Preparing for Imagery From the Next Generation Geostationary Imagers

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The Advanced Baseline Imager (ABI) on the Geostationary Operational Environmental Satellites (GOES)-R series will address a wide range of phenomena, such as weather, climate, oceanographic, and environmental (e.g., hazards) applications. The ABI will improve upon the current GOES Imager with more spectral bands, faster imaging, higher spatial resolution, better navigation, and more accurate calibration.

The Japan Meteorological Agency (JMA) has a nearly identical imager in orbit on Himawari-8 called the Advanced Himawari Imager (AHI).

Improvements of the ABI:

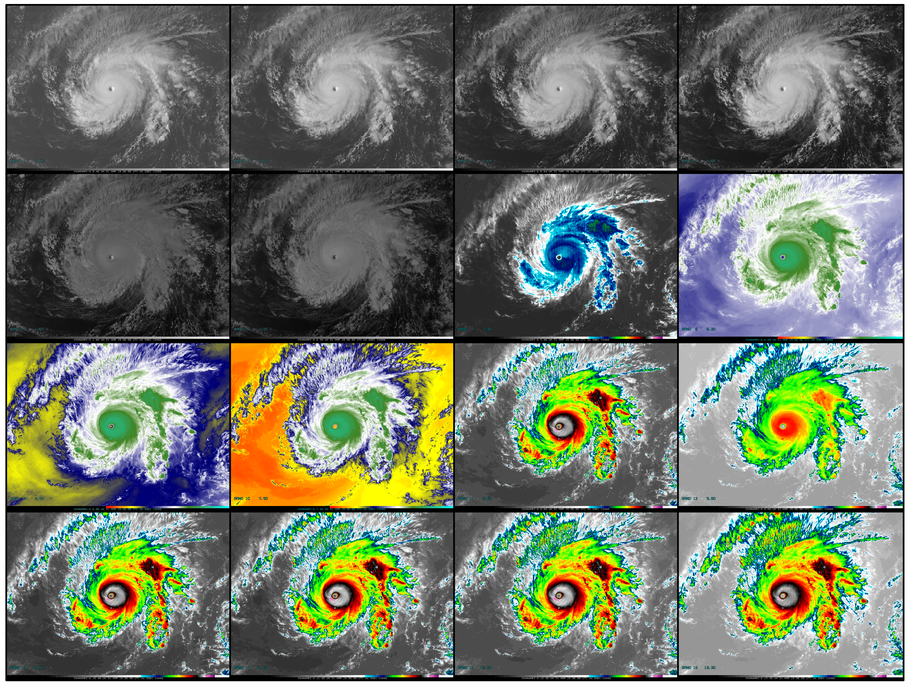
	ABI	Current GOES
Spectral Coverage		
	16 Bands	5 Bands
Spatial Resolution		
0.64 µm Visible	0.5 km	Approx. 1.0 km
Other Visible/Near-IR	1.0 km	n/a
Other Bands (> 2µm)	2.0 km	Approx. 4.0 km
Spatial Coverage		
Full Disk	4 / Hour	Every 3 Hours
CONUS	12 / Hour	~4 / Hour
Mesoscale	Every 30 Sec	n/a
Also:		
	On-orbit calibration of Vis/Near-IR Bands	
	Improved Signal to Noise	

Three Groups of Users:

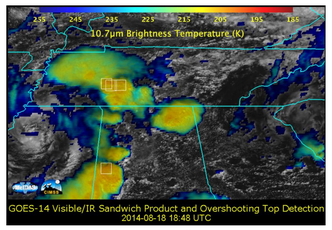
- Direct use of radiance data / imagery
  - Numerical models
  - Forecasters
  - Broadcasters
  - General public/private sector/Internet
- Direct use of satellite derived products
  - Numerical models
  - Forecasters
  - Blended products, etc.
  - General public/private sector/Internet
- Indirect use of services from data/products
  - Basically everyone!

Typhoon Maysak as seen from AHI on 31 March 2015, 06 UTC

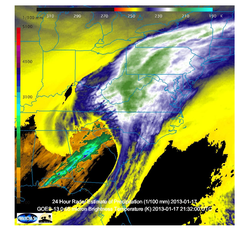
Images generated by Scott Lindstrom in McIDAS-X



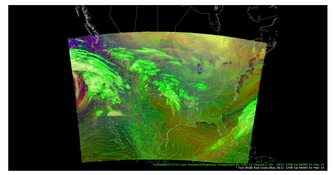
New Visualization Types and Tools:



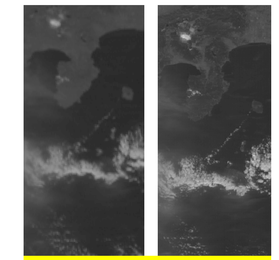
"Sandwich Product" in McIDAS-V



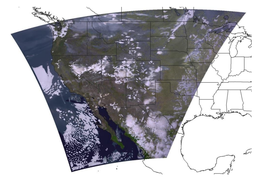
Water Vapor and Radar Images combined in McIDAS-V



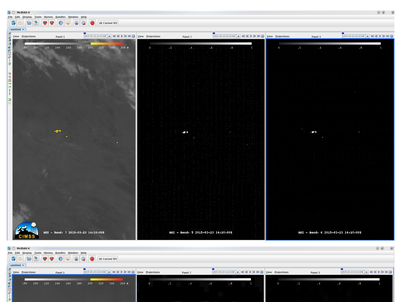
RGB Airmass product with brightness temperatures overlay contours added. Data are simulated GOES-R ABI; in AWIPS-II



A glimpse into the future: much improved spatial resolution on Japan's ABI-like AHI visible band (0.6µm). In McIDAS-X

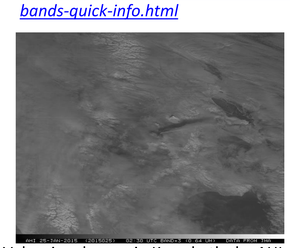


"True Color" image generated from real-time WRF-CHEM simulated ABI data highlighting Pacific Northwest wildfires at 1UTC 19 July 2014



Fires seen in AHI 3.9µm band also seen at night in the 1.6 and 2.3µm bands. In McIDAS-V.

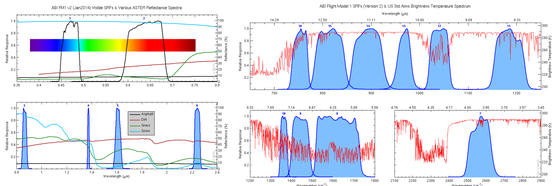
ABI Band Fact Sheets Available online: http://www.goes-r.gov/education/ABI-bands-quick-info.html



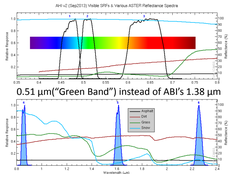
Volcanic ash seen in Kamchatka by AHI 0.5km Vis on Jan 25, 2015. In McIDAS-X

ABI Bands

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



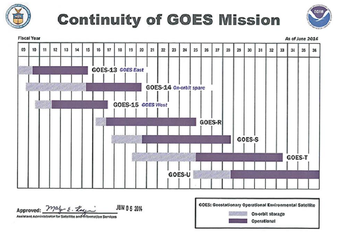
AHI Is Nearly Identical to ABI…



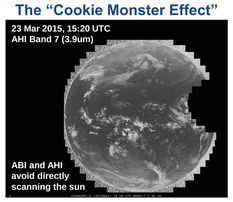
0.51 µm("Green Band") instead of ABI's 1.38 µm

AHI Band	Central Wavelength (µm)	Nominal subsatellite iGFOV (km)	Difference from ABI
1	0.47	1	None
2	0.51	1	Not On ABI
3	0.64	0.5	None
4	0.86	1	Slight Spectral
5	1.61	2	ABI Res is 1km
6	2.26	2	Slight Spectral

Continuity of GOES Mission

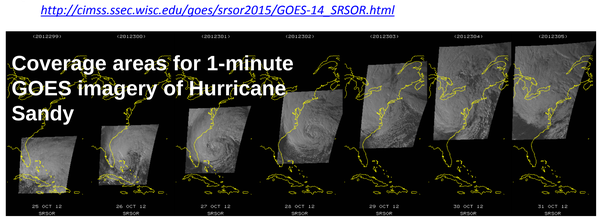


The "Cookie Monster Effect"



Looking Forward: 1-min meso-scale imagery! (BAMS 2015)

http://cimss.ssec.wisc.edu/goes/srsor2015/GOES-14_SRSOR.html



Baseline Products

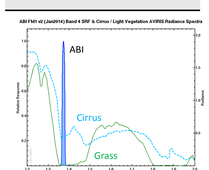
Advanced Baseline Imager (ABI)

Aerosol Detection (Including Smoke and Dust)
Aerosol Optical Depth (AOD)
Clear Sky Masks
Cloud and Moisture Imagery
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Height
Cloud Top Phase
Cloud Top Pressure
Cloud Top Temperature
Derived Motion Winds
Derived Stability Indices
Downward Shortwave Radiation: Surface
Fire/Hot Spot Characterization
Hurricane Intensity Estimation
Land Surface Temperature (Skin)
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Radiances
Rainfall Rate/QPE
Reflected Shortwave Radiation: TOA
Sea Surface Temperature (Skin)
Snow Cover
Total Precipitable Water
Volcanic Ash: Detection and Height

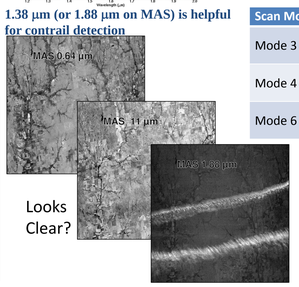
Future Capabilities

Advanced Baseline Imager (ABI)

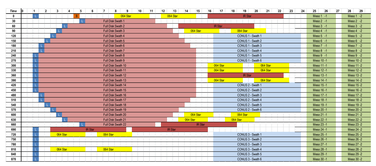
Absorbed Shortwave Radiation: Surface
Aerosol Particle Size
Aircraft Icing Threat
Cloud Ice Water Path
Cloud Layers/Heights
Cloud Liquid Water
Cloud Type
Convective Initiation
Currents
Currents: Offshore
Downward Longwave Radiation: Surface
Enhanced "V"/Overshooting Top Detection
Flood/Standing Water
Ice Cover
Low Cloud and Fog
Ozone Total
Probability of Rainfall
Rainfall Potential
Sea and Lake Ice: Age
Sea and Lake Ice: Concentration
Sea and Lake Ice: Motion
Snow Depth (Over Plains)
SO_2 Detection
Surface Albedo
Surface Emissivity
Tropopause Folding Turbulence Prediction
Upward Longwave Radiation: Surface
Upward Longwave Radiation: TOA
Vegetation Fraction: Green
Vegetation Index
Visibility



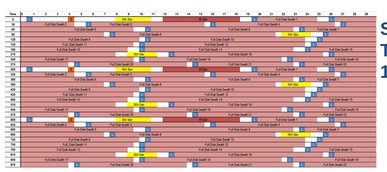
1.38 µm (or 1.88 µm on MAS) is helpful for contrail detection



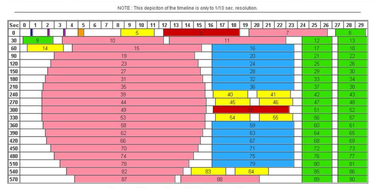
ABI Scan Modes



Scan Mode 3 Time-Time Diagram 15-minutes shown



Scan Mode 4 Time-Time Diagram 15-minutes shown



Scan Mode 6 Time-Time Diagram *10*-minutes shown

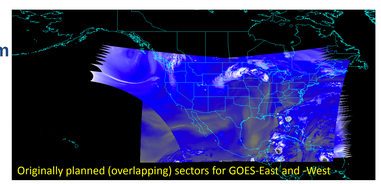
(Figure courtesy of Exelis; illustrative purposes only)

Figure 1 Scan Mode 6 Time-Time Diagram

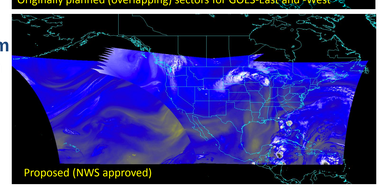
Scan Mode	Full Disk	CONUS	Mesoscale
Mode 3 or "Flex Mode" (Default)	Every 15 Minutes	Every 5 Minutes	2, Every 30 Seconds
Mode 4 or "Continuous Full Disk"	Every 5 Minutes	Never	Never
Mode 6 – Proposed, Not Approved for OPS	Every 10 Minutes	Every 5 Minutes	2, Every 30 Seconds

ABI Scan Mode 6 would align the GOES-R Program with JMA's operations and EUMETSAT plans for 10 Minute Full Disk scans.

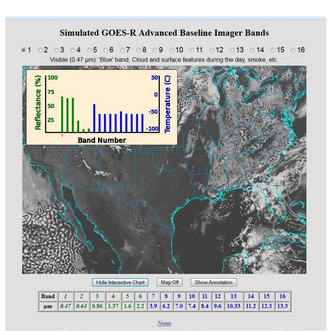
Shifting CONUS



Originally planned (overlapping) sectors for GOES-East and -West



Proposed (NWS approved)



Sample interactive "Bandapp" educational webapp using simulated ABI images: http://cimss.ssec.wisc.edu/goes/webapps/bandapp/

Summary

- We are preparing for GOES-R using AHI and simulated ABI
- We are using multiple tools to visualize and analyze data.
  - McIDAS-X, McIDAS-V, AWIPS-II, IDL, Matlab, Python, etc.

http://www.goes-r.gov