The ABI (Advanced Baseline Imager) on the GOES-R series

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Introduction

The next generation geostationary satellite series will offer a continuation of current products and services and enable improved and new capabilities. The Advanced Baseline Imager (**ABI**) on the GOES-R series has been designed to meet user requirements covering a wide range of phenomena.

The **ABI**:

• Will be used for a wide range of weather, oceanographic, climate, and environmental applications.

• Expands from five spectral bands on the current GOES imagers to a total of 16 spectral bands in the visible, near-infrared and infrared spectral regions.

• Will increase the coverage rate leading to full disk scans at least every 15 minutes.

• Spatial resolution at the sub-point will be 2 km for the infrared bands, 1 km for most of the other bands (except the 1.378 μm) and 0.5 km for the 0.64 μm visible band.

• Will be remapped into a constant projection before dissemination, similar to SEVIRI .

SEVIRI data from EUMETSAT is being used in a number of ways to prepare for ABI data.

The ABI will be the next generation geostationary imager on GOES-R. It is being built by ITT Industries.

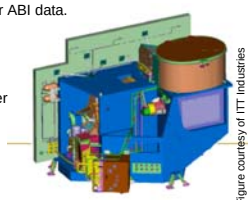


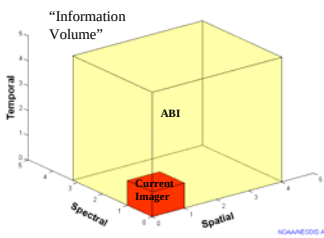
Figure courtesy of ITT Industries

Approximate number of ABI pixels

Input Information			0.5 km	1 km	2 km	
Full disk diameter	17.76	deg	22141	11070	5535	pixels
CONUS height	4.8129	deg	6000	3000	1500	pixels
CONUS width	8.0215	deg	10000	5000	2500	pixels
Meso height/width	1.6043	deg	2000	1000	500	pixels

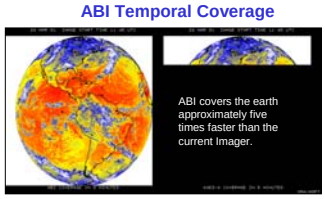
Parameter	Current GOES Imager	Future GOES Imager	Comments
Number of Visible bands	1	2	Cloud cover, plant health and surface features during the day, etc.
Number of Near IR bands	0	4	Cirrus clouds, Low cloud/fog and fire detection, etc.
Number of Infrared bands	4	10	Upper-level water vapor, clouds, SO_2, SST, etc.
Coverage Rate	26 minutes for full disk	15 minutes for full disk, plus CONUS images every 5 minutes, plus meso-scale scans	ABI is approximately five times faster
Spatial resolutions of the 0.6 μm visible band	Approximately 1 km	0.5 km	At the sub-satellite point
Spatial resolutions of the infrared bands	Approximately 4-8 km	2 km	At the sub-satellite point
On-orbit visible calibration	No	Yes	

Improvement Factors: Current and Future GOES Imagers



ABI improves over the current imager by a factor of 3 spectrally, a factor or 4 spatially and a factor of 5 temporally.

ABI Temporal Coverage

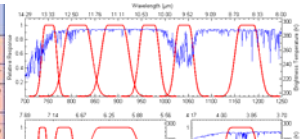


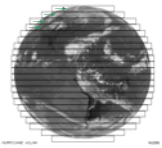
T. J. Schmit, M. M. Gunshor, W. Paul Menzel, Jun Li, Scott Bachmeier, James J. Gurka, 2005: Introducing the Next-generation Advanced Baseline Imager (ABI) on GOES-R, *Bull. Amer. Meteor. Soc.*, Vol 8, August, pp. 1079-1096.

ABI Spectral Bands

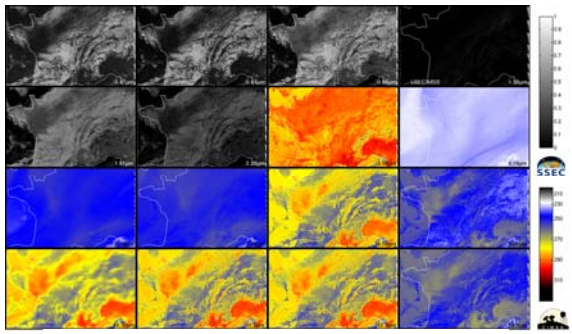
The ABI will have sixteen spectral bands. These are similar to the five bands on the current GOES-8/11 Imagers, plus the 13.3 μm band (similar to those on GOES-12+). Ten additional bands in the visible, near-infrared and infrared spectral regions were added. ABI mock spectral response files are at: *ftp://ftp.ssec.wisc.edu/ABI/SRF/*

Future GOES Imager (ABI) band	Wavelength range (μm)	Central wavelength (μm)	Nominal subsatellite IGFOV (km)	Sample use
1	0.45–0.49	0.47	1	Daytime aerosol over land, coastal water mapping
2	0.59–0.69	0.64	0.5	Daytime clouds fog, insolation, winds
3	0.846–0.885	0.865	1	Daytime vegetation/burn scar and aerosol over water, winds
4	1.371–1.386	1.378	2	Daytime cirrus cloud
5	1.58–1.64	1.61	1	Daytime cloud-top phase and particle size, snow
6	2.225–2.275	2.25	2	Daytime land/cloud properties, particle size, vegetation, snow
7	3.80–4.00	3.90	2	Surface and cloud, fog at night, fire, winds
8	5.77–6.6	6.19	2	High-level atmospheric water vapor, winds, rainfall
9	6.75–7.15	6.95	2	Mid-level atmospheric water vapor, winds, rainfall
10	7.24–7.44	7.34	2	Lower-level water vapor, winds, and SO_2
11	8.3–8.7	8.5	2	Total water for stability, cloud phase, dust, SO_2, rainfall
12	9.42–9.8	9.61	2	Total ozone, turbulence, and winds
13	10.1–10.6	10.35	2	Surface and cloud
14	10.8–11.6	11.2	2	Imagery, SST, clouds, rainfall
15	11.8–12.8	12.3	2	Total water, ash, and SST
16	13.0–13.6	13.3	2	Air temperature, cloud heights and amounts





ABI scan pattern example shown on the full disk.



Sample ABI-like data from MODIS, MET-8 and AIRS on April 11, 2004

The spectral bands on ABI can be constructed using various current instruments such as Meteosat-8, AIRS, and MODIS (above) or the ABI bands can be generated via forward model calculations from high-resolution numerical model profiles (below).

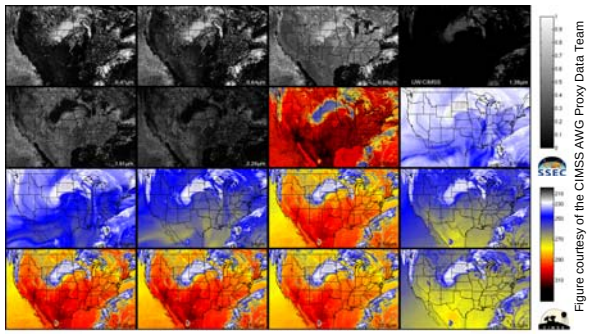
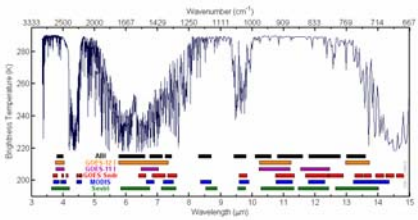


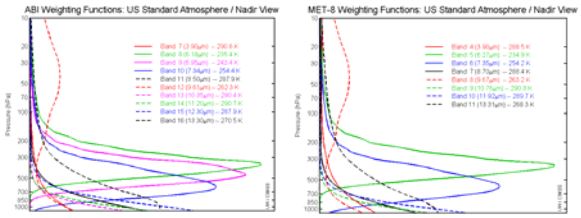
Figure courtesy of the CIMSS AWG Proxy Data Team

Sample ABI-like synthetic data for June 4, 2005 at 18 UTC



There are many similarities for the spectral bands on MET-8 and the ABI. Both have more bands than the current operational GOES imagers. The high resolution spectra is plotted for reference.

Weighting Functions of the Infrared bands



ABI Products

ABI will improve every product from the current GOES Imager and will introduce a host of new products. Current products include: retrieved Atmospheric Motion Vectors (AMVs), Quantitative Precipitation Estimates (QPEs), cloud parameters, clear-sky radiances, Sea Surface Temperature (SST), surface (skin) temperature, detection and characterization of fires, volcanic ash, fog, and cloud-top information. ABI will also provide cloud-top phase/particle size information and improved snow/ice detection, total column ozone, aerosol and smoke detection for air quality monitoring and forecasts. Other new products include vegetation monitoring and upper-level SO_2 detection. In addition, the ABI will be used to generate "pseudo-soundings" to continue the sounder legacy products such as Total Precipitable Water (TPW) and atmospheric stability parameters.

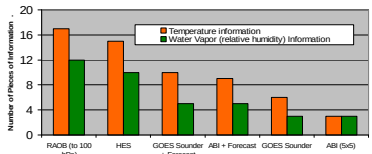
Aerosol Detection (including Smoke and Dust)	Geomagnetic Field	Surface Albedo
Aerosol Particle Size	Probability of Rainfall	*Surface Emissivity* *
Suspended Matter / Optical Depth	Rainfall Potential	Vegetation Fraction: Green
Volcanic Ash *	Rainfall Rate/QPE	Vegetation Index
Aircraft Icing Threat	*Legacy Atm. Vertical Moisture Profile* *	Currents
Cloud Imagery: Coastal	*Legacy Atm. Vertical Temperature Profile* *	Sea & Lake Ice / Age
Cloud & Moisture Imagery	*Derived Stability Indices* *	Sea & Lake Ice / Concentration
Cloud Layers / Heights & Thickness *	*Total Precipitable Water* *	Sea & Lake Ice / Extent & Edge
Cloud Ice Water Path *	*Total Water Content* *	Sea & Lake Ice / Motion
Cloud Liquid Water	Clear Sky Masks	Ice Cover / Landlocked
Cloud Optical Depth	Radiances *	Snow Cover
Cloud Particle Size Distribution	Absorbed Shortwave Radiation: Surface	Snow Depth
Cloud Top Phase	Downward Longwave Radiation: Surface	Sea Surface Temps
Cloud Top Height *	Downward Solar Insolation: Surface	Energetic Heavy Ions
Cloud Top Pressure *	Reflected Solar Insolation: TOA	Mag Electrons & Protons: Low Energy
Cloud Top Temperature *	Upward Longwave Radiation *: Surface & TOA	Mag Electrons & Protons: Med & High Energy
Cloud Type	Ozone Total *	Solar & Galactic Protons
Convection Initiation	*SO_2 Detection* *	Solar Flux: EUV
Enhanced "V"/Overshooting Top Detection	*Derived Motion Winds* *	Solar Flux: X-Ray
Hurricane Intensity	Fire / Hot Spot Characterization	Solar Imagery: extreme UV/X-Ray
Low Cloud & Fog	Flood / Standing Water	
Lightning Detection	*Land Surface (Skin) Temperature* *	
Turbulence		
Visibility		

* = Products degraded from original GOES-R requirements (e.g.; now no HES)

ABI – Advanced Baseline Imager | Continuity of GOES Legacy Sounder Products from ABI | SEISS – Space Env. In-Situ Suite | EXIS – EUV and X-Ray Irradiance Sensors | GLM – Geostationary Lightning Mapper | Magnetometer | SUVI – Solar extreme Ultraviolet Imager

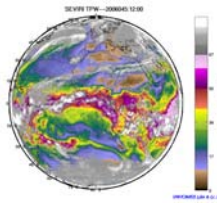
A majority of GOES-R products now will be derived from ABI data.

Profile Information Content



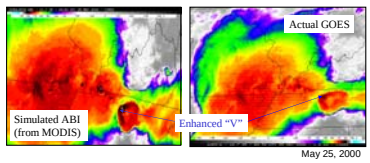
ABI to continue legacy products

The relative vertical number of independent pieces of information is shown. The *moisture* content is similar between the ABI and the current GOES Sounder. The current Sounder does show more *temperature* information than the ABI. This information content analysis does not account for any spatial or temporal differences.



Total Precipitable Water vapor (TPW) overlay on the 11 μm brightness temperature (BT) image (grey shade) from SEVIRI data.

SEVIRI data provided by EUMETSAT



Enhanced "V": The IR window bands show the improved spatial resolutions of the ABI over the current GOES Imager.

Figure courtesy of C. Schmidt, CIMSS

Hurricane Isabel on September 18, 2003 from MODIS

September 2007