

# NOAA Update and Key Issues

*Dr. Stephen Volz, Assistant Administrator for Satellite and Information Services*

Space Studies Board Meeting  
April 28, 2016





# Outline

- NOAA Overview
- NOAA's observing systems
- Space-based observations of the future
- Service-Driven Science and Applications
- NOAA-relevant NAS activity
- Challenges

*2 days with NASA, 30 minutes with NOAA*

# NOAA Strategic Priorities

## NOAA's Top Priorities

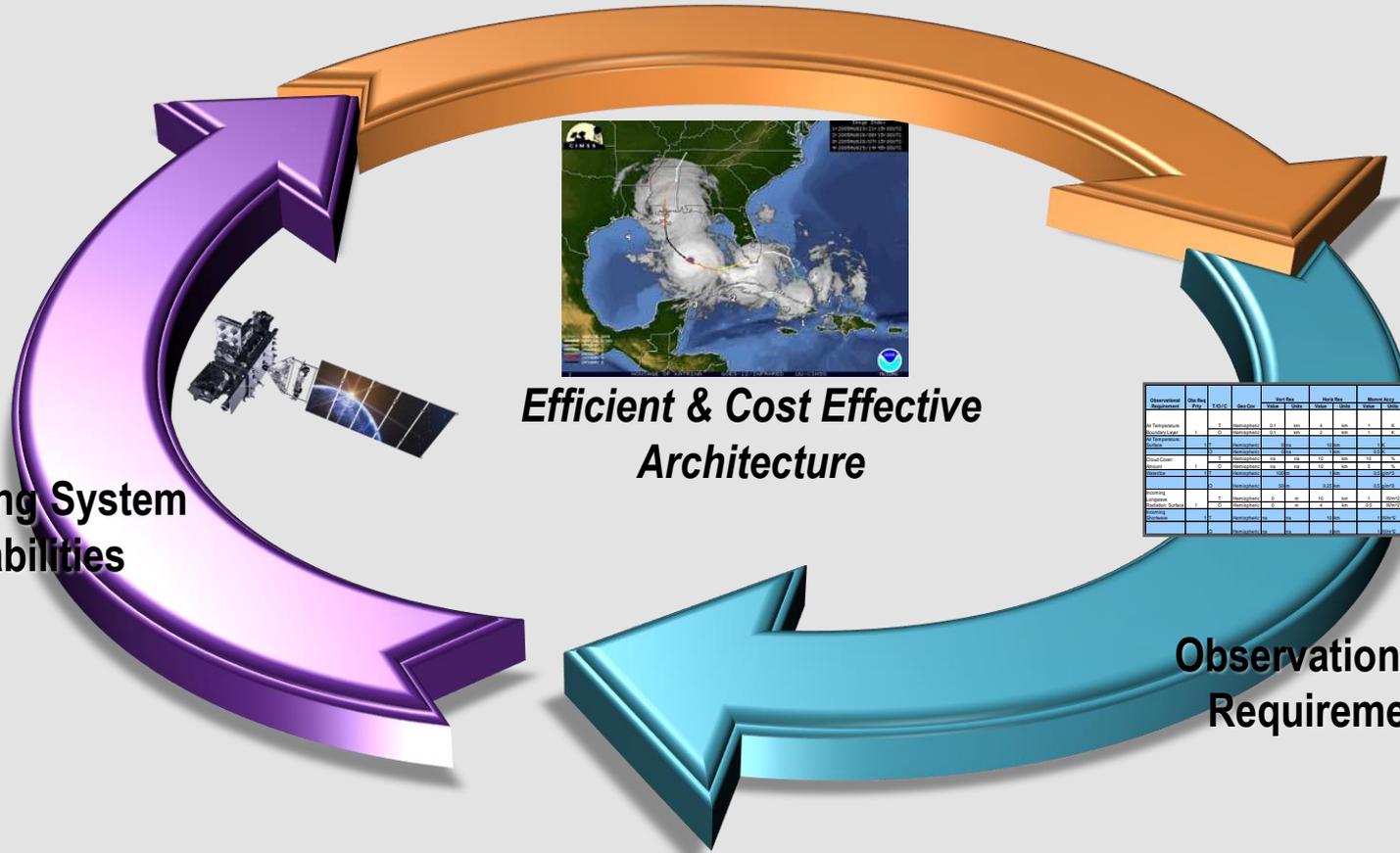
1. Provide Information & Services to Make Communities More Resilient
2. Evolve the National Weather Service
3. *Invest in Observational Infrastructure*
  - **Observations account for \$2.7B of NOAA's \$5.45B budget**
4. Achieve Organizational Excellence

## Core Missions



# NOAA Observing System Council (NOSC) Portfolio Management

Observing System Impacts



Observing System  
Capabilities

*Efficient & Cost Effective  
Architecture*

Observation User  
Requirements

Observation Requirement	Obs. Req. ID	Priority	Category	Obs. Req. Description	Obs. Req. Status	Obs. Req. Lead	Obs. Req. Start	Obs. Req. End	Obs. Req. Budget	Obs. Req. Funding	Obs. Req. Comments
Temperature	1	High	Surface	Global temperature observations	Active	John Smith	2010-01-01	2015-12-31	\$10M	\$10M	Completed
Salinity	2	Medium	Surface	Global salinity observations	Active	Jane Doe	2010-01-01	2015-12-31	\$5M	\$5M	Completed
Sea Level Pressure	3	High	Surface	Global sea level pressure observations	Active	Bob Johnson	2010-01-01	2015-12-31	\$8M	\$8M	Completed
Clouds	4	Medium	Surface	Global cloud observations	Active	Alice Brown	2010-01-01	2015-12-31	\$3M	\$3M	Completed
Wind	5	High	Surface	Global wind observations	Active	Charlie White	2010-01-01	2015-12-31	\$7M	\$7M	Completed
Sea Surface Temperature	6	High	Surface	Global sea surface temperature observations	Active	Diana Green	2010-01-01	2015-12-31	\$9M	\$9M	Completed
Sea Ice	7	Medium	Surface	Global sea ice observations	Active	Frank Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Chlorophyll a	8	Medium	Surface	Global chlorophyll a observations	Active	Grace King	2010-01-01	2015-12-31	\$6M	\$6M	Completed
Ice Thickness	9	Medium	Surface	Global ice thickness observations	Active	Henry Lee	2010-01-01	2015-12-31	\$5M	\$5M	Completed
Ice Extent	10	Medium	Surface	Global ice extent observations	Active	Ivy Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Velocity	11	Medium	Surface	Global ice velocity observations	Active	Jack Adams	2010-01-01	2015-12-31	\$5M	\$5M	Completed
Ice Albedo	12	Medium	Surface	Global ice albedo observations	Active	Karen Baker	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Freeboard	13	Medium	Surface	Global ice freeboard observations	Active	Liam Clark	2010-01-01	2015-12-31	\$5M	\$5M	Completed
Ice Motion	14	Medium	Surface	Global ice motion observations	Active	Mia Evans	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Type	15	Medium	Surface	Global ice type observations	Active	Noah Foster	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Age	16	Medium	Surface	Global ice age observations	Active	Olivia Grant	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Concentration	17	Medium	Surface	Global ice concentration observations	Active	Peter Hill	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Vector	18	Medium	Surface	Global ice motion vector observations	Active	Quinn King	2010-01-01	2015-12-31	\$5M	\$5M	Completed
Ice Motion Magnitude	19	Medium	Surface	Global ice motion magnitude observations	Active	Rachel Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	20	Medium	Surface	Global ice motion direction observations	Active	Samuel Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	21	Medium	Surface	Global ice motion angle observations	Active	Tina White	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	22	Medium	Surface	Global ice motion speed observations	Active	Umar Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	23	Medium	Surface	Global ice motion direction observations	Active	Victoria Green	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	24	Medium	Surface	Global ice motion angle observations	Active	Walter King	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	25	Medium	Surface	Global ice motion speed observations	Active	Xavier Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	26	Medium	Surface	Global ice motion direction observations	Active	Yara Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	27	Medium	Surface	Global ice motion angle observations	Active	Zoe White	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	28	Medium	Surface	Global ice motion speed observations	Active	Adam Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	29	Medium	Surface	Global ice motion direction observations	Active	Alexa Green	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	30	Medium	Surface	Global ice motion angle observations	Active	Benjamin King	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	31	Medium	Surface	Global ice motion speed observations	Active	Bella Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	32	Medium	Surface	Global ice motion direction observations	Active	Brandon Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	33	Medium	Surface	Global ice motion angle observations	Active	Brianna White	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	34	Medium	Surface	Global ice motion speed observations	Active	Brody Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	35	Medium	Surface	Global ice motion direction observations	Active	Bryanna Green	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	36	Medium	Surface	Global ice motion angle observations	Active	Bryson King	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	37	Medium	Surface	Global ice motion speed observations	Active	Bryson Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	38	Medium	Surface	Global ice motion direction observations	Active	Bryson Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	39	Medium	Surface	Global ice motion angle observations	Active	Bryson White	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	40	Medium	Surface	Global ice motion speed observations	Active	Bryson Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	41	Medium	Surface	Global ice motion direction observations	Active	Bryson Green	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	42	Medium	Surface	Global ice motion angle observations	Active	Bryson King	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	43	Medium	Surface	Global ice motion speed observations	Active	Bryson Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	44	Medium	Surface	Global ice motion direction observations	Active	Bryson Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	45	Medium	Surface	Global ice motion angle observations	Active	Bryson White	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	46	Medium	Surface	Global ice motion speed observations	Active	Bryson Black	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	47	Medium	Surface	Global ice motion direction observations	Active	Bryson Green	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Angle	48	Medium	Surface	Global ice motion angle observations	Active	Bryson King	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Speed	49	Medium	Surface	Global ice motion speed observations	Active	Bryson Lee	2010-01-01	2015-12-31	\$4M	\$4M	Completed
Ice Motion Direction	50	Medium	Surface	Global ice motion direction observations	Active	Bryson Scott	2010-01-01	2015-12-31	\$4M	\$4M	Completed



# Expanding Understanding of Our Dynamic Planet



■ Provide useful data in near real-time



■ Provide archived data



■ Use data and conduct research

# Partners in the Global Space-Based Observing System

Signed in the last six months:

- US-EC Agreement on free & open data exchange
- NOAA-Eumetsat Joint Polar System Agreement on polar observations



# Recent and Upcoming Launches



<u>Mission</u>	<u>LRD</u>
DSCOVR	Feb 2015
Jason-3	Jan 2016
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GOES-R	Oct 2016
COSMIC-2A	Q2 FY 2017 (TBR)
JPSS-1	Jan 2017 (Target)
	NLT Mar 2017
GOES-S	2018
COSMIC-2B	2019 (TBR)
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To follow post 2019:	
GOES-T, GOES-U	
JPSS-2, JPSS-3, JPSS-4	

# Entering the New Era with JPSS and GOES-R

## JPSS



- Over 2000 channels
- Spectral resolution in IR/mw
- Hi-Res visible (Arctic, fire, ...)
- Night time imagery for Polar viewing

## GOES-R



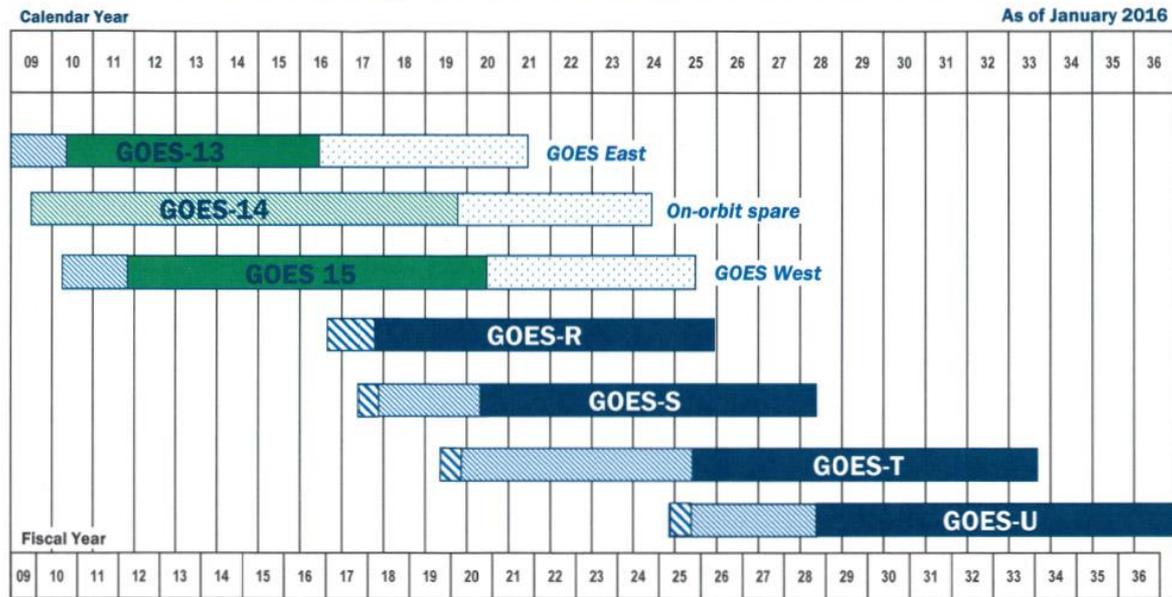
- Advanced Baseline Imager w/16 channels
- More rapid coverage of global and focused areas
- Geostationary Lightning Mapper

***Increasing ability to blend all of this data with other data sources in real time in AWIPS2 for situational awareness & in data assimilation for numerical forecast models***

# GOES Flyout Chart



## NOAA Geostationary Satellite Programs Continuity of Weather Observations



Approved:   
 Assistant Administrator for Satellite and Information Services



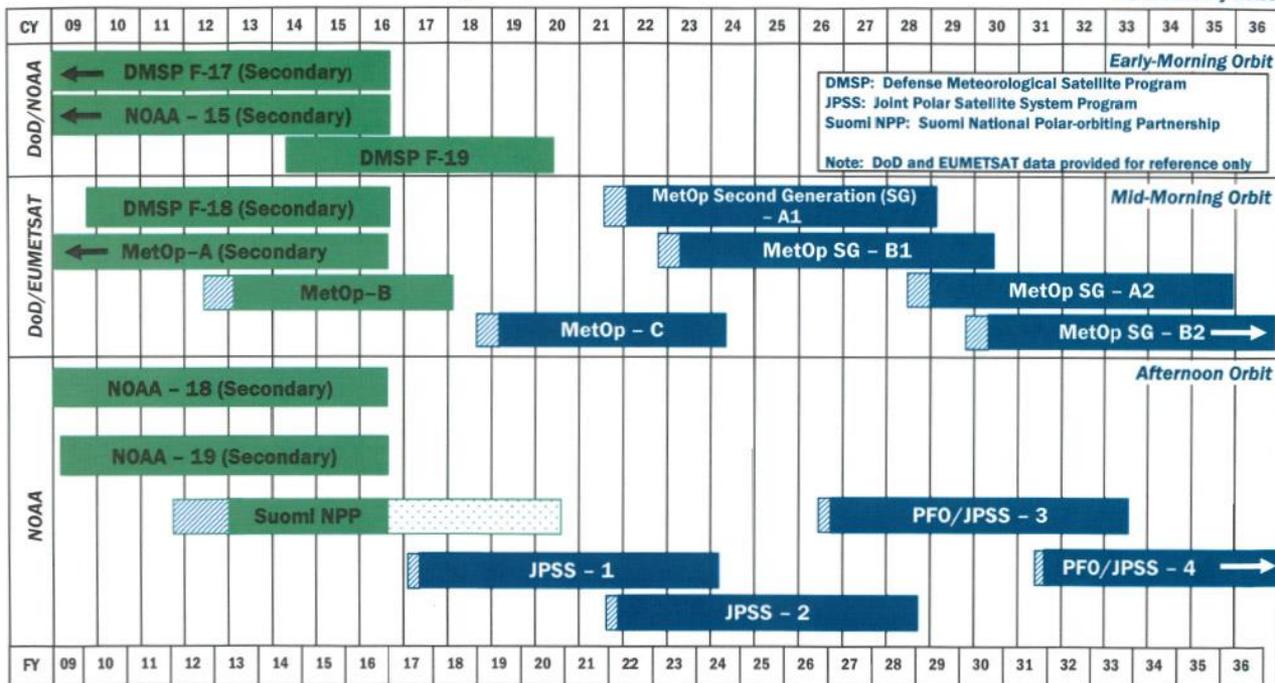
# Polar Flyout Chart



## NOAA & Partner Polar Satellite Programs Continuity of Weather Observations



As of January 2016



DMSP: Defense Meteorological Satellite Program  
 JPSS: Joint Polar Satellite System Program  
 Suomi NPP: Suomi National Polar-orbiting Partnership  
 Note: DoD and EUMETSAT data provided for reference only

Approved:   
 Assistant Administrator for Satellite and Information Services

Note: Extended operations are reflected through the current FY, based on current operating health.

	In orbit		Post Launch Test
	Fuel-Limited Lifetime Estimate		Planned Mission Life, from Launch Readiness Date
	Launched before Oct 2008		Operational beyond Dec 2036



# FY 2017 NESDIS Overview

- FY 2017 Budget Request provides **\$2,303.6 million total for NESDIS**; a \$45.7 million decrease (~2%) from the FY 2016 Enacted, including a \$49M reduction due to planned program changes (from planned roll off of GOES-R and JPSS)
- This request supports the priorities of the Administration, Department of Commerce and NOAA. In meeting these priorities, in FY 2017 NESDIS will:
  - Launch GOES-R, and continue building S, T, and U to ensure continuous Geostationary coverage of the western hemisphere
  - Launch JPSS-1, continue to build JPSS-2, and plan for PFO to ensure availability of data for weather prediction models
  - Launch COSMIC-2A constellation of six satellites, together with the USAF and Taiwan, providing critical tropical Radio Occultation measurements
  - Conduct essential architecture development for next generation weather and space weather
  - Assess viability of Commercial Data through pilot purchases
  - Maintain 24x7 satellite operations, product development, processing and distribution, and maintain the critical national environmental data archive

# Architecting the Future Observing System

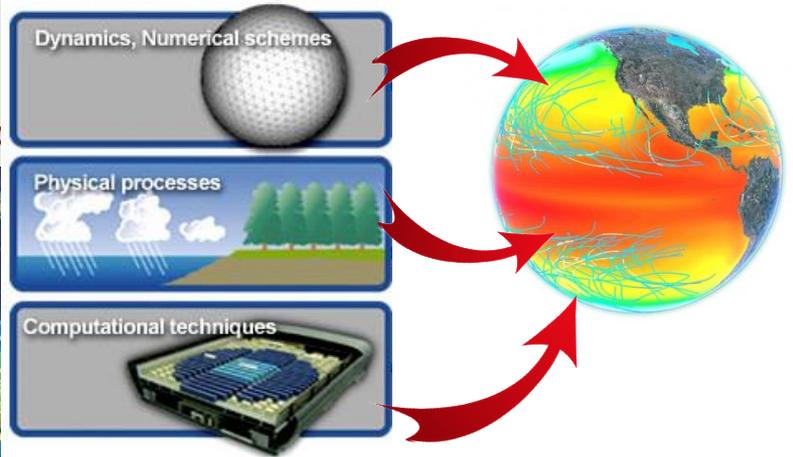
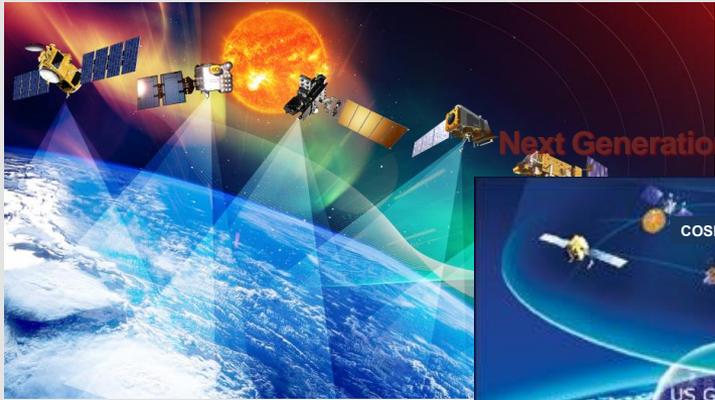
*Develop a space-based observing enterprise that is flexible, responsive to evolving technologies, and economically sustainable.*

--FY15 NOAA Annual Guidance

Global Earth Observing Satellite System

Integrated & Assimilated Operational Data Flow

Next Generation Integrated & Adaptive Ground System



# Opportunities & Challenges: Commercial Data



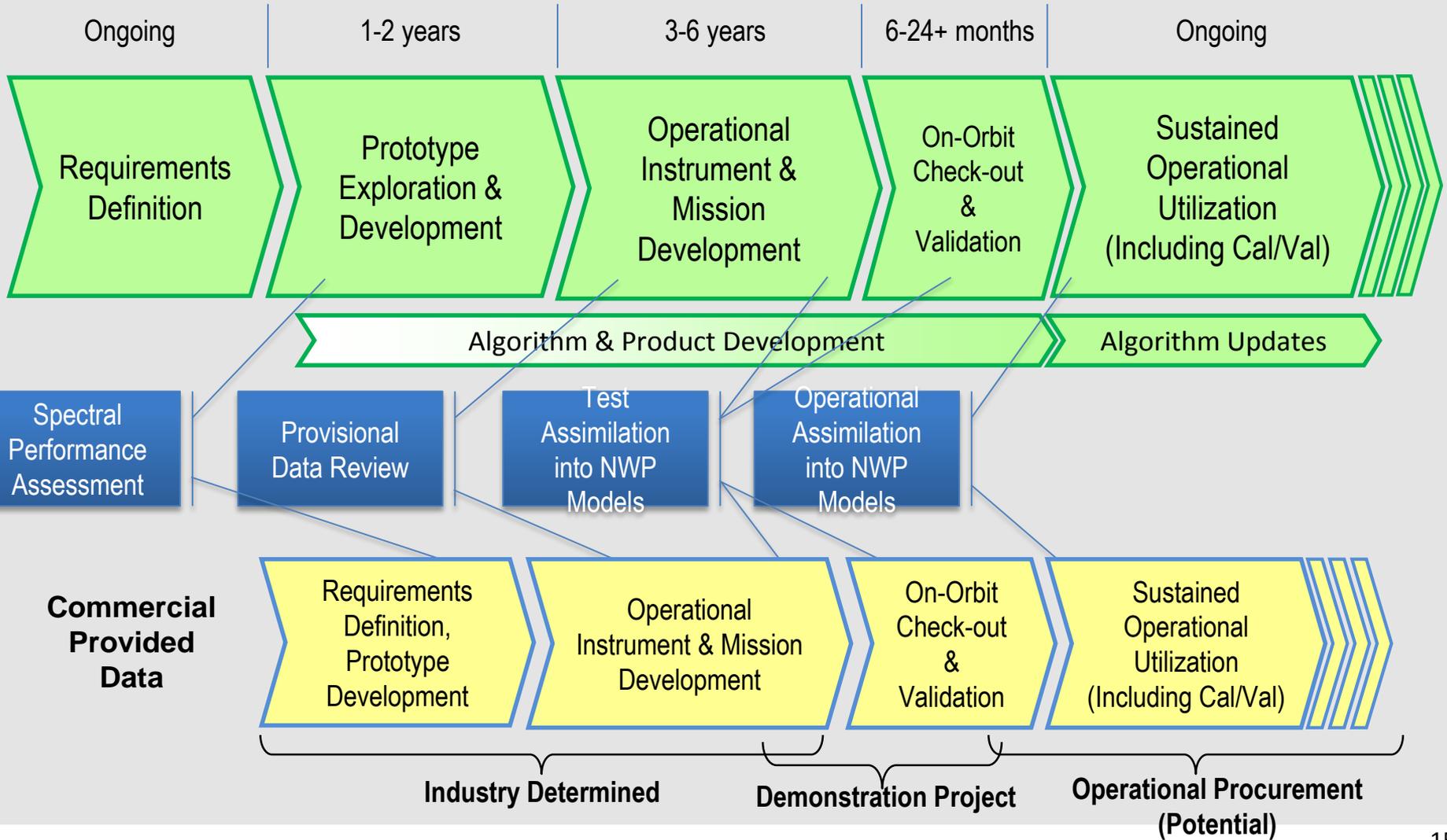
The existence of commercial companies preparing to or actually delivering quality satellite observations is an emerging factor in our future system architecture studies



We have a number of challenges to be addressed as we add them into our assessments, including reconciling industry's development timeline with our deployment timelines



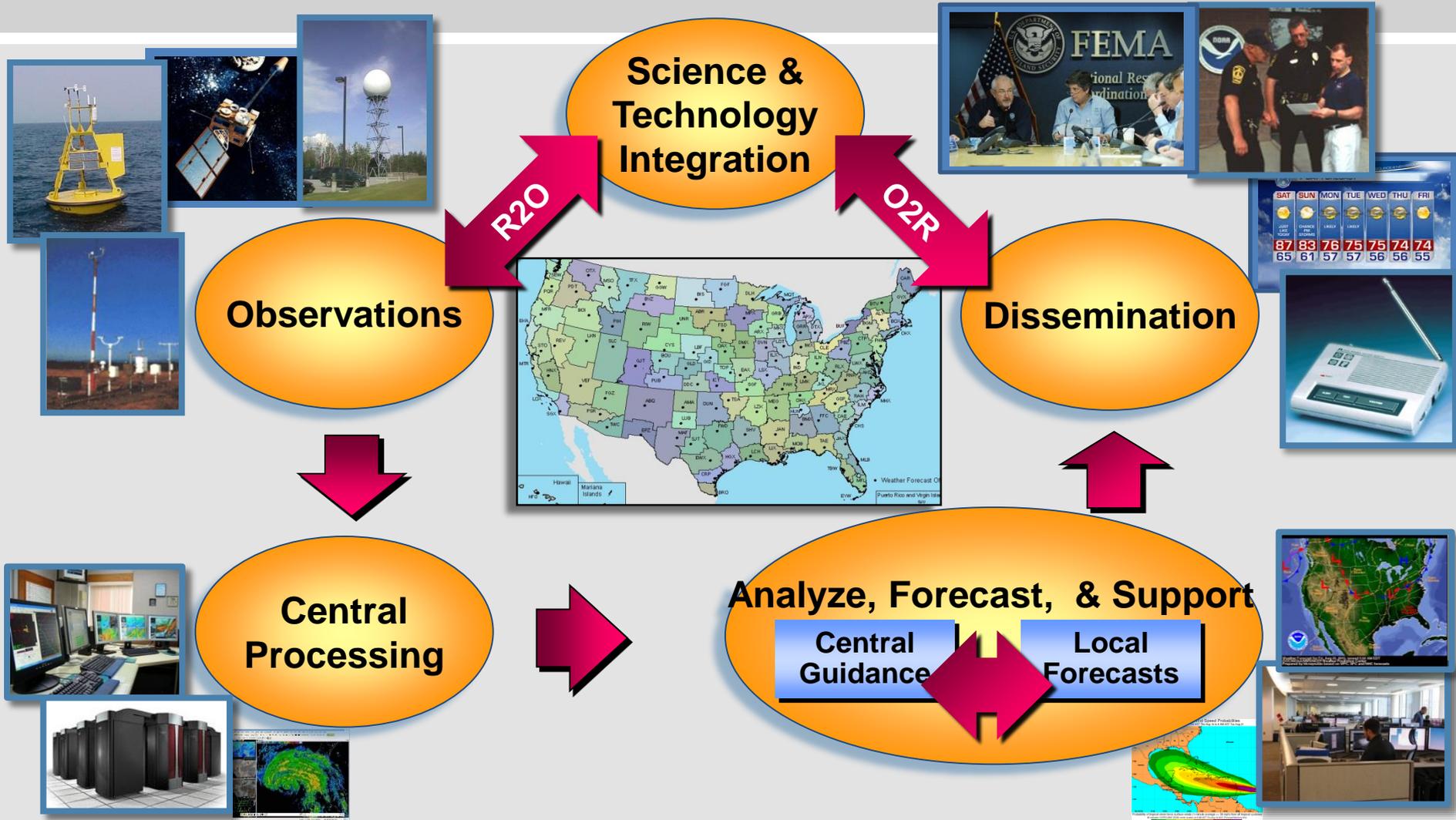
# Opportunities & Challenges: Commercial Data





# UTILIZATION OF SATELLITE DATA

# The Forecast Process



# NWS Strategic Outcome: A Weather-Ready Nation

- Becoming a Weather-Ready Nation is about building community resiliency in the face of increasing vulnerability to extreme weather, water & climate events

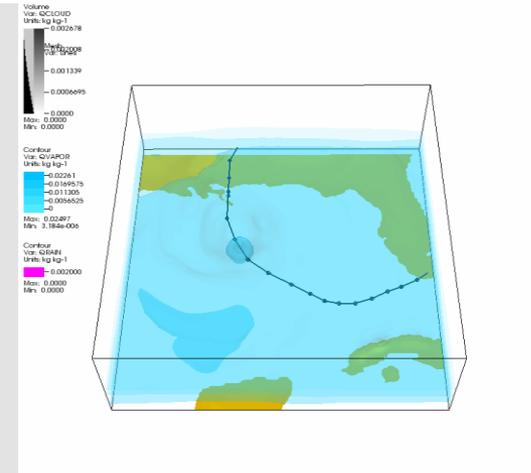
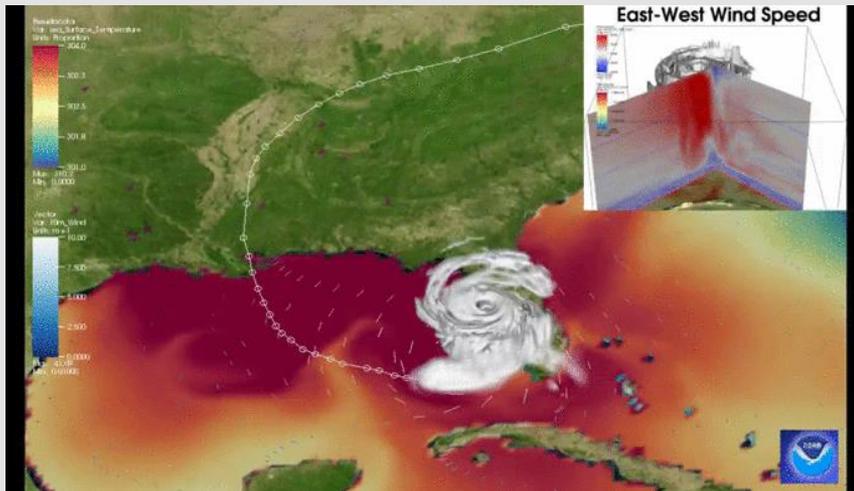
## ***“Ready, Responsive, Resilient”***

- Requires NWS to:
  - Fully integrate our field structure to produce:
    - *Better forecasts and warnings*
    - *Consistent products and services*
    - *Actionable environmental intelligence*
- Go the “last mile” to connect forecasts to critical national, state and location decisions
  - *Provide Impact-based Decision Support Services (IDSS)*
  - *Deliver through multiple and reliable dissemination pathways*
  - *Work with partners, including embedding NWS in Emergency Operations Centers and incorporating Social Sciences, to gain the public’s needed response*

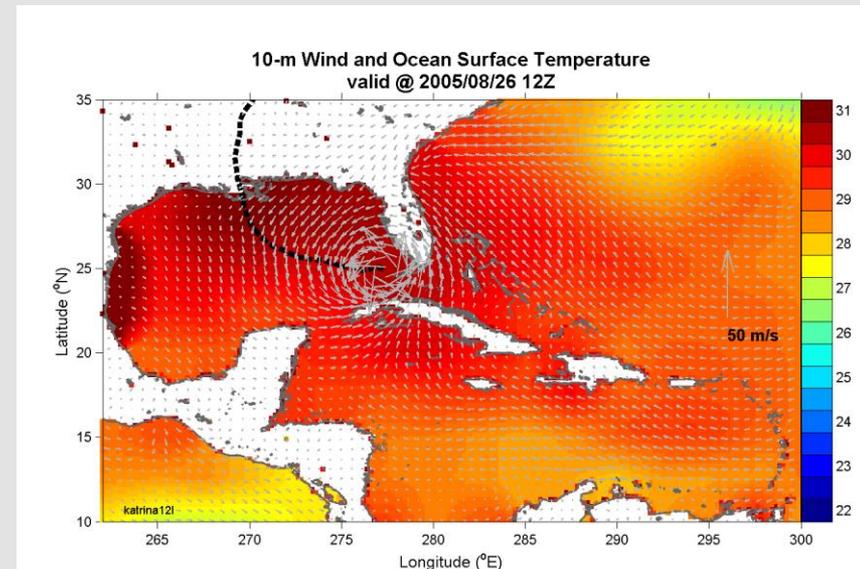


***Involves entire US Weather, Water and Climate Enterprise WORKING TOGETHER  
to achieve far-reaching national preparedness for weather events***

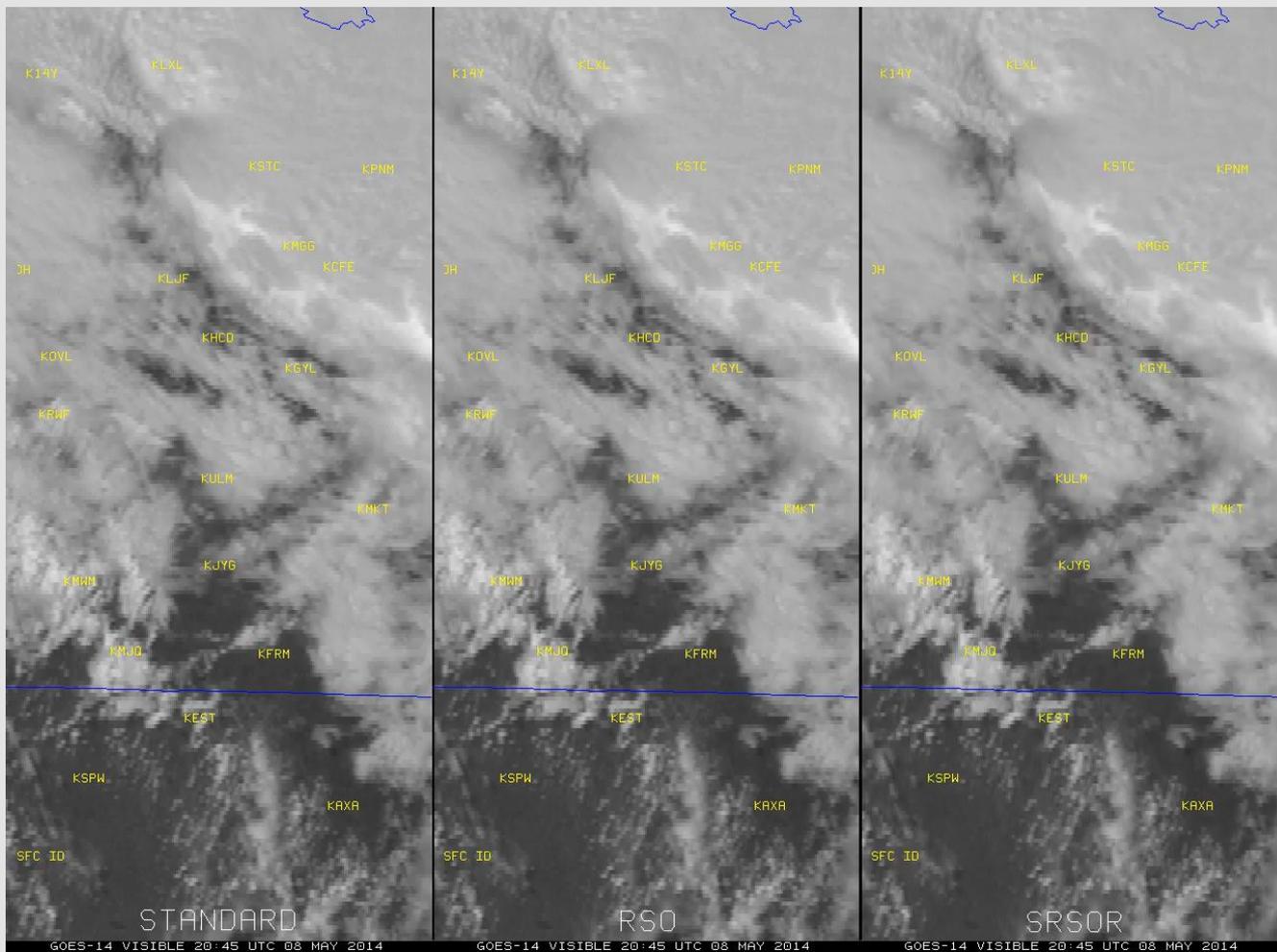
# 3-D Visualization of Hurricane Katrina Forecasts from 2015 Operational HWRF



- Hurricane Katrina reminds us of critical and complex interactions between atmosphere, ocean, waves and land – all need to be accurately represented in numerical models for improving the forecast guidance
- NCEP Operational HWRF has demonstrated significant progress in improving the forecasts for high-impact events like Katrina

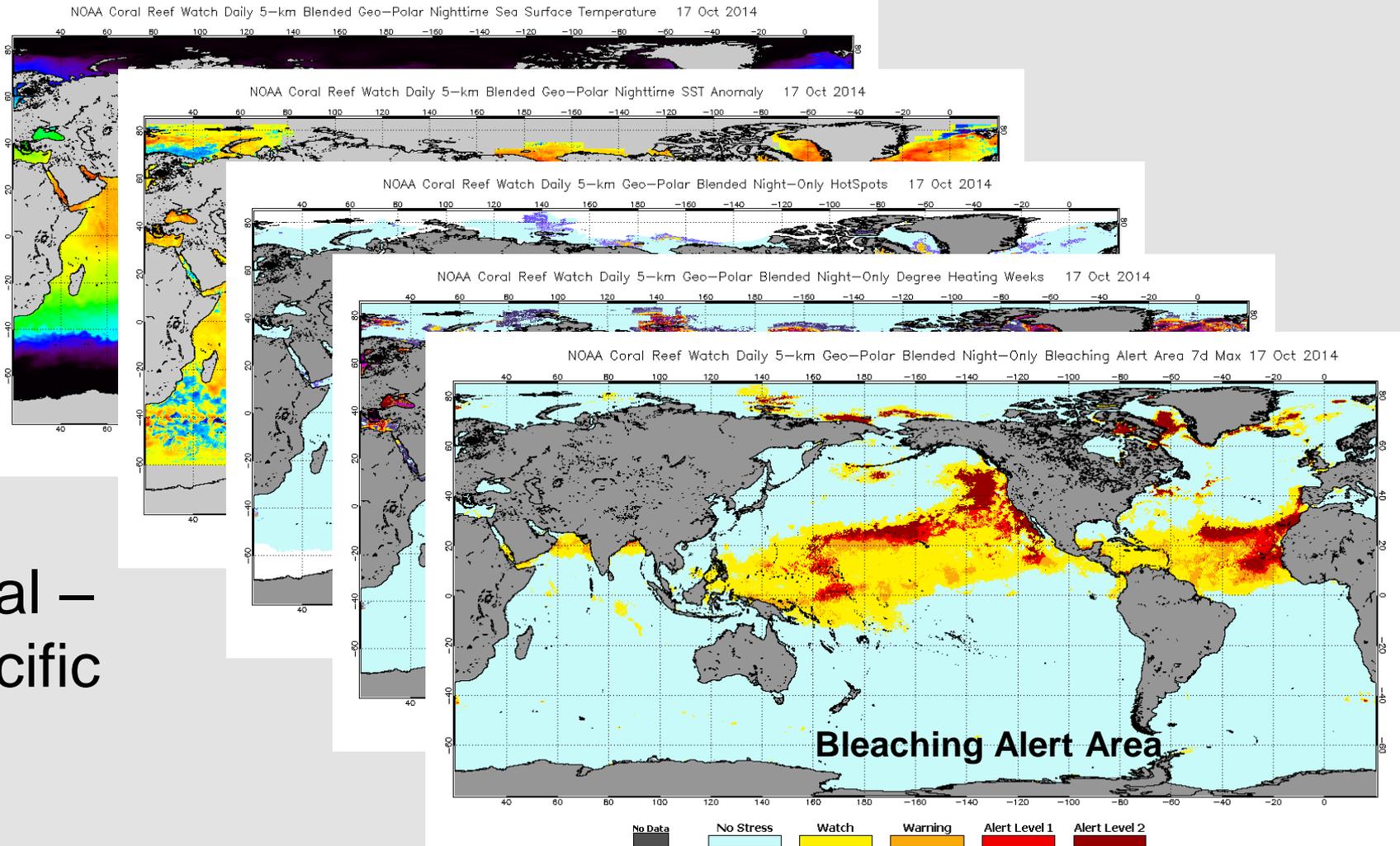


# GOES-R Capabilities: Now and in the Future



Credit: Cooperative Institute for Meteorological Satellite Studies

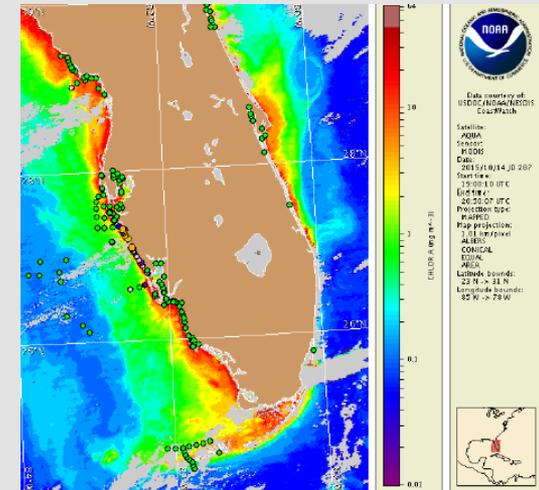
# Coral Reef Watch 5-km Satellite-Based Products



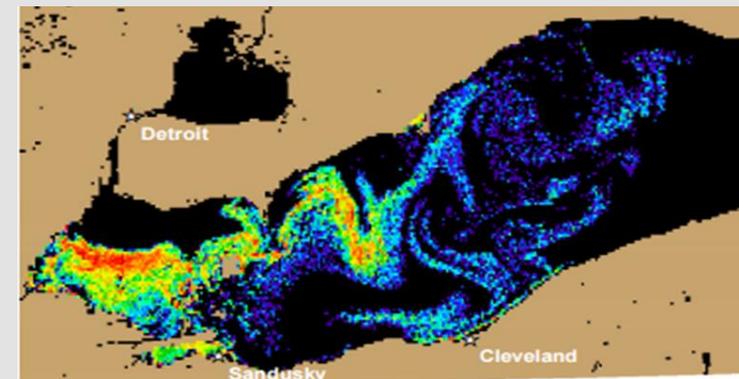
Coral –  
specific

# One NOAA Collaboration for Ecological Forecasting

- NOS models run on NOAA/NWS operational supercomputer
- HAB, Hypoxia, Vibrio prediction in Gulf of Mexico led by NOS
- HAB – Real-time prediction in Great Lakes by NOS/OAR-GLERL:
- **The 5<sup>th</sup> NWS Strategic Goal “ Enable environmental forecast services supporting healthy communities & ecosystem”:**
  - **Gulf of Mexico** (status: operational)
    - NWS: WFOs Tampa and **new in 2015**, Miami and Key West, issue Beach Hazard Statements for high respiratory irritation from HAB
  - **Lake Erie** (status: experimental)
    - NWS (**new in 2015**): WFO Detroit provides decision support dashboard to NOS HAB analysts; WFO Cleveland hosts Lake Erie HAB web page



Source: NESDIS; 10/15/15



Source: NESDIS; 9/8/15

# NOAA Lake Erie HAB Bulletin (MERIS 2009-2011, now MODIS, soon Sentinel-3/OLCI!)



**Experimental  
Lake Erie Harmful Algal Bloom Bulletin**  
2011-008  
08 September 2011  
National Ocean Service  
Great Lakes Environmental Research Laboratory  
Last bulletin: 22 July 2011

**Bloom  
from  
MERIS**

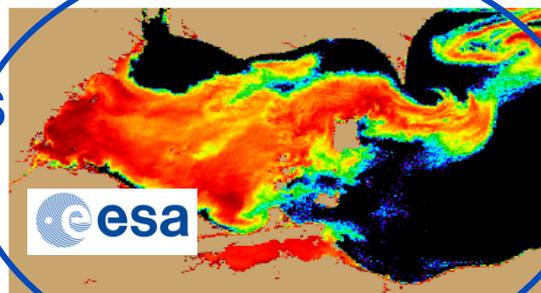


Figure 1. MERIS image from the European Space Agency. Imagery shows the spectral shape at 681 nm from September 03, where colored pixels indicate the likelihood of the last known position of the *Microcystis* spp. bloom (with red being the highest concentration). *Microcystis* spp. abundance data from shown as white squares (very high), circles (high), diamonds (medium), triangles (low), + (very low) and X (not present).

**Forecast  
(with Great  
Lakes CFS)**

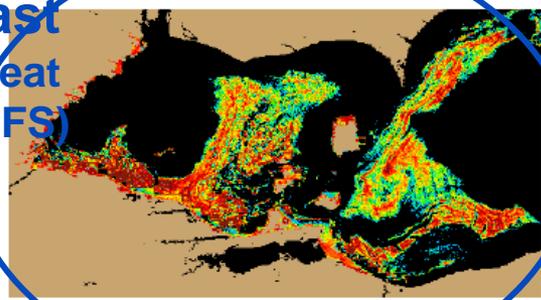
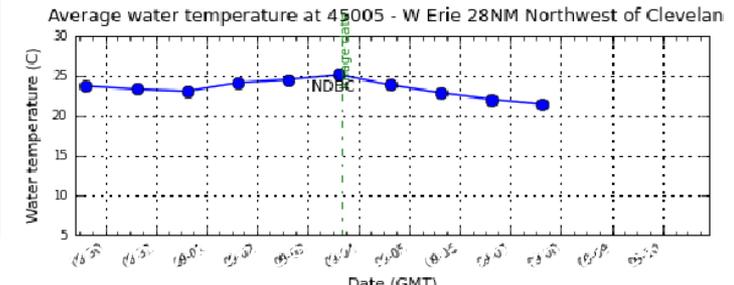
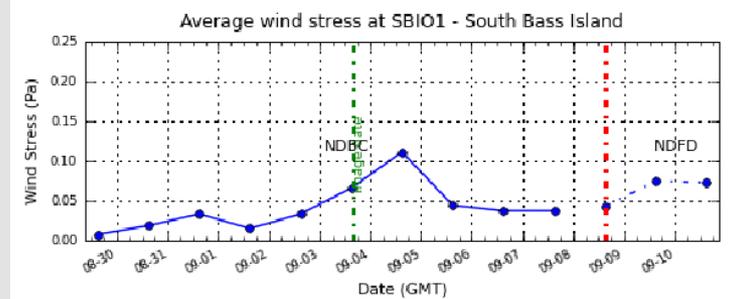


Figure 2. Nowcast position of *Microcystis* spp. bloom for September 08 using GLCFS modeled currents to move the bloom from the September 03 image.

- The value of what we bring is the ability to deliver a consistent information product with variable source observations
  - Initially a lot of work, but with enterprise ground and science work the additional investment for future missions is significantly reduced



# National Water Center

## University of Alabama – Tuscaloosa, AL

Initial Operating Capability: May 26, 2015



**VISION:** Scientific excellence and innovation driving water prediction to support decisions for a water resilient nation.

### **BENEFITS:**

- State-of-the science modeling for global to street level predictions (*from 6,000 forecast locations to 2.7 million stream reaches*)
- Operations Center to establish common operating picture within NOAA and among water agencies; decision support for floods to droughts (*flood mapping to street level*)
- Proving ground to accelerate research to operations; partnerships with research communities (*e.g. CHUASI, National Flash Flood Interoperability Experiment*)
- Provides single place for multiple Agencies and disciplines to collaborate



# Ongoing SSB Activities w/Relevance to NOAA

- ESAS 2017 Decadal Survey
  - NOAA is actively involved as a sponsor along with NASA and USGS
  - Increased effort to address operational Earth observation needs
- Achieving Science Goals with Cubesats
  - Exploring the potential for science from Cubesats
  - Understanding the difference between cubesats for demonstration and for operational use
  - Report will influence our work on operational cubesats, and our assessment of developmental maturity and operational mission risk
- NASA Science Mission Extensions
  - Processes and evaluation criteria for extensions for NASA missions may have elements in common elements with NOAA missions

## **Also, from the BASC:**

- Advancing Social and Behavioral Science Research and Application within the Weather Enterprise



# A Few Challenges

- Continue to deliver the complex and expensive systems on time and on budget
  - *Challenge: Continued commitment to maintain the pace of the GOES and JPSS satellites now under contract*
- Evolve the NESDIS and NOAA satellite utilization model to incorporate seamlessly data from multiple sources, including interagency, international, and commercial
  - *Challenge: Devise and implement operational approach to ingest data from all sources while meeting time latency, quality, validation, and IT security requirements*
- Define a new operating paradigm where the system is characterized as much by the product output as by the satellite input
  - *Challenge: Places significantly greater emphasis on the data processing and ground system hardware and data management, including increased funding*

# Thank you!



# NOAA

America's Environmental Intelligence Agency

*Putting environmental information into the hands of people who need it.*



## ENVIRONMENTAL INTELLIGENCE



Observations   Monitoring   Assessment   Modeling   Forecasts and Products

## TOP PRIORITIES FOR 2014-2018

**1** Make communities more resilient

**2** Evolve the Weather Service

**3** Invest in observational infrastructure

**4** Achieve Organizational Excellence



## NOAA's role in civilian space-based Earth Observation

“The Budget supports NOAA's broad environmental mission and redefines NASA and NOAA Earth-observing satellite responsibilities whereby NOAA will be responsible only for satellite missions which contribute directly to NOAA's ability to issue weather and space weather forecasts and warnings to protect life and property.”

-FY16 President's Budget Request

NOAA is committed to meeting the observational requirements of its Line Offices – the National Weather Service (NWS), the Marine Fisheries Service (NMFS), and the Ocean Service (NOS) – with systems developed, deployed, and leveraged by NESDIS and the Office of Marine and Aviation Operations (OMAO). The NOAA Observing Systems Council (NOSC) serves as the coordinating body for trades and discussions.