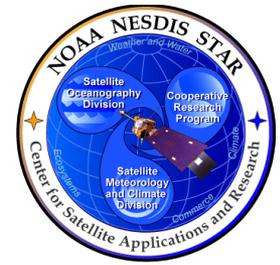




# Enterprise Plan for Algorithm Development and Integration to Operations

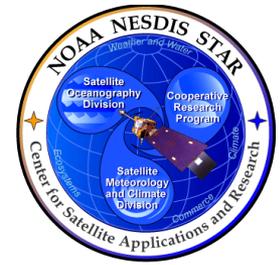
January 7, 2015

Walter Wolf, Jaime Daniels, and Lihang Zhou  
*NOAA/NESDIS, Center for Satellite Applications and Research (STAR)*  
Shanna Sampson, Tom King, and Bigyani Das  
*IMSG, Inc.*



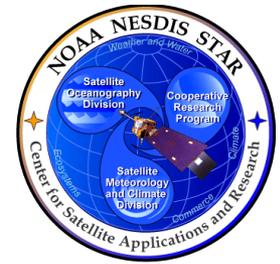
# Motivation – Users

- Brings continuity of NOAA products between current and future NOAA operational satellites
- Supports the NWS Office of Science and Technology's implementation strategy of multi-sensor algorithms and products



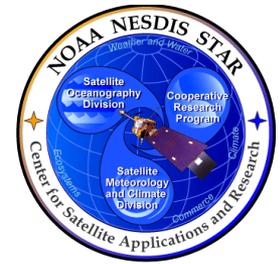
# Motivation – NESDIS

- Enterprise Algorithms have the following advantages:
  - Continuity of NOAA products between current and future NOAA operational satellites.
  - Cost effective processing for NOAA products
  - Maintenance of fewer algorithms and systems within operations



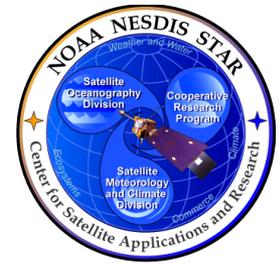
# Infrastructure

- For the development of the GOES–R products, STAR implemented the STAR Algorithm Processing Framework
- The Framework infrastructure was designed to enable the processing of data from GOES–R and other satellites
- Framework allows algorithms access to a variety of data sets with minimal effort once they have been integrated into the system



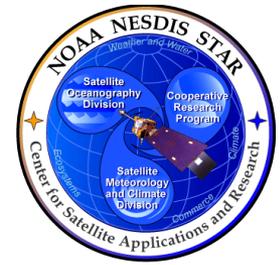
# Framework Capabilities

- To reduce the processing time for all the algorithms, the following was implemented within the Framework:
  - Satellite data and ancillary data is stored in memory for use by the algorithms
  - Common ancillary data is used across algorithms (where possible)
  - Forward model is run once for all algorithms
  - The Framework understands the precedence for each algorithm and runs the algorithms accordingly



# Framework Details

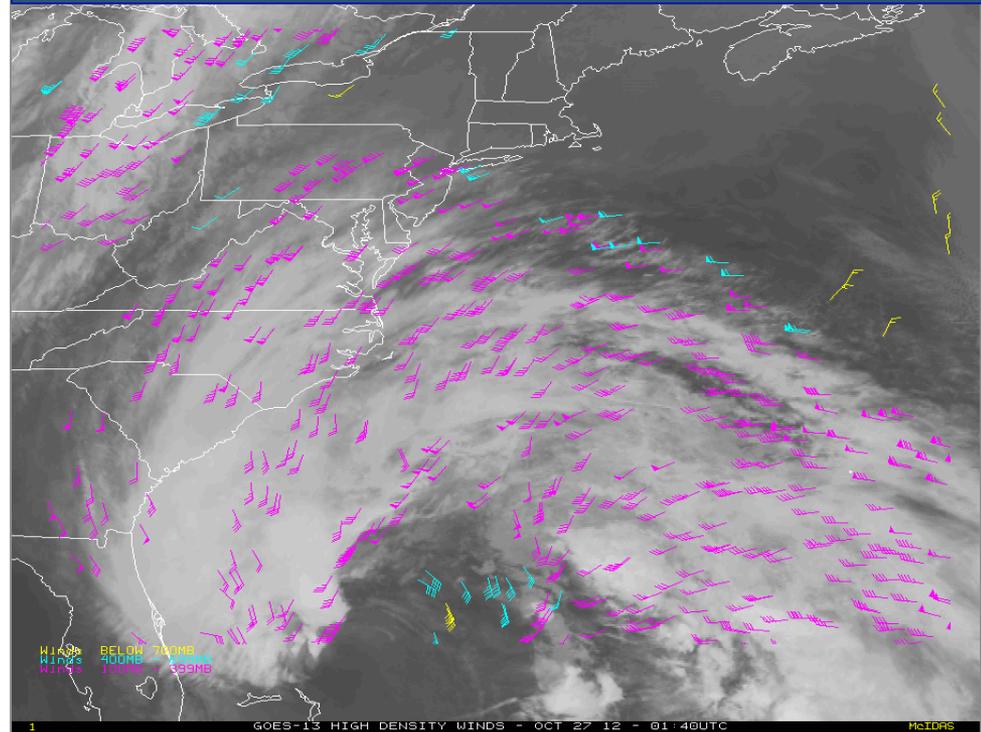
- Algorithms plugged into the framework are subroutine calls
- Data is not read within the algorithm, all input data is either passed into the algorithm or is read via a function call
- Readers and writers of all types of input and output data are treated as algorithms
- One data format (NetCDF4) for all inputs and outputs
- The Framework is run by perl scripts for data handling



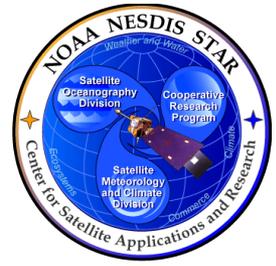
# Prototype Algorithm

- Derived Motion Winds (DMW) was the first product that was implemented as an enterprise algorithm
- The GOES-R DMW algorithm within the Framework was modified to process GOES satellite data
- The GOES-R Cloud Mask and Cloud Height algorithms, both precedence algorithms for the DMW algorithm, were updated as well
- Will go operational within the next 3 months

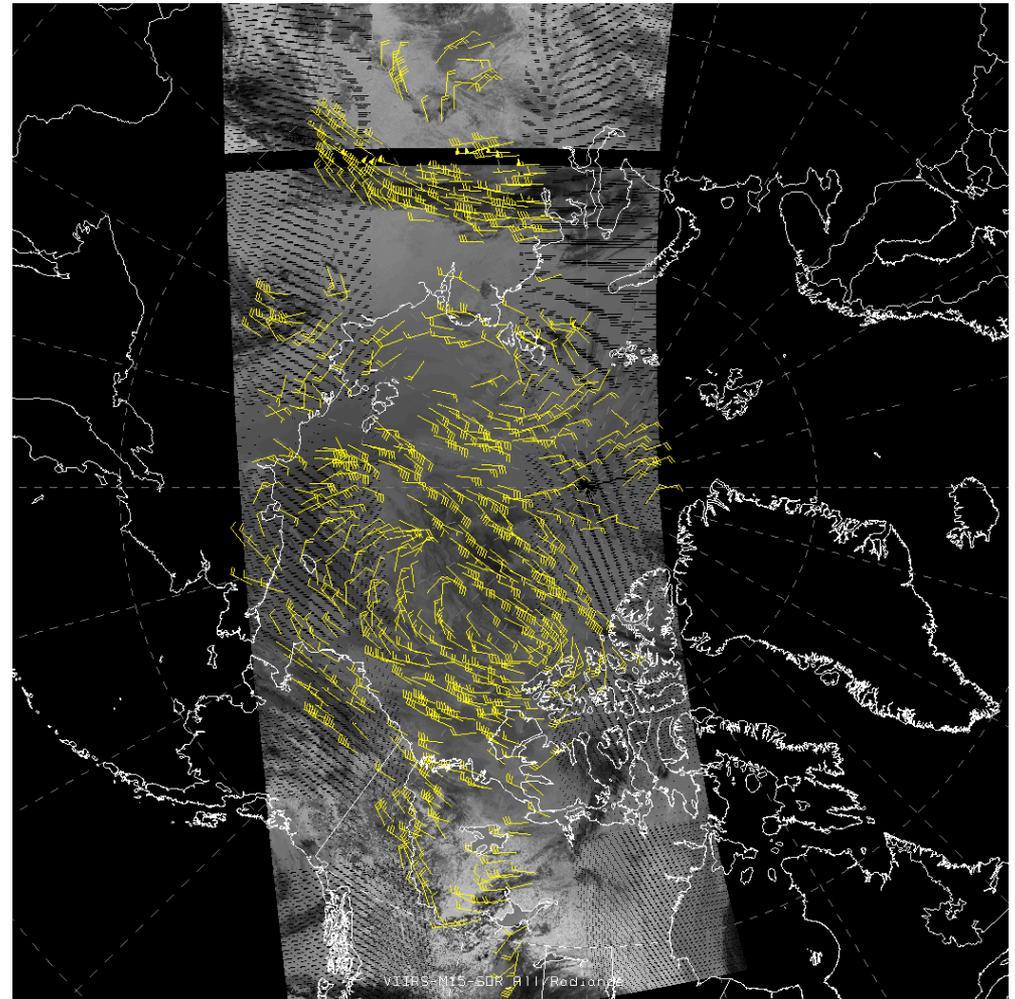
Cloud-drift winds derived from 15-min GOES-13 imagery over Hurricane Sandy (4-day loop)



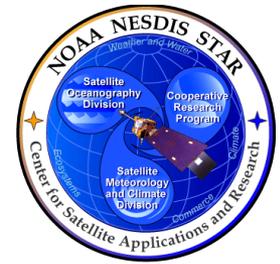
# Derived Motion Winds – Polar Application



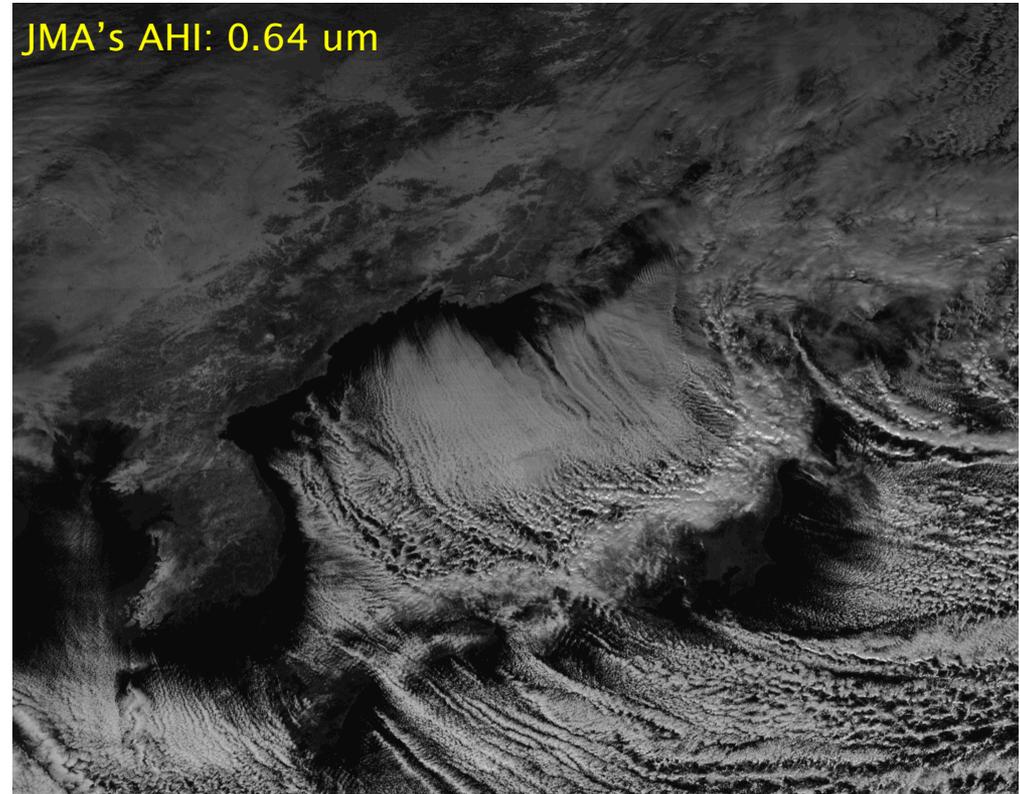
- The GOES/GOES-R DMW algorithm was updated to derive winds from the VIIRS instrument on Soumi-NPP
- The GOES-R Cloud Mask and Cloud Height algorithms, both precedence algorithms for the DMW algorithm, were updated as well
- The VIIRS polar winds product became operational in NESDIS on 8 May 2014.
- This is the first GOES-R algorithm to become operational.

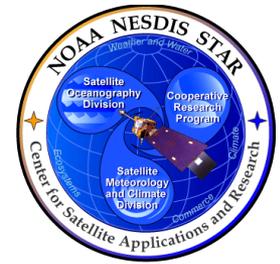


# Derived Motion Winds – Enterprise Algorithm



- The DMW algorithm is being updated to process Himawari-8 AHI data
- The last two DMW products to be upgraded to the GOES-R DMW algorithm are the AVHRR and MODIS winds
  - A project plan has been submitted and is yet to be funded
  - If funded, all NOAA DMW operational products will be from the enterprise algorithm

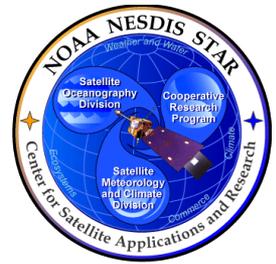




# More Enterprise Algorithms

- Work is being conducted to modify NOAA Heritage Cloud, Cryosphere, Volcanic Ash, and Aerosol algorithms to work on VIIRS data
- For most products, the heritage algorithm is the GOES-R algorithm.
- This will bring scientific consistency between the GOES-R products and VIIRS products

# Cloud Products



- Cloud Mask
- Cloud Top Phase
- Cloud Type
- Cloud Top Height
- Cloud Cover Layers
- Cloud Top Temperature
- Cloud Top Pressure
- Cloud Optical Depth
- Cloud Particle Size Distribution
- Cloud Liquid Water
- Cloud Ice Water Path

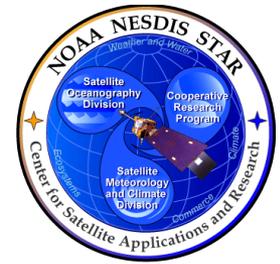
(All GOES-R heritage)



# Aerosol Products

- Aerosol Detection
- Aerosol Optical Depth
- Aerosol Particle Size
  
- Volcanic Ash Mass Loading
- Volcanic Ash Height

(All GOES-R heritage)



# Cryosphere Products

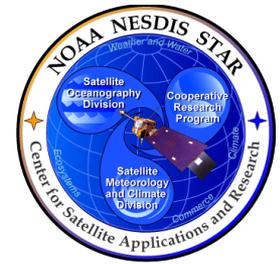
- Binary Snow Cover
- Fractional Snow Cover
- Ice Concentration and Cover
- Ice Surface Temperature
- Ice Thickness / Age

(Ice products have GOES-R heritage,  
Snow products have operational  
heritage)



# Reduced Cost

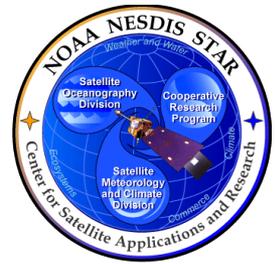
- GOES–R, GOES, VIIRS, and other L1B readers are implemented once into the Framework for all the algorithms
- Ancillary data readers were already implemented into the Framework, no extra work when adding the product for an additional satellite
- Output files already existed from the GOES–R algorithms, no new output files required when adding an additional satellite



# Operational Software

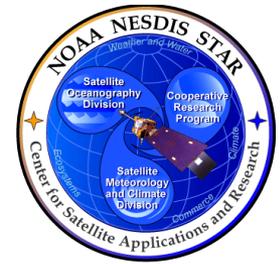
- Framework currently in operations for VIIRS DMW and is in the process of being transitioned to operations for the processing of GOES Winds
- Software has already been reviewed by operational personnel for software and security standards
- Scripts to run the Framework for testing have already been developed

# Conclusion



- GOES–R Derived Motion Winds algorithm has been modified to create GOES winds and VIIRS polar winds products
- One common code base is now used for the DMW product for GOES–R, GOES and VIIRS
  - Continuity of NOAA products between current and future NOAA operational satellites.
  - Cost effective processing for NOAA products
  - Maintenance of fewer algorithms in operations
- GOES–R and heritage algorithms are being updated to create Cloud, Aerosol and Cryosphere products from the VIIRS instrument
- More algorithms are planned for this enterprise approach

# Please Visit These Posters



- Joint Poster Session 1: Poster 141:  
GOES–R AIT: Development of Standard Test Data Sets for Routine Testing
- Joint Poster Session 2: Poster 676:  
Routine Validation of the GOES–R Multi–Satellite Processing System Framework
- Joint Poster Session 2: Poster 677:  
GOES–R AIT: Near–Real–Time Processing
- Joint Poster Session 2: Poster 678:  
GOES–R AIT: Configuration Management