



# Transition and Evaluation of RGB Imagery to WFOs and National Centers by NASA SPoRT

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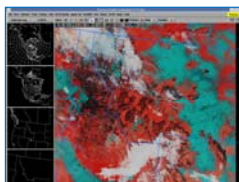
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## SPoRT RGB Initial Transition & Evaluation

MODIS Snow/Cloud (right) and True Color (below) RGB imagery has been used by SPoRT partners since 2004 to examine changes in surface features such as snow cover, vegetation, ocean color, fires, smoke plumes, and oil spills.



**Great Falls, MT Application**  
Snow cover change monitored for potential flooding of rivers and streams.

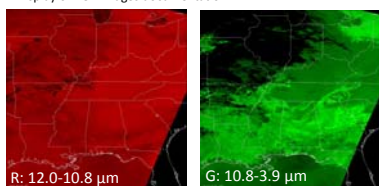


**Mobile, AL Application**  
2010 Deep Water Horizon event. MODIS imagery supported response efforts.

## An Example of RGB Construction

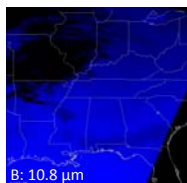
Night Microphysics				
Color	Channels (µm)	MIN	MAX	GAMMA
R	12.0-10.8	-4 K	+2 K	1.0
G	10.8-3.9	0 K	+10 K	1.0
B	10.8	243 K	293 K	1.0

**Table 1.** Recipe for construction of the Night Microphysics product designed by EUMETSAT, based upon their Best Practices for Display of RGB Images documentation.

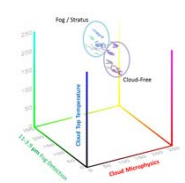


R: 12.0-10.8 µm

G: 10.8-3.9 µm

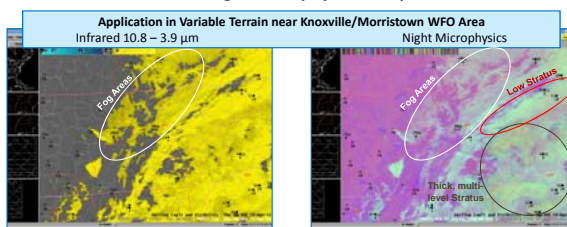


B: 10.8 µm



**Figure 1.** An example of the red, green, and blue color inputs to the Nighttime Microphysics product derived from MODIS based upon EUMETSAT guidelines and separation of features by color.

## MODIS Night Microphysics Composite

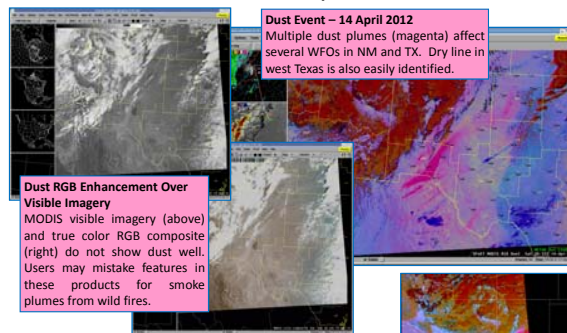


**Night Microphysics Differentiates Low Cloud Features:** In lower right, tan shades indicate thicker, multi-level clouds (more red contributed to RGB) while in other areas bright aqua represents low thick clouds, where visibility is likely VFR but ceilings can be IFR. The near gray or dull aqua areas represent shallow dense fog where IFR conditions are occurring. Note the northwest MRX and southern JKL areas have fog.



**WFO Houston/Galveston Feedback**  
0810Z, 25 March 2012: Forecasters notice the aqua coloring corresponds to low clouds with many observations reporting ceilings at IFR levels (blue oval) while visibilities are VFR. They also notice that the near gray and violet colors (yellow oval) corresponds to shallow, dense surface fog with both visibilities and ceilings at IFR levels at my sites.

## MODIS Dust Composite



**Dust Event - 14 April 2012**  
Multiple dust plumes (magenta) affect several WFOs in NM and TX. Dry line in west Texas is also easily identified.

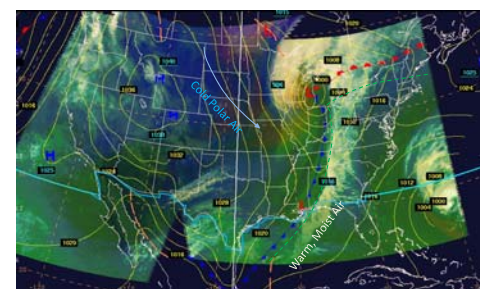
**Dust RGB Enhancement Over Visible Imagery**  
MODIS visible imagery (above) and true color RGB composite (right) do not show dust well. Users may mistake features in these products for smoke plumes from wild fires.

**WFO ABQ Image Capture**  
Users at WFO Albuquerque, NM sent this image (right) of the Dust RGB with observations overlaid. The product assisted with analysis of plume location and size to allow users to edit existing gridded forecast product for blowing dust.

**VIIRS Dust RGB at the Edge**  
In addition to MODIS, VIIRS captured the dust event (above). Note the quality of detail is good at the swath edge. This is an advantage of VIIRS over MODIS.

## GOES Sounder Air Mass Composite

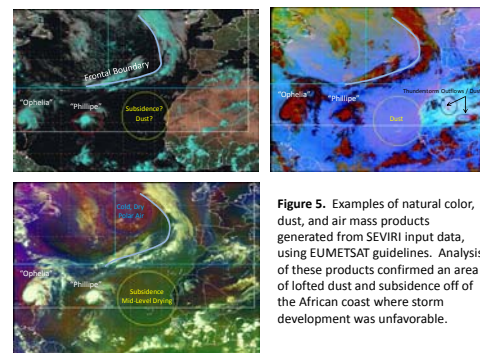
- Although the current GOES East and West imagers lack some of the spectral bands required to produce an air mass image, the GOES Sounder can be used to produce capabilities expected from the GOES-R Advanced Baseline Imager.
- CIRA has developed a technique to produce the air mass product from the GOES Sounder, with hourly updates of imagery across the United States.
- In the image below, the CIRA GOES Sounder RGB Air Mass product provides continuity to the MODIS imagery by relating color to synoptic-scale features.



**Figure 4.** Air Mass multispectral RGB imagery developed by CIRA based upon channels available on the GOES Sounder. In this case, a midlatitude cyclone was moving through the Upper Midwest on November 9, 2011, with various shades depicting cloud cover, moisture, and cold air moving in behind the cold front. Synoptic features and isobars provided by the NOAA/NCEP Hydrometeorological Prediction Center.

## SEVIRI Multispectral Composites

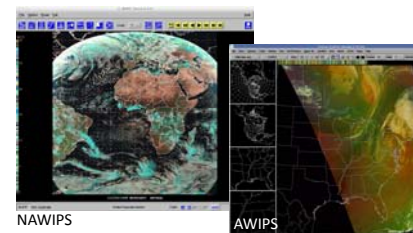
- EUMETSAT produces RGB composite imagery in real-time from the SEVIRI instrument aboard Meteosat-9. SPoRT produces equivalent imagery from NESDIS data.
- SEVIRI products can be used to monitor the Atlantic basin, with multiple products helping to confirm features based upon multispectral characteristics.
- Clear skies in the natural color image correspond to regions of subsidence and lofted dust, precluding the widespread development of convection.
- The multispectral composites in each product each provide a unique depiction of the ongoing weather and cloud features, useful in image interpretation.



**Figure 5.** Examples of natural color, dust, and air mass products generated from SEVIRI input data, using EUMETSAT guidelines. Analysis of these products confirmed an area of lofted dust and subsidence off of the African coast where storm development was unfavorable.

## Applications in the GOES-R Proving Ground

- Although RGB composite imagery are 24-bit, current AWIPS and NAWIPS systems do not support their display.
- SPoRT has developed a technique to display these images in AWIPS and NAWIPS by quantizing each to the number of colors displayable with system: 254 for AWIPS, 95 for NAWIPS.
- Images are provided to NOAA/NWS WFOs and NOAA/NCEP National Centers participating in the GOES-R Proving Ground.
- These products are evaluated by duty forecasters with responses provided to algorithm developers at SPoRT and CIRA in order to improve the products prior to their possible availability in the GOES-R era.



**Figure 6.** Examples of SEVIRI natural color product displayed in the current version of NAWIPS, and example of a MODIS air mass product displayed in AWIPS. These systems are used at NOAA/NWS Weather Forecast Offices National Centers to integrate various data sets.

## Summary and Future Work

- The launch of NPP provides additional observations from VIIRS, which similar to MODIS and will provide additional composites:

Product	Instruments	Purpose
Air Mass	SEVIRI, MODIS, GOES Sounder	Air mass type discrimination
Dust	SEVIRI, MODIS, VIIRS	Blowing or suspended dust
Night Microphysics	SEVIRI, MODIS, VIIRS	Fog and low clouds
Day Microphysics	SEVIRI, MODIS, VIIRS	Fog and low clouds
Day Snow/Fog	SEVIRI, MODIS, VIIRS	Fog, low clouds, and snow
Daytime Storms	SEVIRI, MODIS, VIIRS	Identifies convective storms
Natural Color	SEVIRI, MODIS, VIIRS	Approximates a true color image
True Color	MODIS, VIIRS	True color, photograph image
False Color Snow	MODIS, VIIRS	Discriminate clouds from snow

**Table 2.** RGB composites expected from sensors currently in orbit.

- Interactions with forecasters, algorithm developers at CIRA, and discussions with EUMETSAT will continue to improve upon current products in advance of their potential availability from GOES-R.
- Additional forecaster feedback will be acquired to understand how to best apply these products to weather forecasting and analysis, with feedback implemented into future training materials.

## Acknowledgements

To be filled in.....