New Sounding Products from the Next Generation of Geostationary Environmental Operational Satellites

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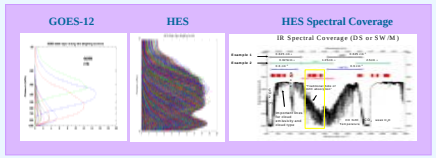
Abstract

The Advanced Baseline Imager (ABI) and the Hyper-spectral Environmental Suite (HES) instruments on the next generation of Geostationary Environmental Operational Satellite's (GOES-R series), provide the opportunity for improved sounding algorithms in extreme weather situations. We will describe the activities within sounding application team of the GOES-R Algorithm Working Group (AWG) to merge the hyper-spectral experience from polar satellites, such as the Atmospheric Infrared Sounder (AIRS) and Infrared Atmospheric Sounding Interferometer (IASI), with the high spatial and temporal sampling of GOES sounding products.

Next Generation of GOES Sounding

Next generation of GOES will address ***four key remote sensing areas:***

	GOES 12 Sounder	GOES-R HES
• *spatial resolution*	10 km	4-10 km
• *spectral coverage*	18ch	~1600ch
and resolution		0.5 cm-1
• *temporal resolution*	20 min	15 min
• *radiometric accuracy*	0.3 k	0.1 k



HES will improve vertical sounding capabilities relative to the current GOES sounder.

Weather Forecast Objectives

- **Global NWP:**
- *Vertically resolved winds*
  - *NWP wind field initialization*
- *Vertically resolved large scale moisture flux*
  - *Hadley cell intensity*
- *Surface T and Q profiles*
- **Tropical Storms and Hurricanes:**
- ***Deep layer mean wind*** *steering currents for forecasting storm trajectory and speed*
- ***Vertically resolved moisture*** *in-flow/out-flow*
- ***Ocean temperature ahead of storm***
- ***Upper level vertical wind*** *shear that leads to storm dissipation*
- ***SST cooling*** *produced by tropical storm winds*

- **Continental Severe Convective Storms:**
- *Localize surface heating, moisture convergence, and thermodynamic stability change*
  - *boundary layer capping inversion*
- *dry layer aloft*
  - *stable regions aloft*
- *Jet stream position and upper level dynamic forcing*

Products will be improved by HES

Core Products	Derived Products
Infrared Radiances	Atmospheric Stability
Upward Long-wave Radiation	Convective Initiation
Atmospheric Temperature Profile	Capping Inversion
Atmospheric Water Vapor Profile	Moisture Flux
Surface Temperature, Emissivity	Hurricane Intensity
Total water content	Derived Moisture Winds
Total Ozone (Day & Night)	Clear Sky Masks
Ozone Profiles	Icing Threat
Carbon Monoxide Concentration	Microburst Wind-speed Potential
Cloud Top Temperature, Pressure	
Cloud Top Height & Thicknesses	
Cloud Type, Particle Size Distribution	
Aerosol Detection:	
Dust and Volcanic Ash	
SO2 Detection	

Sounding Application Team

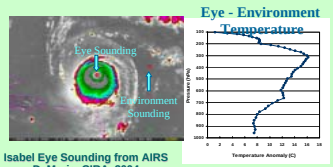
Sounding Team Mission:

To develop, demonstrate and recommend end-to-end capabilities for the GOES-R Ground Segment and to provide sustained post-launch validation, and product enhancements

Team Members

Chris Barnet	NOAA/NESDIS/STAR
Yong Han	NOAA/NESDIS/STAR
John LeMarshall	JCSDA
Jun Li	CIMSS
Tim Schmit	NOAA/NESDIS/STAR
Bill Smith	Hampton Univ.
Larrabee Strow	UMBC
Dave Tobin	CIMSS

Current capabilities



Isabel Eye Sounding from AIRS DeMaria, CIRA, 2004

Hyper-spectral sounding using polar instruments (*e.g.*, AIRS) and aircraft (*e.g.*, HIS, SHIS, NAST-I) are mature; however, they are optimized for polar orbits (*e.g.*, low temporal sampling).

Geo-sounding algorithms using low spectral resolution data are mature.

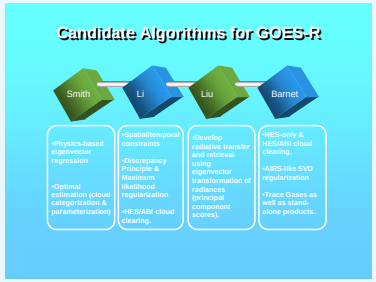
Temporal constraints (*e.g.*, Kalman filtering concepts and temporal cloud clearing, analogous to spatial constrains in polar algorithms are under study.

Hyper-spectral trace gas algorithms (*e.g.*, O3 & CO) are in development with the AIRS instrument and will be transferred to operations with the IASI instrument.

Demonstration of cloud clearing concepts using only hyper-spectral data, forecast models, and collocated imager data have been explored.

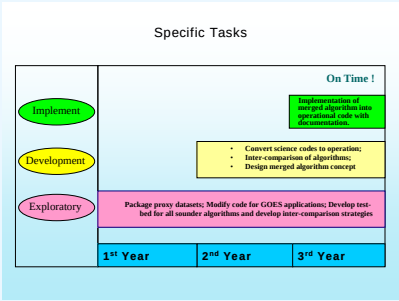
Algorithm Development Strategy

- **Four algorithm concepts were defined for study:**



Execution time is critical for GOES-R applications and methods to utilize temporal continuity is important!

- **End to end capabilities**:

. Instrument Trade Studies
. Proxy Dataset Development
. Algorithm Development
. Product Demonstration Systems
. Test Bed Datasets
. Development of Cal/Val Tools
. Integrated Cal/Val Enterprise System
. Application Development
. User Readiness
. Sustained Product Validation
. Algorithm and application improvements

- **Sounding Team Schedule**: