Poster 1.18

GOES-R ABI Color Product Development

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Abstract

The current Geostationary Operational Environmental Satellite (GOES) series was inaugurated in 1994 with the launch of GOES-8 and will continue with two more satellites (GOES-O and P) past the most recent GOES-13 launched in 2006. The next generation GOES (beginning with GOES-R) will be launched in the 2012 time frame. This new series of satellites will include improved spatial, temporal, spectral, and radiometric resolution. The last two characteristics are manifest by an increased number of spectral bands and increased precision for measurements from those bands. Because of the long lead-time needed to design, build, and test this new and complex satellite system, it is already time to do the background work needed to prepare for the development and implementation of GOES-R.

Preparations for GOES-R for applications to analysis and forecasting mesoscale weather events are well underway. The approach for these "Risk Reduction" activities is to use data from existing operational and experimental satellites to create subsets of observations that will be available from GOES-R. Particular emphasis will be focused on product development, both to improve existing products and to create new products from the additional resolution capabilities that will be available. In addition, color can be used to better represent and discriminate among the wide range of features that can be detected with GOES-R spectral bands. Two focus areas for product development that have been explored are the detection and discrimination of fog and stratus from other cloud and land-surface features, as well as monitoring of blowing dust and smoke from fires.

GOES-R ABI Bands and Bandwidths

ABI Band	Central Wavelength (µm)	Wavelength Range (µm)	Band Explanation	Spatial Resolution (km) @ nadir
1 (blue)	0.47	0.45 - 0.49	Visible/reflective	1
2 (red)	0.64	0.59 - 0.69	Visible/reflective	0.5
3	0.865	0.846 - 0.885	Reflective	1
4	1.378	1.371 - 1.386	Cirrus	2
5	1.61	1.58 - 1.64	Snow/ice	1
6	2.25	2.225 - 2.275	Particle size	
7	3.90	3.80 - 4.00	Shortwave IR window	2
8	6.19	5.77 - 6.6	Water vapor	
9	6.95	6.75 - 7.15	Water vapor	
10	7.34	7.24 - 7.44	Water vapor	
11	8.5	8.3 - 8.7	Water vapor, SO2	
12	9.61	9.42 - 9.8	Ozone	
13	10.35	10.1 - 10.6	Longwave IR window	
14	11.2	10.8 - 11.6	Longwave IR window	
15	12.3	11.8 - 12.8	Longwave IR	
16	13.3	13.0 - 13.6	Longwave IR	

Comparison of GOES-R ABI with MODIS bands

GOES-R ABI		MODIS	
Band Number	**Wavelength (µm)**	**Band Number**	**Wavelength (µm)**
1 (blue)	**0.47**	**3 (blue)**	**0.47**
2 (red)	**0.64**	**1 (red)**	**0.64**
3	**0.865**	**2**	**0.86**
4	**1.378**	**26**	**1.38**
5	**1.61**	**6**	**1.64**
6	**2.25**	**7**	**2.13**
7	**3.90**	**22**	**3.96**
8	6.19	No Equivalent	No Equivalent
9	**6.95**	**27**	**6.7**
10	**7.34**	**28**	**7.3**
11	**8.5**	**29**	**8.55**
12	**9.61**	**30**	**9.7**
13	10.35	No Equivalent	No Equivalent
14	**11.2**	**31**	**11.0**
15	**12.3**	**32**	**12.0**
16	**13.3**	**33**	**13.3**

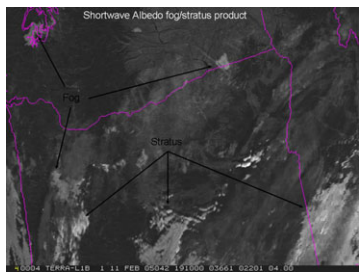

Figure 1a: Shortwave Albedo Product showing patches of fog and stratus in southern Washington and Oregon at 1910 UTC (daytime) on 11 February 2005. Fog and stratus are white/light, whereas ice clouds and most land surfaces are dark.

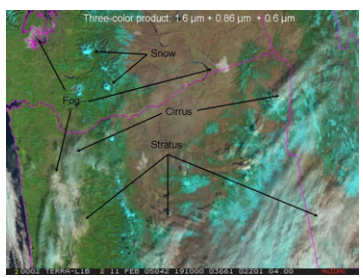

Figure 1b: MSG "natural" Three-Color Product showing patches of fog and stratus, as well as snow and groundcover, for the same scene as in Figure 1a. Snow and ice clouds are cyan, low clouds are white, vegetated land surfaces are green, and non-vegetated land is brown.

Summary of Three-Color Image Combinations for blowing dust detection/discrimination

Thee-Color Product Name	Red component	Green component	Blue component	Image Example
MSG "natural" color product	**1.6 µm**	**0.86 µm**	**0.6 µm**	**Figure 1b**
MSG "day snow-fog" product	**0.8 µm***	**1.6 µm***	**3.9 µm (solar/reflected part only)***	**Not shown**
Modified thee-color fog/stratus product	**0.6 µm albedo**	**1.6 µm albedo**	**Shortwave (3.9 µm) albedo**	**Figure 1c**

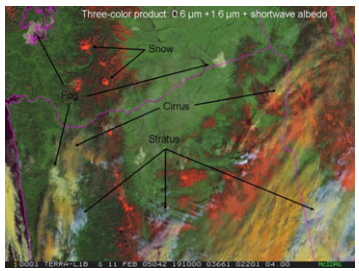

Figure 1c: New Fog/Stratus Three-Color Product that better discriminates clouds from land, and between different levels and types of clouds, for the same scene as in Figure 1a and 1b. Snow is orange/red; high-level cirrus/ice clouds are yellow/orange; low-level stratus/water clouds have a blue tint; and fog (on the ground) is whiter than stratus clouds that are off the ground. Most land surfaces are green, the color discrimination of different land types being sacrificed for cloud level and type discrimination.

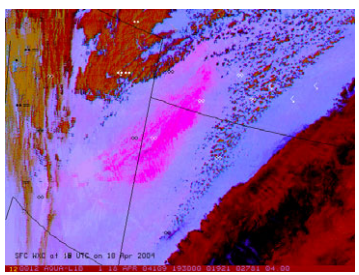

Figure 2a: Rosenfeld three-color atmospheric dust product for a case of blowing dust over eastern Colorado and western Kansas and Nebraska on 18 April 2004 at 1930 UTC. The product is generated from the ABI-equivalent MODIS bands at 8.7, 10.8, and 12.0 µm. Airborne dust is magenta-colored, immediately surrounded by a clear-sky background in blue, along with clouds in yellow, rust and black. Composited weather symbols for the area indicate haze (∞).

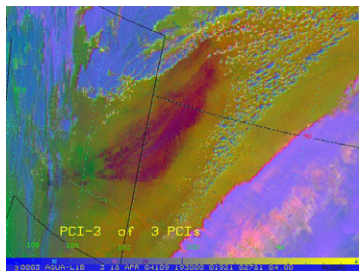

Figure 2b: Three-color atmospheric dust product generated from PCI-2, 3, and 1 (red, green, and blue, respectively) in Figure 4a, showing dust as red, immediately surrounded by a clear-sky background in yellow/orange. Note also the unexplained area in green near the origin of the dust plume. Clouds are blue and pink.

Summary of Three-Color Image Combinations for daytime fog/stratus detection/discrimination

Thee-Color Product Name	Red component	Green component	Blue component	Image Example
Rosenfeld "dust" 3-color product	**12.0 - 10.8 µm***	**10.8 – 8.7 µm***	**10.8 µm***	**Figure 2a**
3-color blowing dust product (8.7, 10.8, and 12.0 µm)	**PCI-2 (of 3 PCIs)**	**PCI-3 (of 3 PCIs)**	**PCI-1 (of 3 PCIs)**	**Figure 2b**
Modified 3-color blowing-dust product (adding 3.9 µm)	**PCI-2 (of 4 PCIs)**	**PCI-4 (of 4 PCIs)**	**PCI-3 (of 4 PCIs)**	**Figure 2c**

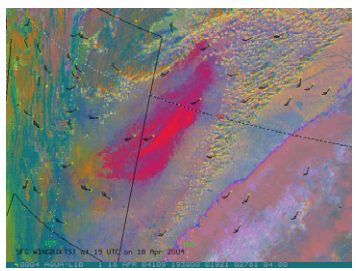

Figure 2c: New three-color blowing dust product generated from PCI-2, 4, and 3 (red, green, and blue, respectively) in Figure 5a, showing dust as red, immediately surrounded by a clear-sky background in neutral color. Note again the area near the origin of the dust plume, this time in yellow. Clouds are represented by more neutral colors as well. Plotted winds represent the flow at the surface at the time of the image.