

Blog Help Files: GOES Imagery

NOAA's Geostationary Operational Environmental Satellites (GOES)* provide frequent measurements of visible, infra-red, and water vapor wavelengths that are used by meteorologists to determine the threat of severe weather in the United States. Currently, NOAA operates GOES-10 (GOES-West) and GOES-12 (GOES-East); the coverage provided by each satellite is shown in Figure 1.

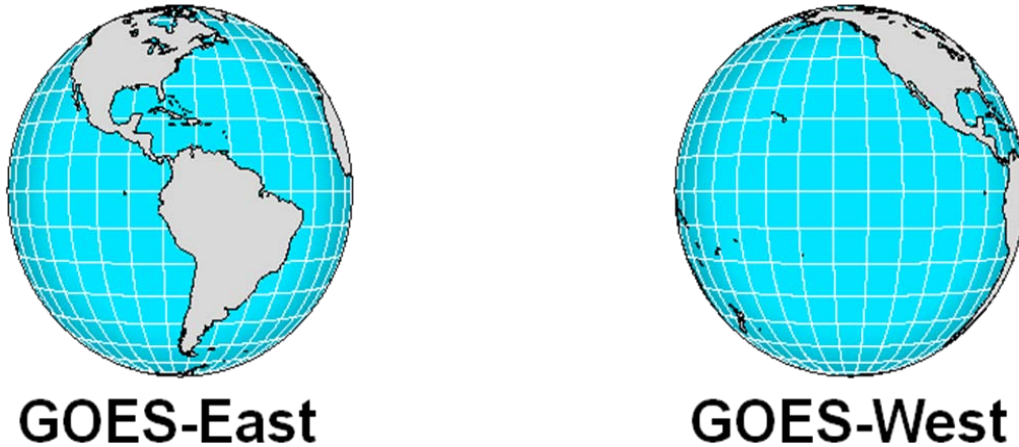


Figure 1. Geographic coverage of the GOES-East (left) and GOES-West (right) satellites.

The GOES carry a radiometer, called the Imager, which measures solar radiation reflected from the Earth's surface and terrestrial radiation emitted from the Earth. The Imager has five bands, called channels, each of which measures a different wavelength range:

- Channel 1: Visible (0.55-0.75 μm)
- Channel 2: Shortwave IR (3.80-4.00 μm)
- Channel 3: Water Vapor (6.50-7.00 μm)
- Channel 4: IR 1 (10.20-11.20 μm)
- Channel 5: IR 2 (11.50-12.50 μm)

Measurements from the Imager are used to generate several types of images of weather phenomena, which should be familiar to watchers of the Weather Channel or local weather forecasts. The most commonly-used GOES images include the following:

- **Visible** image (Channel 1): indicates the location and movement of clouds associated with fronts, thunderstorms, hurricanes, and Mesoscale Convective Systems (MCSs). Because they are derived from visible wavelengths, GOES visible images are only available during daylight hours.

- **Shortwave IR** image (Channel 2): indicates the height of clouds associated with severe weather (higher clouds are colder). GOES shortwave IR images are also used to indicate the location/movement of clouds and weather systems at night when visible imagery is not available.
- **Water vapor** image (Channel 3): indicates the amount of water vapor associated with fronts, thunderstorms, hurricanes, and MCSs – the more water vapor, the greater the potential rainfall and strength of the system; useful for identifying the location and movement of fronts and weather systems and forecasting storm development.

Figures 2-4 are examples of GOES visible (Figure 1), shortwave IR (Figure 2), and water vapor (Figure 3) images of Hurricane Bill from 18:15 UTC,* August 19, 2009.

*For more information about:

- Geostationary satellites, see the **Satellite Basics Help File**
- UTC, see the **Universal Coordinated Time Help File**

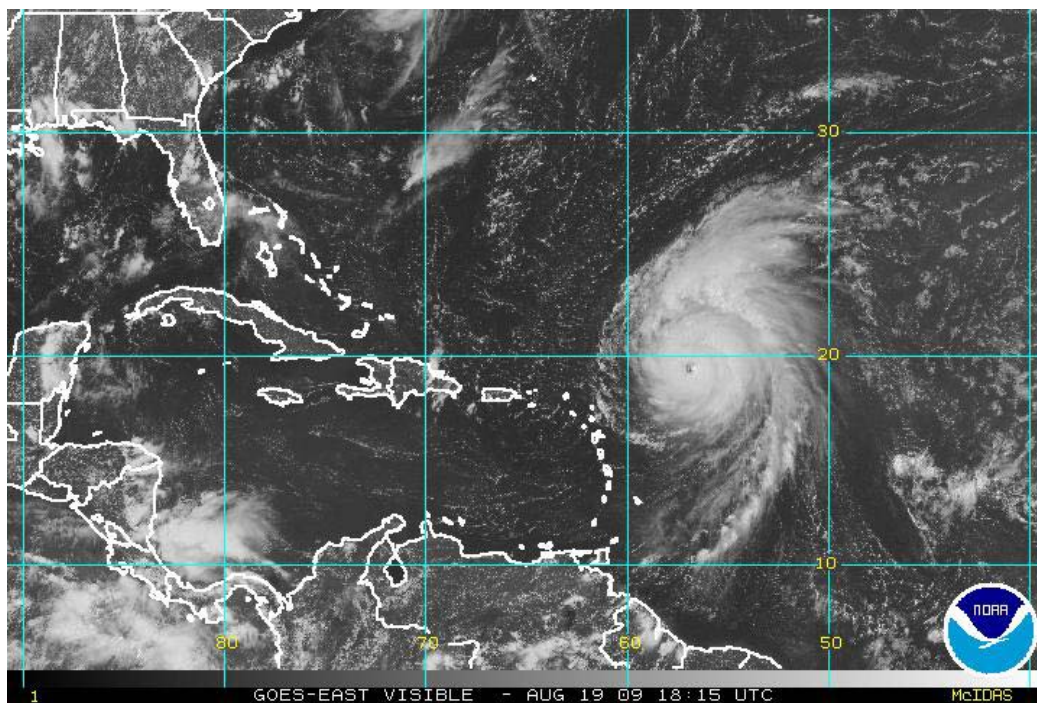


Figure 2. GOES-East visible (channel 1) image of Hurricane Bill from 18:15 UTC, August 19, 2009. The visible channel of GOES measures visible solar radiation reflected by clouds, which is why they appear white in the image.

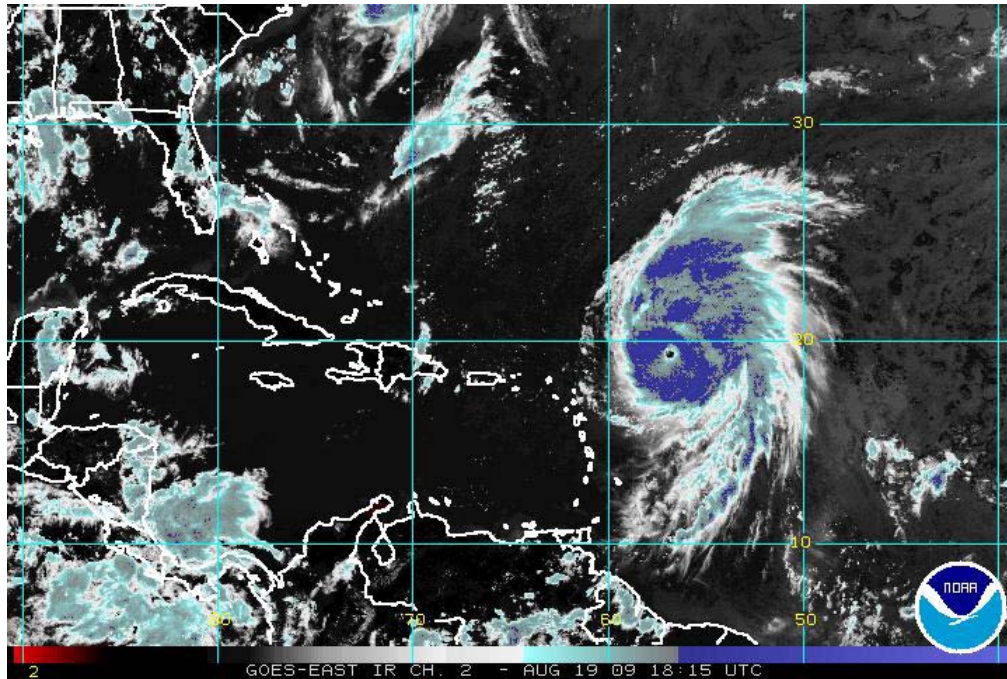


Figure 3. GOES-East shortwave infra-red (channel 2) image of Hurricane Bill from 18:15 UTC, August 19, 2009. Note the dark blue colors of Bill, indicating the very tall, and cold, cloud-tops of the hurricane.

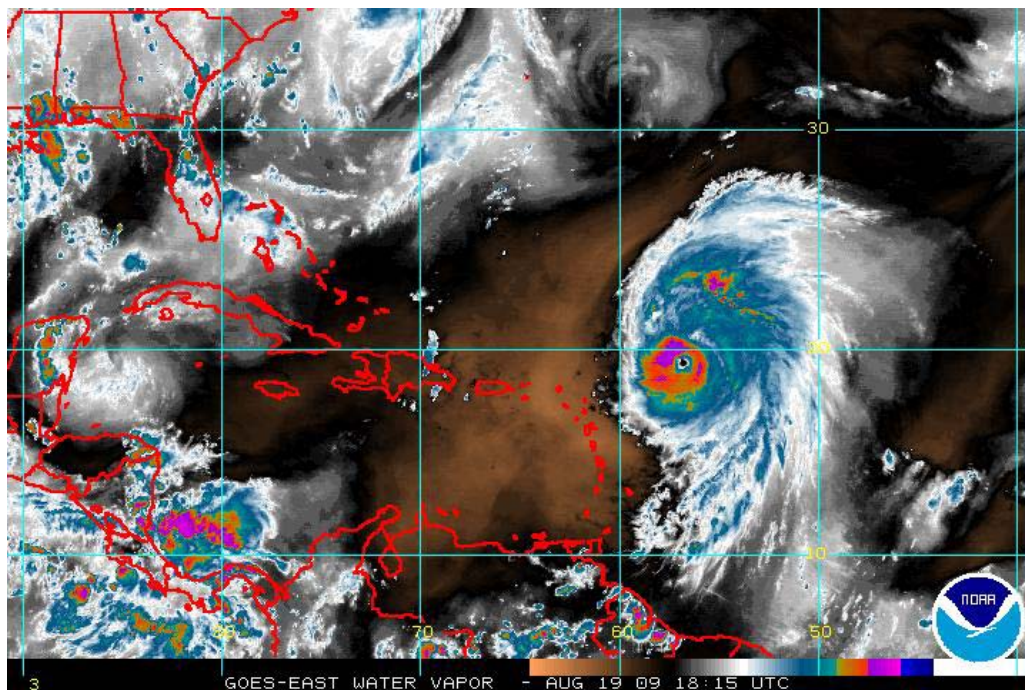


Figure 4. GOES-East water vapor (channel 3) image of Hurricane Bill from 18:15 UTC, August 19, 2009. Note the rainbow-colored areas of Bill and the thunderstorms in the Caribbean Sea, just east of Nicaragua and Costa Rica, which indicate high concentrations of water vapor. The brown areas on the western periphery of Bill indicate very dry air associated with subsidence (sinking air).