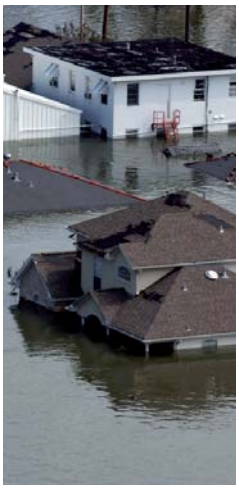
GOES-R Wind Products

October 2009

Hurricane Intensity Estimation



What Is GOES-R?

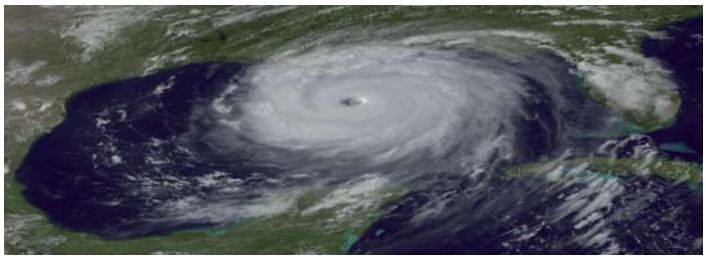
The Geostationary Operational Environmental Satellite - R Series (GOES-R) is the next generation of National Oceanic and Atmospheric Administration (NOAA) geostationary Earth-observing systems. Superior spacecraft and instrument technology will support expanded detection of environmental phenomena, resulting in more timely and accurate forecasts and warnings. The Advanced Baseline Imager (ABI), a sixteen channel imager with two visible channels, four near-infrared channels, and ten infrared channels, will provide three times more spectral information, four times the spatial resolution, and more than five times faster temporal coverage than the current system. Other advancements over current GOES capabilities include total lightning detection (in-cloud and cloud-to-ground flashes) and mapping from the Geostationary Lightning Mapper (GLM), and increased dynamic range, resolution, and sensitivity in monitoring solar X-ray flux with the Solar UV Imager (SUVI). GOES-R is scheduled for launch in 2015.

What Are the Safety and Economic Implications of Improved Hurricane Intensity Forecasts?

NOAA's focus on public service and safety is clearly formalized in its mission and vision statements. At NOAA's National Hurricane Center (NHC), the specific mission is to save lives, mitigate property loss, and improve economic efficiency by issuing the best watches, warnings, forecasts, and analyses of hazardous tropical weather, and by increasing understanding of these hazards. The mean annual damage to mainland U.S. from tropical storms/hurricanes is $4.9 billion, and the U.S. has at least a 1 in 6 chance of experiencing losses related to hurricanes of at least $10 billion[1]. Hurricane Katrina in 2005 was a powerful example of a devastating disaster that could have been much worse if not for the accurate and timely track forecasts and warnings issued by NHC. While hurricane track forecasts have generally improved over the past decade or two, less progress has been made with intensity forecasts, showing only a modest improvement in skill. The slow rate of improvement in intensity analysis and forecast accuracy, and the particularly large errors that can occur in dangerous episodes of rapid intensification, have prompted NHC to elevate this issue to its top priority for the tropical meteorology research community. While gains clearly have been made, the losses in Katrina and in other storms, the looming threat of additional hurricane-induced loss of life, and the remaining significant limitations in hurricane intensity analysis and forecast accuracy show that work remains to be done to fully address the goals set by NHC.

How Will GOES-R Address This Hazard?

The GOES series of environmental satellites have historically been one of the principle tools utilized by NHC to monitor hurricane activity. Over the years, algorithms have been developed to estimate hurricane intensity from GOES imagery. The **Hurricane Intensity Estimate (HIE)** product will produce real-time estimates of hurricane central

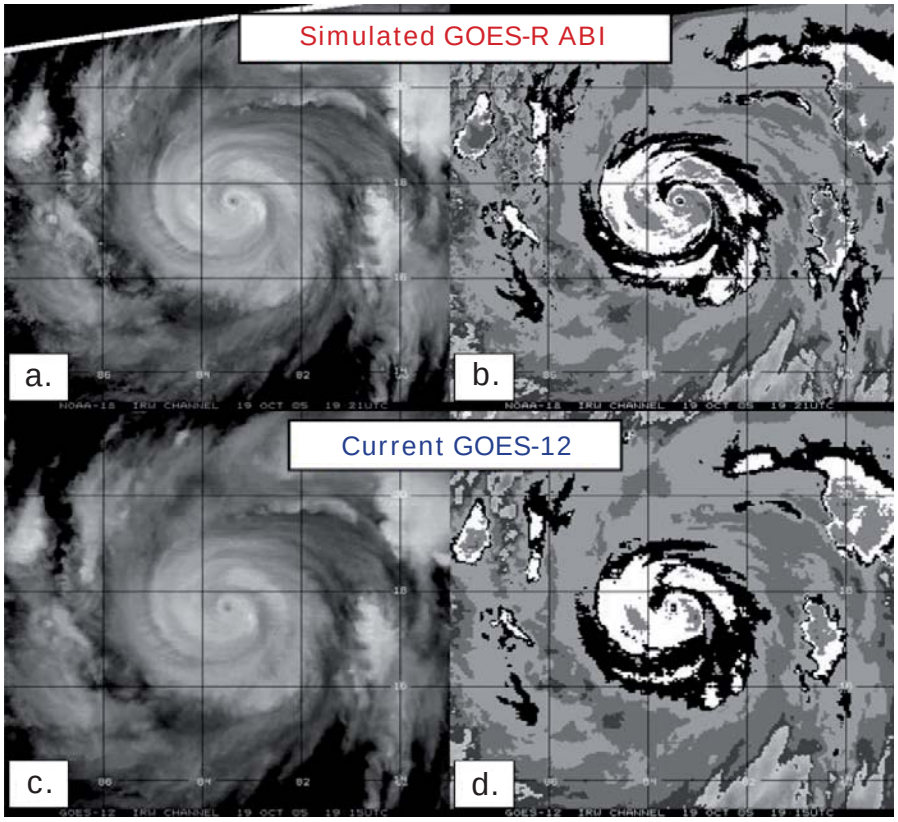


Top, Hurricane Katrina on 28 August, 2005 as it approached New Orleans. Middle and Bottom images are from Hurricane Katrina's damage along the Louisiana and Mississippi coasts.

pressure and maximum sustained winds from the ABI imagery that will be used by NHC forecasters to help assess current intensity trends.

How Does This Algorithm Work?

The **HIE** algorithm is a derivative of the Advanced Dvorak Technique (ADT), an objective and fully automated algorithm that operates on current GOES data and is now used operationally by NHC. The **HIE** will generate real-time hurricane intensity estimates using 10.35µm infrared window channel imagery. The improved performance and higher spatial resolution of the ABI provides greater accuracy of feature attributes as well as the ability to detect even smaller features, allowing for better characterization of small hurricane eyes. The primary products that will be generated by the **HIE** include an intensity estimate analysis from the most current satellite image being interrogated, as well as additional information about the intensity trend of the analyzed storm. Graphical illustrations and textual listings of the hurricane intensity estimates will be viewable and distributed to the user community in real time.



Simulated GOES-R ABI infrared imagery with black/white contrast stretch (a) and "Hurricane" enhancement (b) compared to current GOES-12 imagery (c and d) for Hurricane Wilma on October 19, 2005. The contrast stretch/enhancements show the improved capability to capture small eye features with the ABI.

Research and Development Partners for Hurricane Intensity Products

- Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin
- NOAA National Environmental Satellite, Data and Information Service, Center for Satellite Applications and Research (NESDIS/STAR)
- NOAA/NESDIS Office of Satellite Data Processing and Distribution (OSDPD)/Satellite Analysis Branch (SAB)
- NOAA National Hurricane Center (NHC)
- Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University

On the Web

http://cimss.ssec.wisc.edu/tropic2/real-time/adt/adt.html
http://www.osdpd.noaa.gov/ml/ocean/tropical.html
http://rammb.cira.colostate.edu/products/tc_realtime/

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What Are The Benefits?

NOAA's National Hurricane Center issues hurricane analyses, forecasts, and warnings for the U.S. coastline as well as large parts of the North Atlantic and Pacific Oceans, and in support of many nearby countries. The advanced observational capabilities available from GOES-R will enable the NHC to make more accurate estimates of hurricane intensity, leading to improved forecasts and extended forecast lead times. The new information from the GLM and ABI will also improve forecasts through better hurricane model initialization.

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[1]Pielke, R.A., and Landsea, C.W., 1998, "Normalized Hurricane Damages in the United States: 1925-1995," Weather and Forecasting, 13: 621-631.