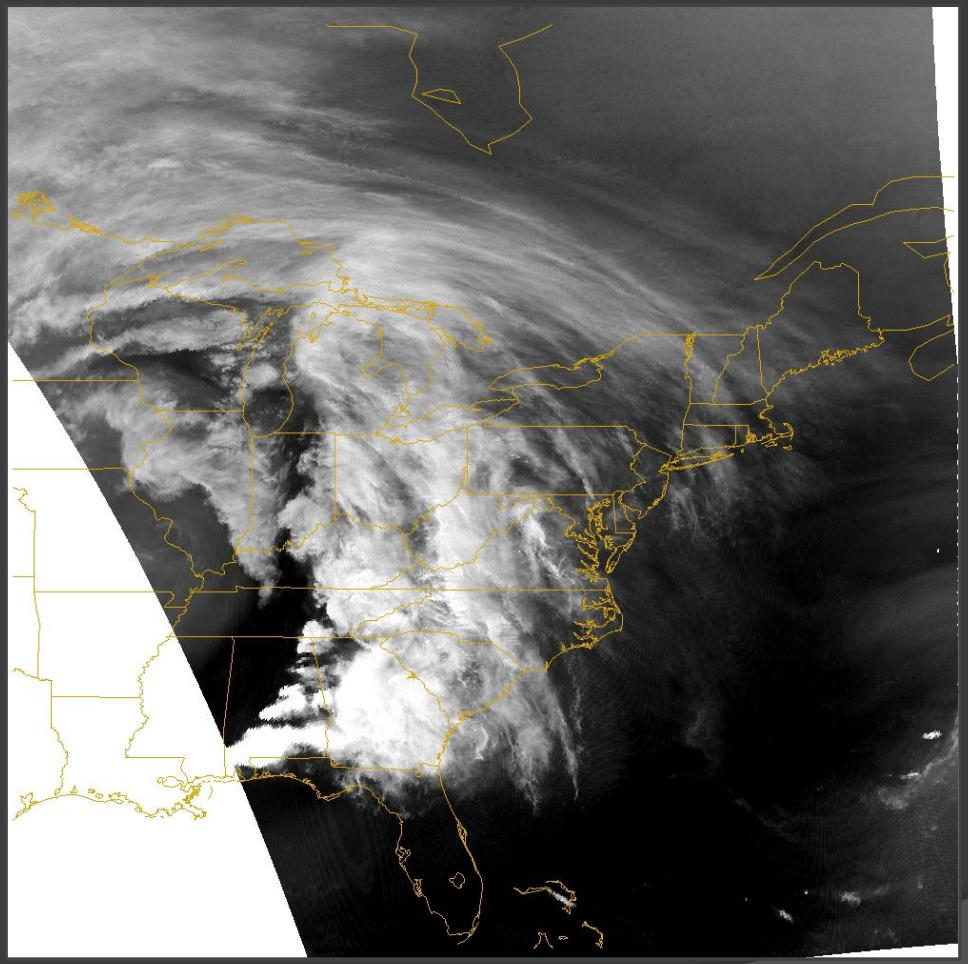
- Advantages
  - Nighttime microphysics imagery incorporates channels used in single channel and spectral difference products.
  - Extent and depth of fog events is more clear than in single channel imagery.
  - Provides a preview of GOES-R capabilities.
- Disadvantages
  - Unconventional color scheme.
  - Appearance can be influenced by surface temperatures.
- Conclusion
  - The nighttime microphysics product provides a better technique for nocturnal fog detection than current techniques.

Air Mass

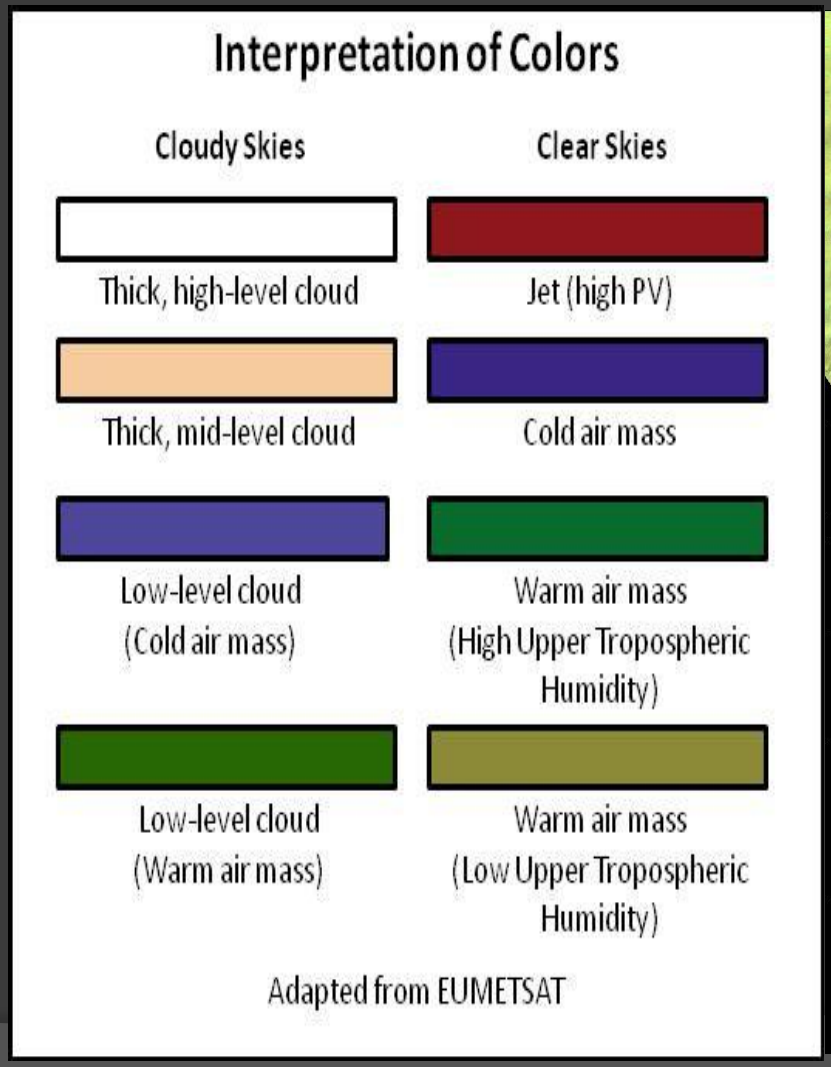
- Air mass product helps to distinguish among synoptic-scale features, such as fronts and jets.
- Utilizes MODIS channels/channel differences:
  - 6.2 μm-7.3 μm
  - 9.7 μm-10.8 μm
  - 6.2 μm (inverted)
- Current techniques
  - Single channel water vapor imagery (GOES 6.7 μm)

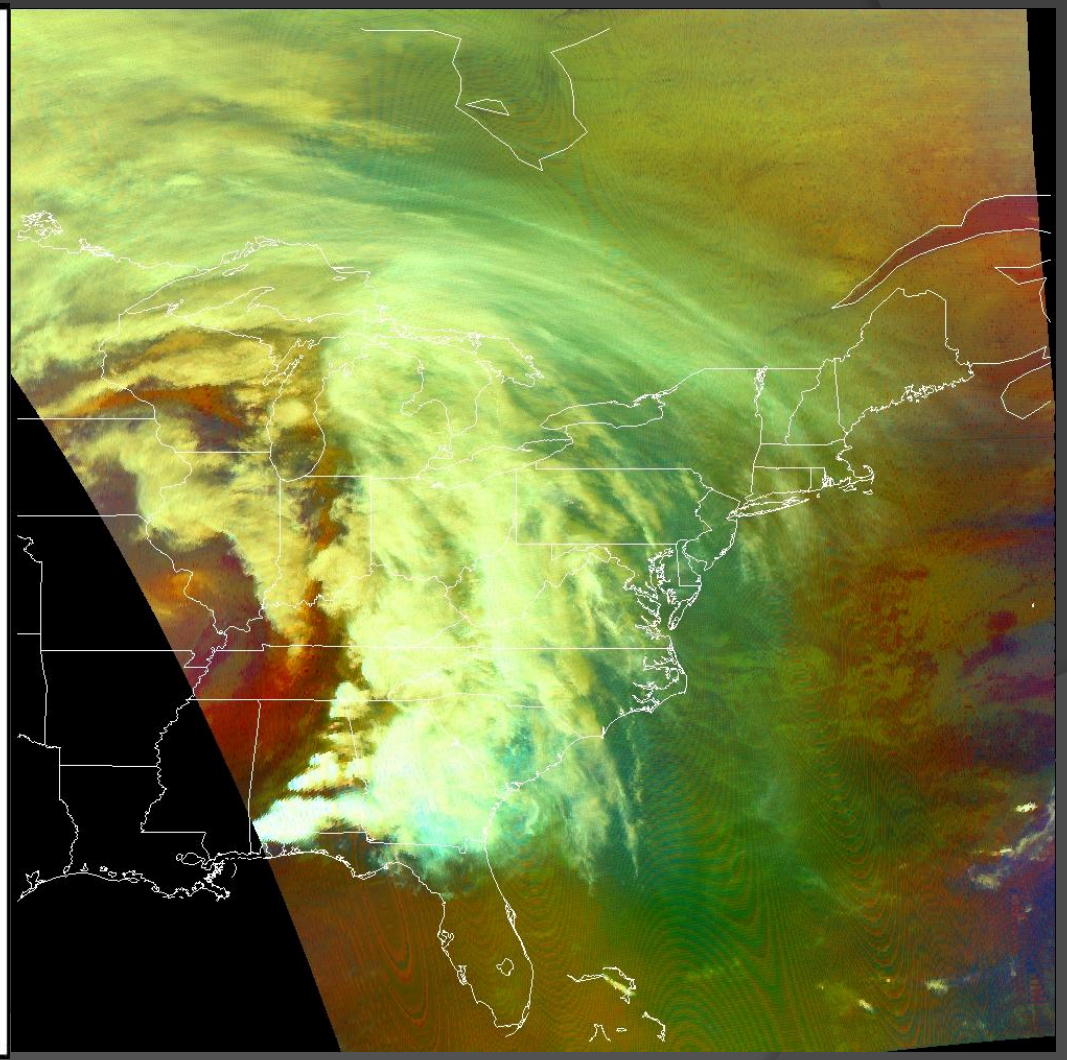
Case Study: 16 April 2011, 0315Z

6.8 μm Water Vapor Image

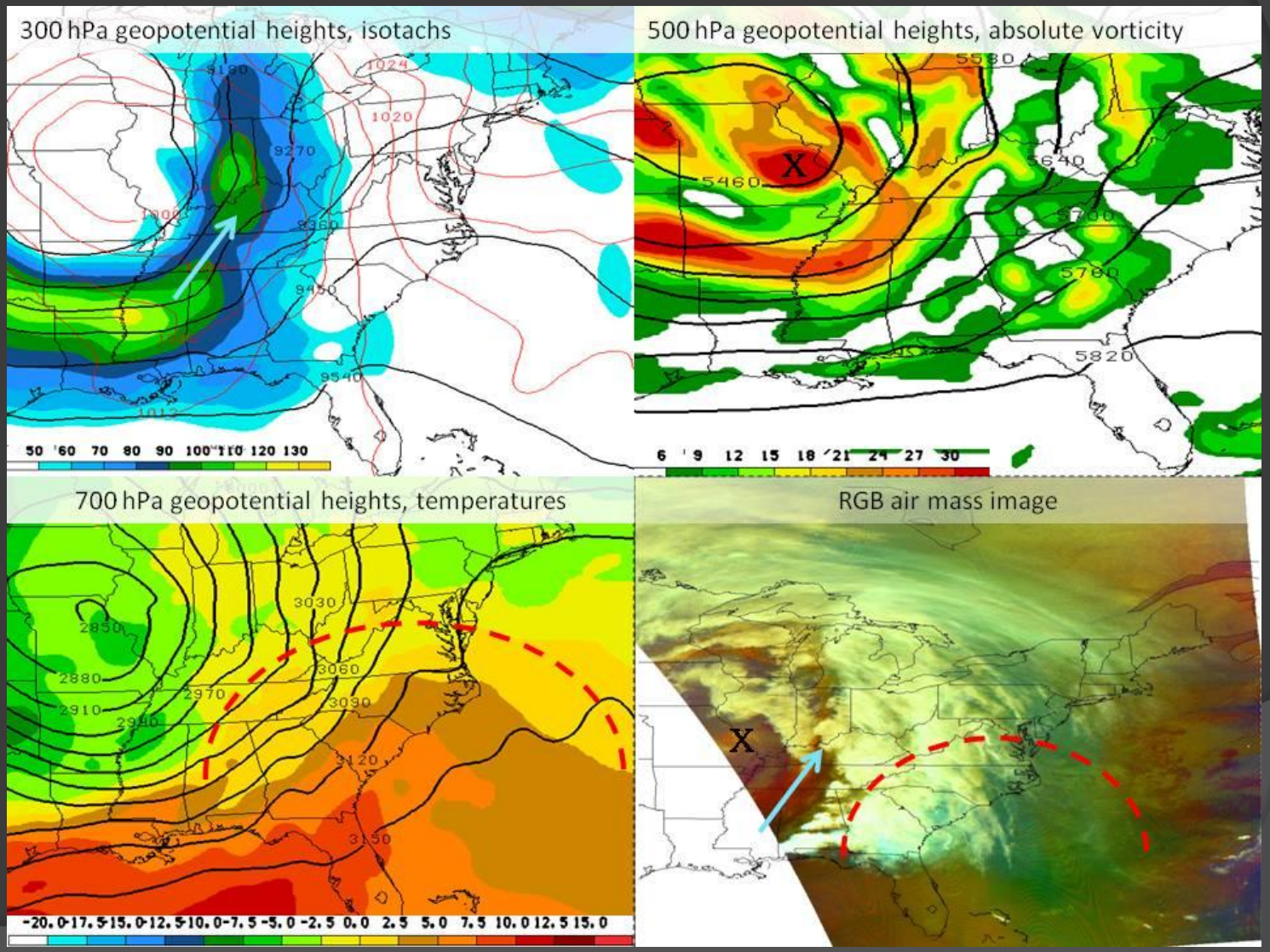


Case Study: 16 April 2011, 0315Z
Air Mass Multispectral Image





RUC Analysis Comparison



Air Mass Summary

- Advantages
  - RGB color characteristics increase certainty when identifying features.
  - A wider range of features is visible in this imagery.
  - Combines several channels into one product
  - Can be used to identify vorticity maximums in some cases
  - Provides a preview of GOES-R capabilities
- Disadvantages
  - Clouds can obscure frontal boundaries.
  - Lower clouds can have similar colors as the air masses.
- Conclusion
  - The air mass product efficiently combines a larger volume of data to provide the operational community with a more versatile, accurate diagnostic tool than water vapor imagery.

Conclusion

- The volume of available satellite data will continue to increase, especially after the implementation of GOES-R.
- Efficient methods must be employed to utilize available data to its full potential.
- RGB compositing provides a way to optimize multiple satellite data with a single product.
- The nighttime microphysics product is an improvement to current nocturnal fog detection techniques.
- The air mass product supplements water vapor imagery.
- The NASA SPoRT Center will continue developing RGB satellite products for transition to NWS forecast offices.

Questions?