

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

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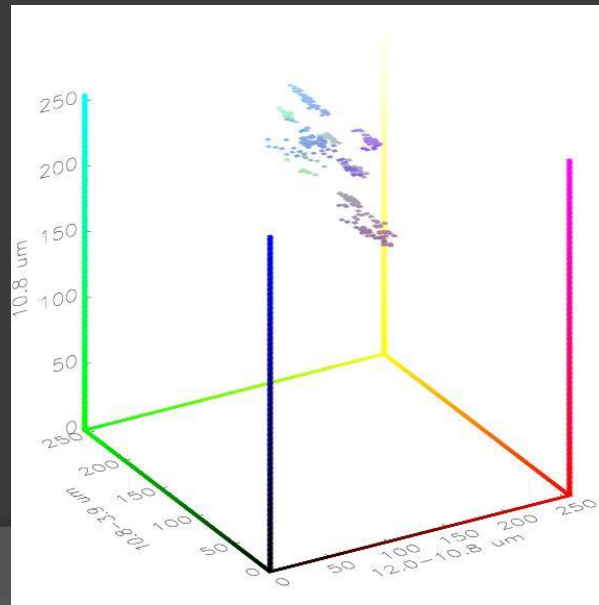
NASA SPoRT Center, Huntsville, Alabama²

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

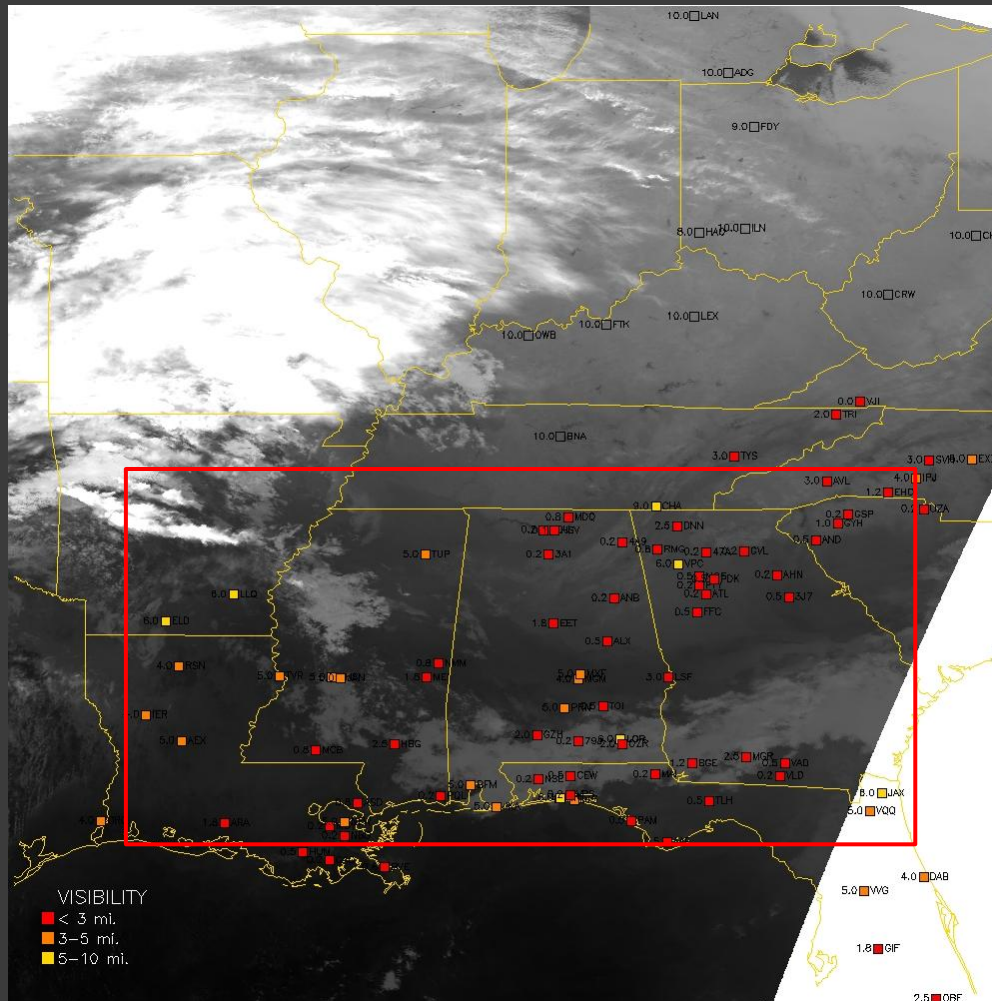
- ⦿ Current observations and satellite products do not resolve nocturnal fog clearly.
- ⦿ Current satellite techniques
 - Single channel ($10.8\mu\text{m}$)
 - SPoRT spectral difference ($10.8\mu\text{m}-3.9\mu\text{m}$)
- ⦿ Nighttime Microphysics product helps to distinguish among high clouds, low clouds,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

Case Study: 24 November 2010, 0815Z

11 μm Infrared Image

Visibility

- < 3 mi.
- 3 – 5 mi.
- 5 – 10 mi.

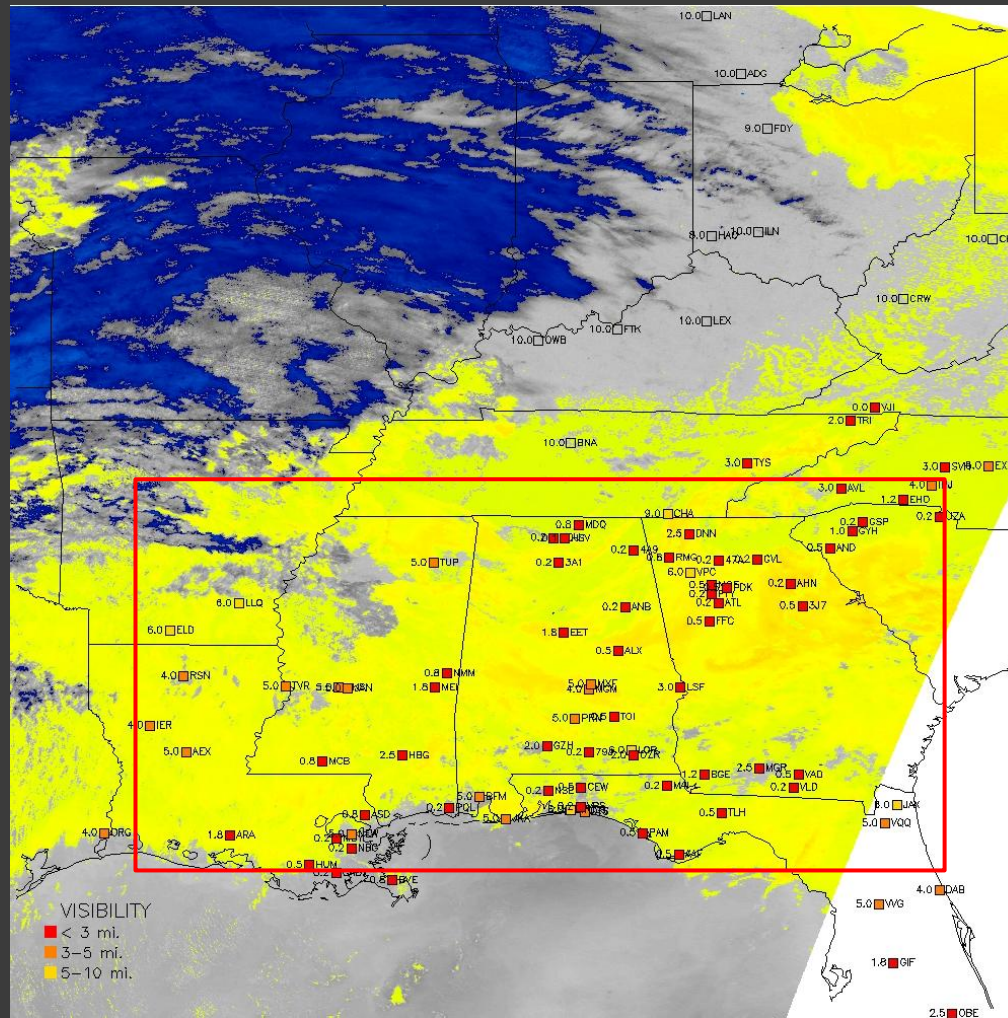


Case Study: 24 November 2010, 0815Z

11 μm - 3.9 μm Spectral Difference Image

Visibility

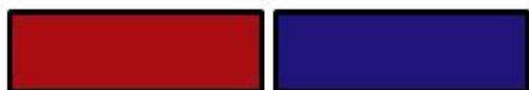
- < 3 mi.
- 3 - 5 mi.
- 5 - 10 mi.



Case Study: 24 November 2010, 0815Z

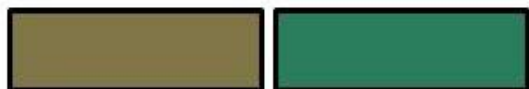
Multispectral Nighttime Microphysics image

Color Interpretation



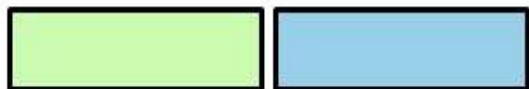
Thick, high cloud

Thin cirrus



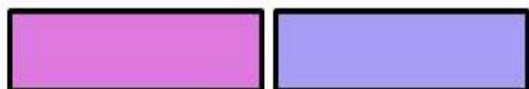
Thick, mid-level cloud

Thin, mid-level cloud



Cold, low cloud

Warm, low cloud



Land

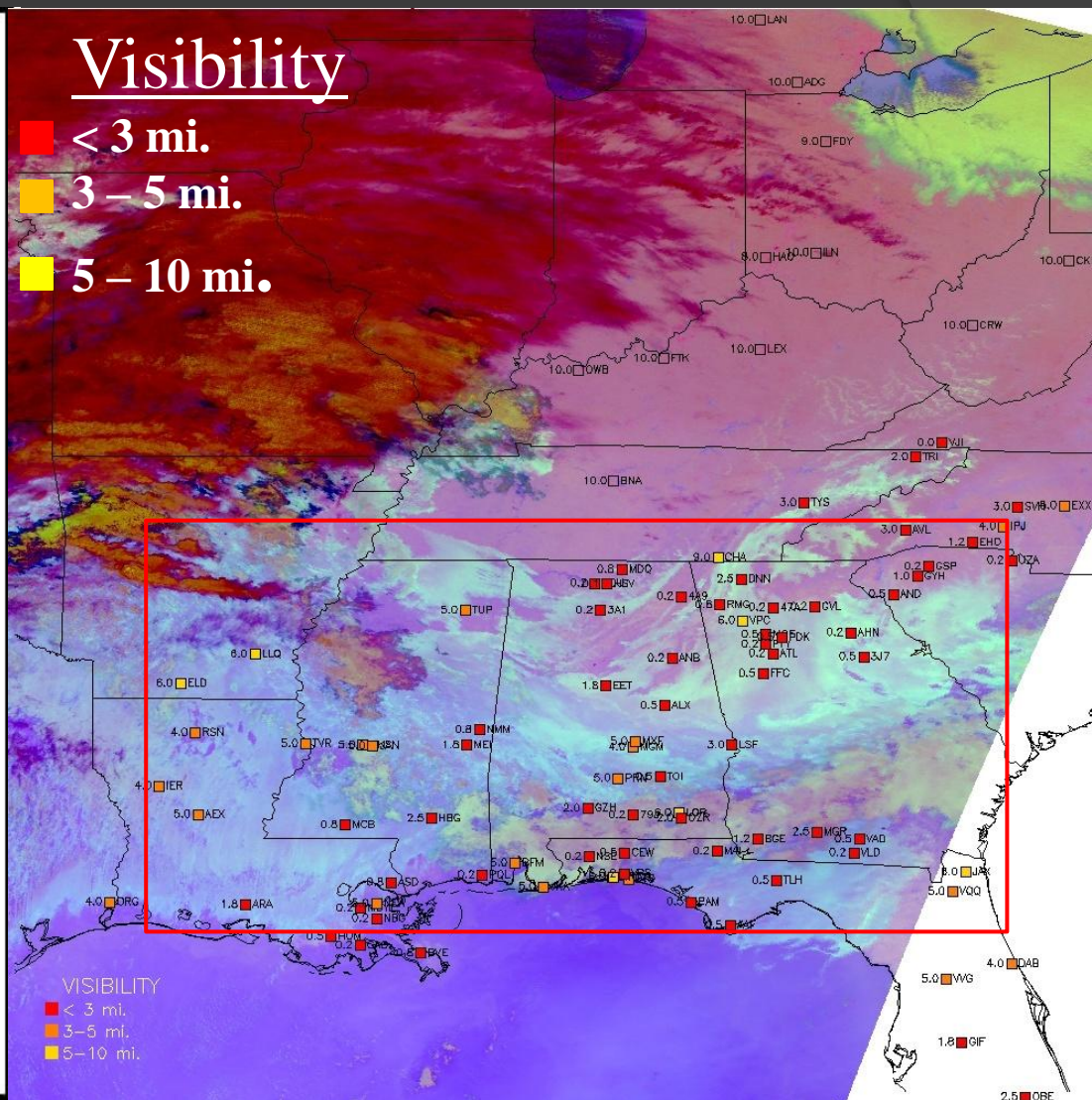
Water

Z

Adapted from "Night Microphysical" interpretation diagrams by EUMETSAT.

Visibility

- < 3 mi.
- 3 – 5 mi.
- 5 – 10 mi.



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

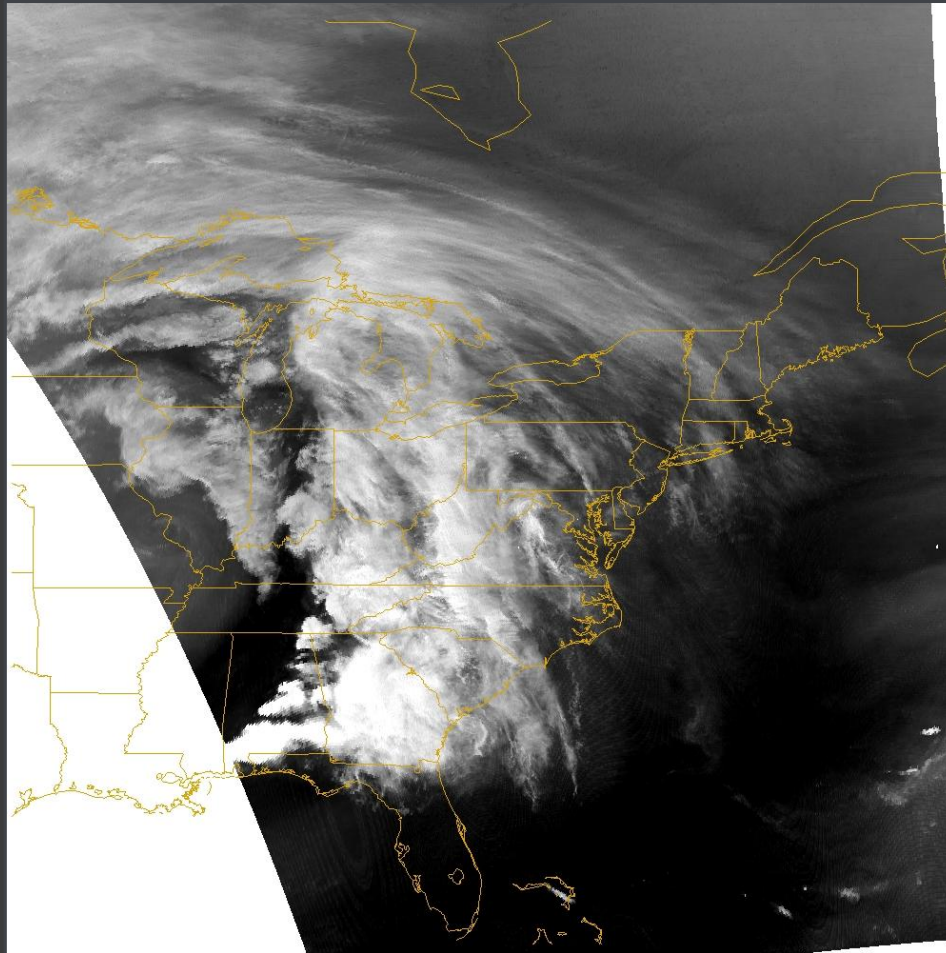
- The nighttime microphysics product provides a better technique for nocturnal fog detection than current techniques.

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



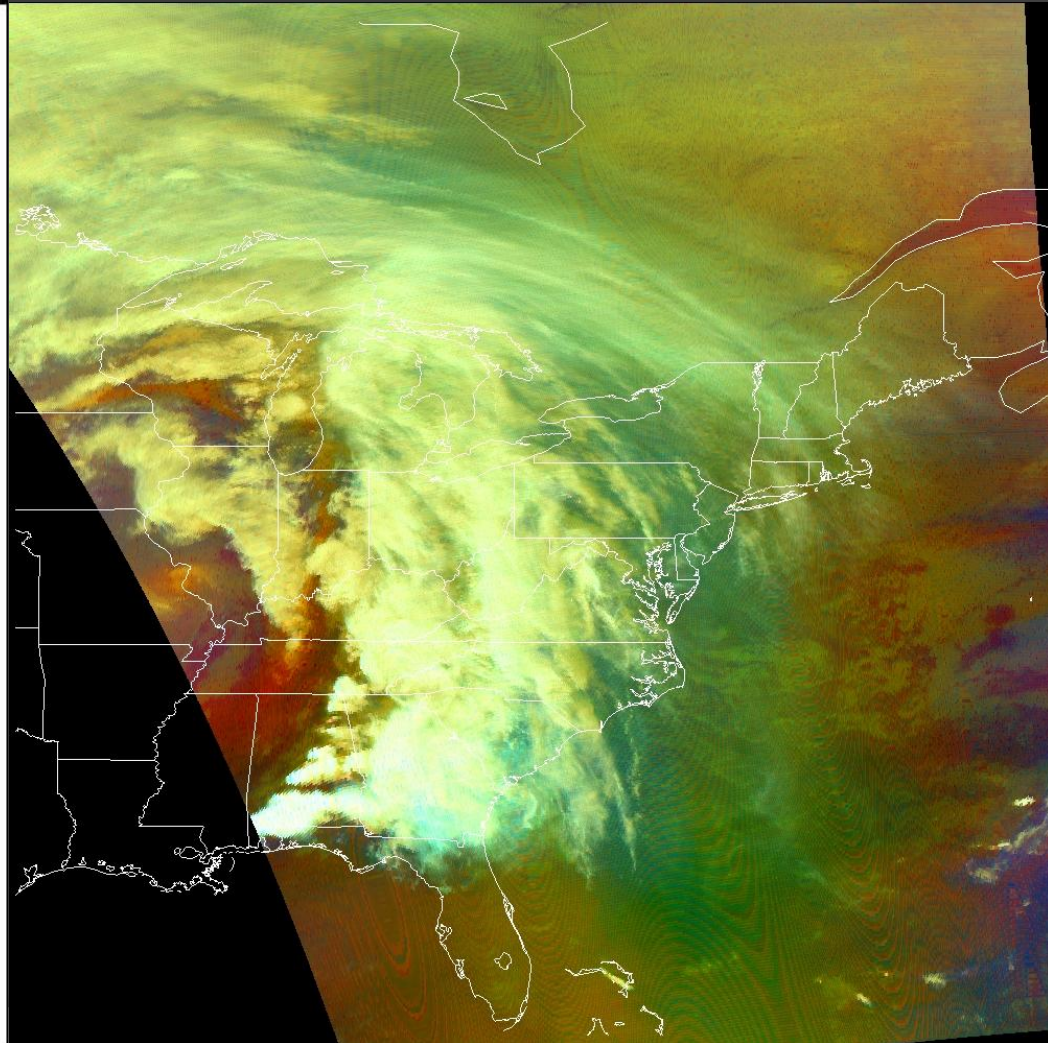
Case Study: 16 April 2011, 0315Z

Air Mass Multispectral Image

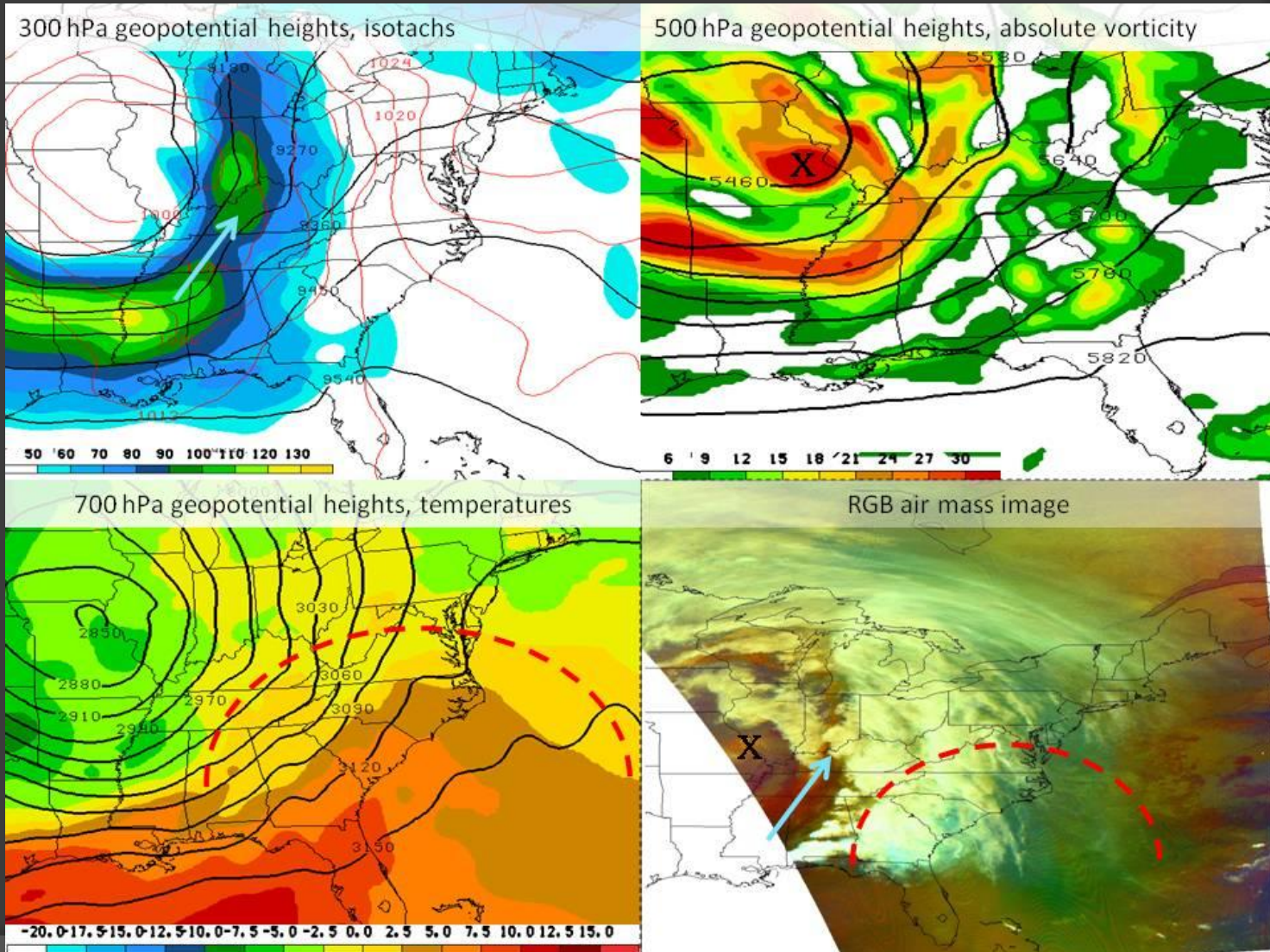
Interpretation of Colors

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



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.