



# **NWS Partners Meeting**

**Dr. Louis W. Uccellini**

**Director, National Weather Service**

**NOAA Assistant Administrator for Weather Services**

**July 18, 2016 – NWS Partners Meeting**

**Tuscaloosa, AL**

# Outline

- Open Environmental Information Services Update
- Status of FY2016 Budget; Portfolio Priorities
- Building a Weather-Ready Nation
- Operations Workforce Analysis Project

# Open Environmental Information Services Update

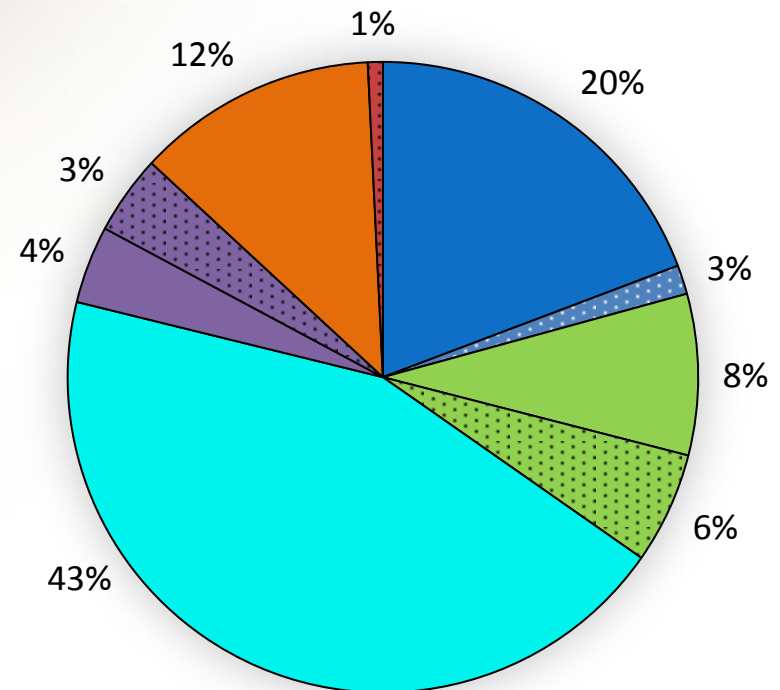
- Implemented GFS Requests:
  - Simulated satellite output
  - Provide consistent temporal resolution
  - Hourly output through 5 days
  - Access to GFS in native resolution
- Access provided to:
  - “Extreme Weather Index” tools currently in experimental mode
  - Post-processed model grids produced by NCEP centers
  - Model catalog on NCEP produced model data
- Increase GEFS spatial resolution

# FY2016 Enacted Budget Composition by Portfolio

PPA	Funds*	Full Time Employees (FTE)
Observations ORF	216,363	804
Observations PAC	16,720	-
Central Processing ORF	92,871	232
Central Processing PAC	64,261	22
Analyze, Forecast and Support ORF	496,031	3,010
Dissemination ORF	44,743	82
Dissemination PAC	45,684	-
Science and Technology Integration ORF	138,826	488
Facilities PAC	8,650	-
<b>TOTAL</b>	<b>1,124,149</b>	<b>4,638</b>

\* In thousands of dollars

## Funds Breakdown



# FY2016 Priorities

## Observations

- JPSS/GOES-R Readiness
- NEXRAD Service Life Extension
- Autosonde testing
- Buoys sustained
- ASOS SLEP

## Science & Technology Integration

- Model upgrades: GEFS, HWRF, NWPS, HRRR, NWM
- HEFS implementation in RFCs
- Exp. Winter Weather Days 4-7 Outlook
- Exp. Arctic Sea Ice Outlooks,
- Grants: CSTAR/NGGPS/HFIP/Testbeds (\$4.7M FY16)
- National Blend of Models V1/Virtual Lab
- Exp. Week 3-4 Temp and Precip
- Geospace Model Transitioned
- Nearshore Wave Prediction System (NWPS)

## Facilities

- Relocation with partners, if possible
- Second one-third Facility Condition Assessments
- WFO Relocations: Phoenix & Cleveland

## Central Processing

- Central computer upgrade
- AHPS locations added
- AWIPS/NAWIPS Merger
- Hourly GFS



**WRN Ambassador Initiative**  
**3300 Ambassadors**

## Dissemination

- “One NWS Network”
- NOMADS, MAG, MADIS, MRMS, nowCOAST, FTPPRD, [www.weather.gov](http://www.weather.gov)

## Analyze, Forecast, Support

- Impact-based Decision Support
- Hazard Simplification
- National Impacts Catalog
- Enable Ecological Forecasting
- Impact-based Warning Demo expanding nationally
- National Water Model Exp. products
- Weather/Climate linkage (e.g., week 3-4 outlooks)
- Operational Tropical Potential Storm Surge Flooding Map
- Extratropical Storm Surge Requirements
- Probabilistic winter outlooks and snowfall predictions



# Computer Status/Model Implementation Supported through HFIP and Sandy Supplemental

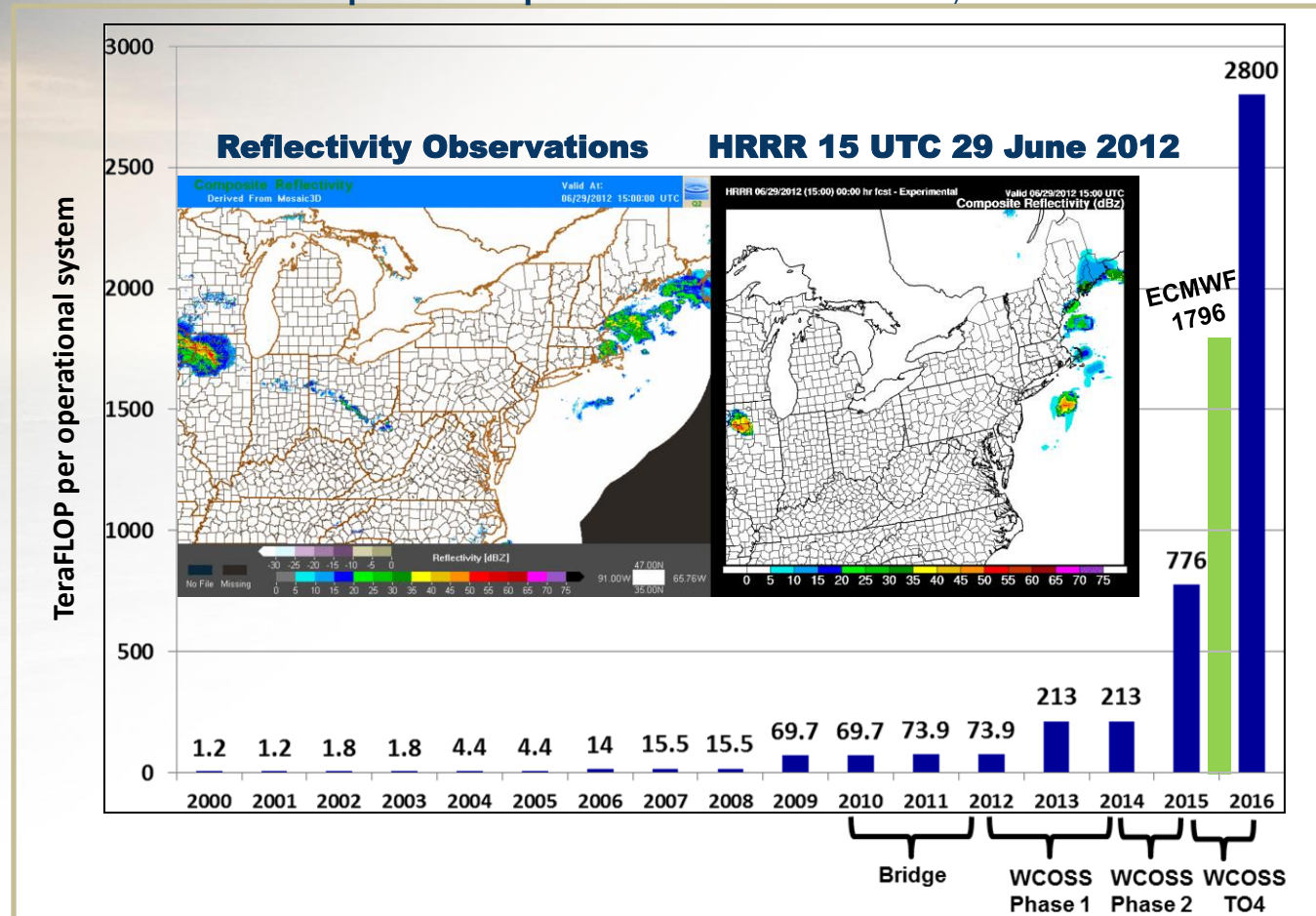
## Key Atmospheric Model Upgrades Complete:

- Jan 2015: Global Forecast System (GFS) upgraded – 13km out to 10d.
- Jun 9, 2015: 2km HWRf
- Sep 2015: SREF, GEFS
- Mar 8, 2016: HIRSW implemented on Cray
- May 11, 2016: GFS/4D ENKF
- July 12, 2016: HWRf – Wave Watch 3

## Upcoming Model Upgrades:

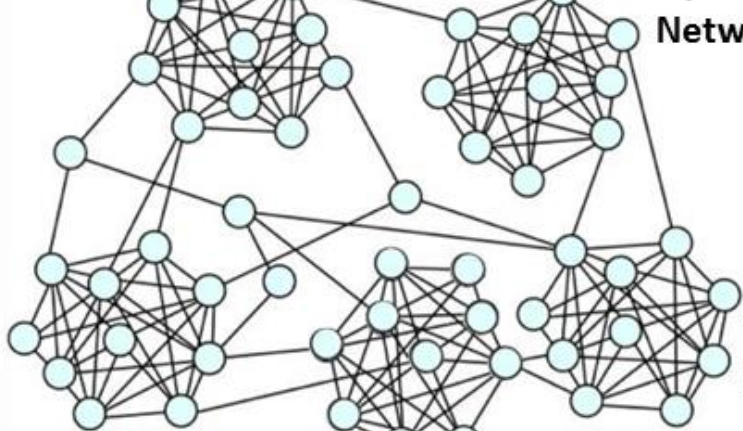
- HRRR v2.0 (HRRRe) (Mid August 2016)
- HPC-Based Water Modeling:
  - Deploy National Water Model on WCOSS (Late Summer 2016)

Increased HPC capacity to 2.8 petaFLOPs  
 (for primary and backup, respectively—for a total of 5.6 PF)  
 Accepted for Operations: November 30, 2015



# Dissemination NWS Network Updates

## Network Operation Centers



OPSNet

Regional Networks

## Open Campus Network



NCEP Network

**100% Dissemination Backup with College Park and Boulder**

- ✓ Physical Plant fit-up & IT Equip Install for IDP Infrastructure in Boulder
- ✓ NOMADS and FTPPRD backup in Boulder
- 100% backup at College Park and Boulder:
- Sept 2016 – MADIS, MAG, MRMS, Radar Level III, TGFTP, www.weather.gov
- Dec 2016 – NWSWG Functions Re-architected & NWSWG Silver Spring and Fairmont retired

## "OneNWS" Network

IDP Dissemination Site DSRC (Boulder, CO)

IDP Dissemination Site NCWCP (College Park, MD)

Network "Backbone"

Supercomputer (Reston, VA)

Supercomputer (Orlando, FL)

Functionality already in place at IDP College Park (as of July 2016)

- NOMADS
- FTPPRD
- NWSWG Switch
- TGFTP\*
- MADIS\*
- MRMS\*
- MAG\*
- GMDSS
- Weather.gov
- nowCOAST
- IRIS/INWS
- NWS GIS Services
- NOS Chart Tile
- Radar Level II

\*Boulder Testing in Progress

WFOs

RFCs

National Centers

Internet

External Partners

CWSUs / CMD CTR

The future OneNWS Network will consolidate all operational networks (OPSnet, Regional, etc.) as single managed network under NCEP Central Operations (NCO).

A dramatic sky with a sunburst breaking through clouds over a beach. The sun is partially obscured by dark, heavy clouds, creating a bright glow and lens flare effect. The sky transitions from a pale yellow near the horizon to a deeper blue at the top. In the foreground, the ocean waves are visible, washing onto a sandy beach. The overall mood is one of resilience and hope.

# **Building a Weather-Ready Nation**



# NWS Strategic Outcome: *A Weather- and Water-Ready Nation*



**“Ready, Responsive, Resilient”**

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

*Better forecasts and warnings*

*Consistent products and services*

*Actionable environmental intelligence*

*Connecting forecasts to decisions*

***Involves the entire US Weather, Water and Climate Enterprise WORKING TOGETHER***

**We have 3300 WRN Ambassadors**

# The Job Doesn't End with Forecasts and Warnings



***“First, it should be understood that forecasts possess no intrinsic value. They acquire value through their ability to influence the decisions made by users of the forecasts.”***

**“What is a Good Forecast? An Essay on the Nature of Goodness in Weather Forecasting”**

*– by Allan H. Murphy; Weather and Forecasting (June 1993)*



# Realizing the Full Value of Forecasts:

## Connecting Forecasts to Critical Decisions

*\* Completing the Forecast, National Academies of Science, 2006*

Generating forecasts and warnings



Connecting those forecasts & warnings with impacts (IDSS)  
*"Impact-based Decision Support Services"*



**Mission Success**



*The best hydrometeorological forecasting in the world*



**BUILD TRUST**  
Develop relationships,  
know partner needs



# What Does it Mean to the NWS?

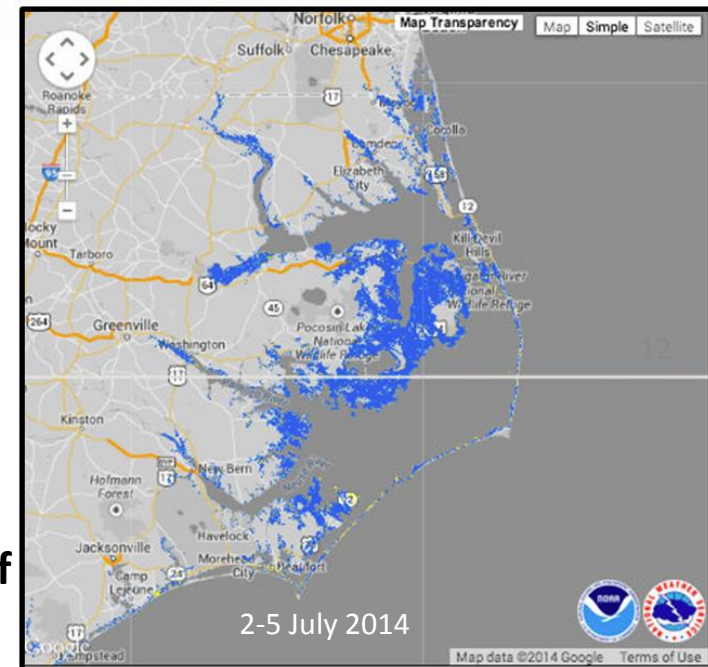
**Building a Weather- & Water-Ready Nation will change the way we work—and change the nature of our products:**

- **Becoming more oriented toward Earth System Sciences (atmosphere, ocean, land, cryosphere)**
- **Social Science - ensure message delivered = message received for desired outcomes (e.g. How to describe and display “storm surge?”)**
- **Understanding decision makers and their “shifting risk preferences” before/during/after an event**
  - *“Organized” – Government (NWS Focus Area)*
  - *“Loosely Coupled” – Social Organizations*
  - *“Organic” – Individuals*
- **Connecting observations/forecasts/warnings to “Key Decision Points” in all service areas**
- **How we measure success: determining intrinsic value of the forecast and IDSS**

## Hurricane Arthur Potential Storm Surge Mapping

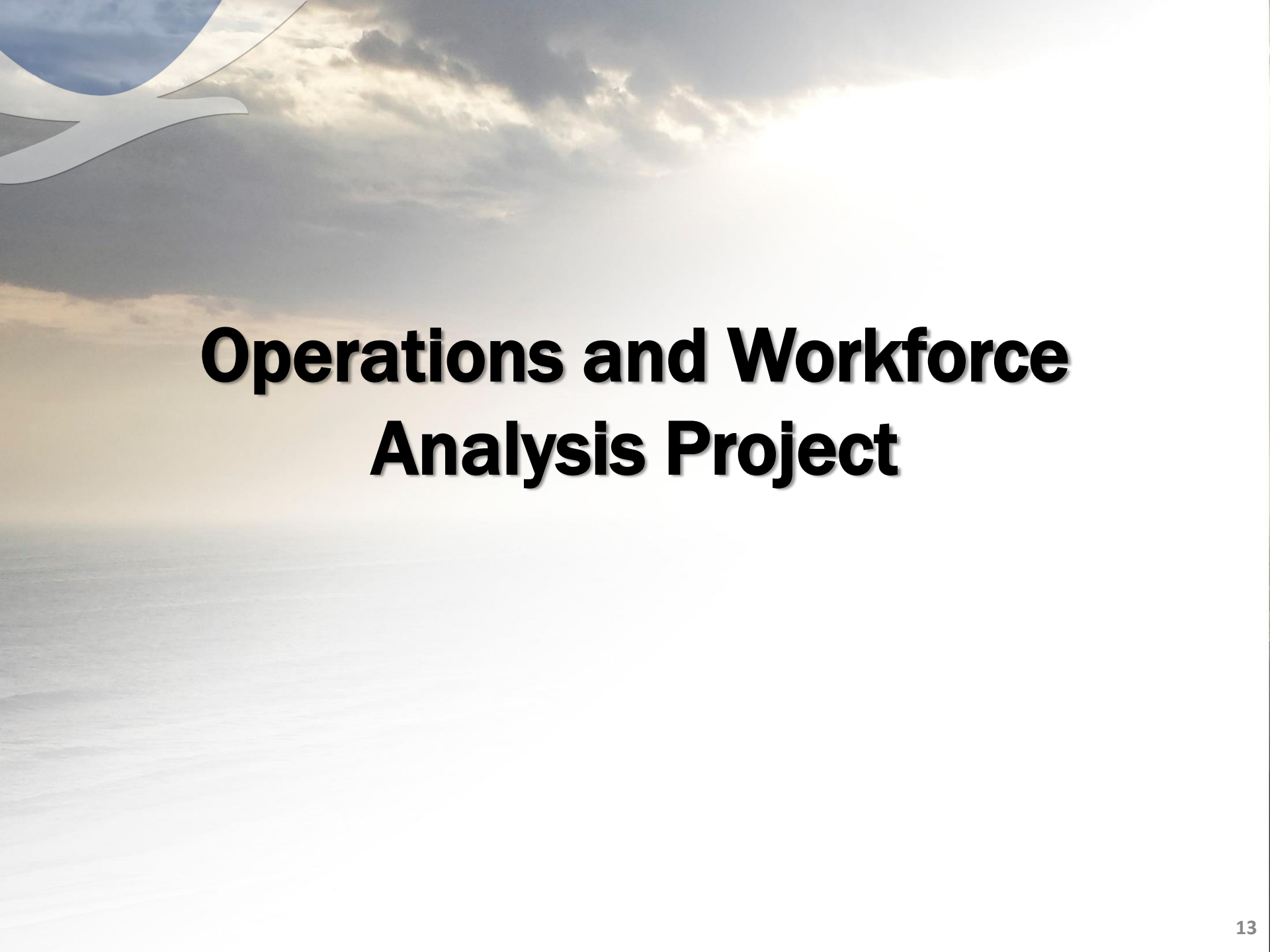
*‘Best Guess, Worst Case Scenario’*

NHC Experimental Potential Storm Flooding Map  
Tropical Storm ARTHUR (2014) Advisory 7  
From 11 AM EDT Wednesday July 02 to 04 PM EDT Saturday July 05



*The NWS must evolve to complete these goals*





# **Operations and Workforce Analysis Project**

# Operations & Workforce Analysis (OWA) Project

## Objectives

- 1 Current State Baseline:** Understand, baseline current operations & workforce model
- 2 Evaluation of IDSS:** Qualify and quantify IDSS across the entire organization
- 3 Current State Gaps:** Identify gaps which are required to support IDSS and achieve a Weather-Ready Nation
- 4 Stakeholder Engagement and Change Management:** Develop the capacity to involve stakeholders throughout the project
- 5 Recommendation of Alternatives:** Develop recommendation(s) to close gaps, leverage state-of-the-art science and technology, consider geographic differences and enable services and workforce concepts
- 6 Implementation:** Follow through with plans, quick wins, and phased implementation

Involve, engage, communicate with internal and external stakeholders throughout

# OWA Phase 1 Summary



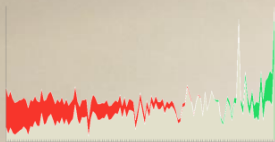
Partners' Use of IDSS:  
Surveys Sent to EMs & Interviews  
Conducted (*Summer 2015*)



# Insights for the Future

## FROM TODAY...

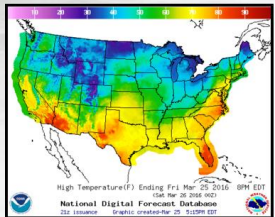
Inconsistent service which, at times, do not go “beyond the forecast” to explain impacts



Mismatch in workload & skills



Variation in partners served



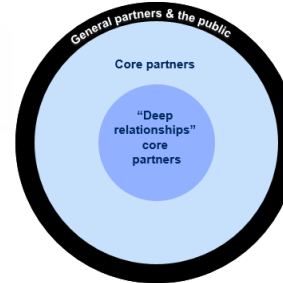
Variation in products and services;  
Redundancy in internal processes

## TO THE FUTURE...

NWS provides consistent levels of decision support before & during events



Healthy org. culture & structure



Defined IDSS partner types



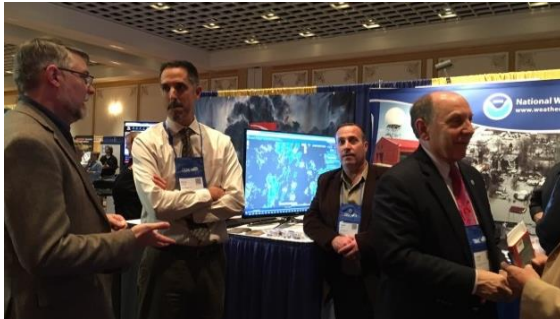
Clearer & enhanced core services



# Building Awareness: External Engagement

## Emergency Managers

- International Association of Emergency Managers (IAEM)
- National Emergency Management Association (NEMA)
- Local EMs



## Congress, OMB, agencies and General Public

- OMB & Congressional
- American Meteorological Society (AMS)
- National Weather Association (NWA)
- Federal, state, local, agencies
- NAPA, NAS



## Engage larger weather/water/climate enterprise

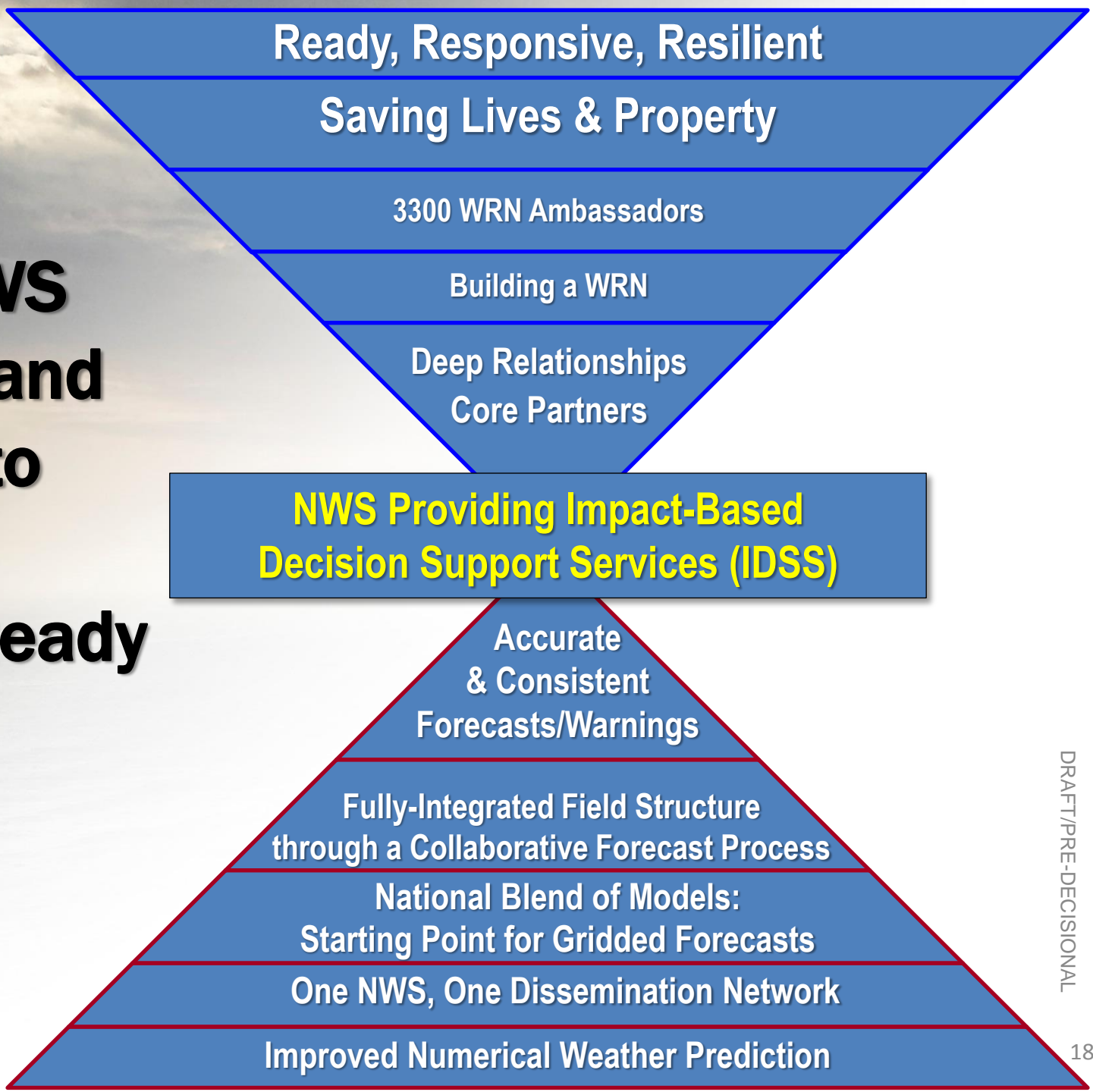
- External partners
- Media
- Private sector
- Water Resource Managers



## Insights and input

- Overwhelming support from EM and Water Resource community for continued and improved NWS IDSS
- Private sector support for IDSS philosophy and interest to continue the private/public partnership conversation

# Linking NWS Forecasts and Warnings to Building a Weather-Ready Nation



# Report Card: Remarkable Forecasts of Extreme Events and Provision of Impact-Based Decision Support Services (IDSS)

- **October 2015 South Carolina 20" Rain**
  - Record setting rain predicted a week in advance
  - IDSS provided from national to local levels
- **Central U.S. Post Christmas 2015 Storm**
  - 6-8 day lead time for heavy rain, snow, severe weather
  - IDSS provided from national to local levels
- **January 2016 East Coast Blizzard**
  - 8 day lead time drove IDSS at the state and local levels
- **June 2016 Southwest Heat Wave:**
  - Excessive Heat Watches issued a week in advance
  - IDSS provided from state to local level, including onsite support



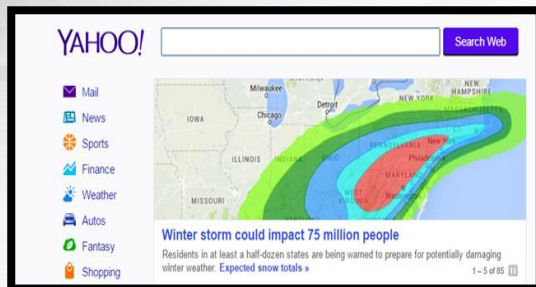


# January 2016 Blizzard & Coastal Storm: Connecting All of the Pieces

Jan 15 - 18

Medium range products begin identifying snowstorm threat for the end of next week

NWS offices begin briefing partners on potential storm



Jan 19

Confidence increasing

Partner Coordination/ Briefings



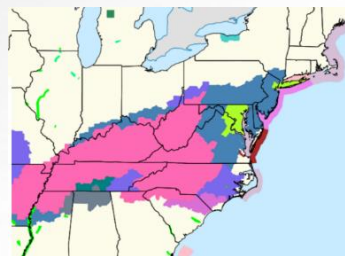
Media interviews

Jan 20

Partner Coordination/ Briefings

Media interviews

Blizzard Watches Issued



Jan 21

Fed./state/local govts make critical decisions *before* the snow begins

**State of Emergency Declared:**

- North Carolina
- Virginia
- West Virginia
- District of Columbia
- Maryland
- Pennsylvania
- New Jersey
- New York

Blizzard Warnings Issued

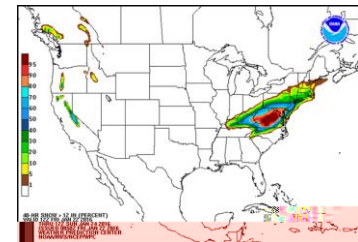
1 pm: Press Briefing



Jan 22

Snow begins in the Mid-Atlantic

Snow forecast adjusted to include NYC in Blizzard Warning



Schools/Govt Close  
Flights Canceled  
Roads Closed





# January 2016 IDSS Example: Long Island Expressway comparison to 2013

2013 Snowstorm



**The Past**

2016 Snowstorm



**With NWS Impact-Based  
Decision Support Services  
(IDSS)**

# **Building a Weather- and Water-Ready Nation**

## **National Conversation**

### **Integrated Water Information for 21<sup>st</sup> Century**

- **Overarching Themes from Regional Workshops: Tuscaloosa, AL, Sacramento, CA and Washington D.C.**
  - Improving access to water data will drive collaboration;
  - Creating incentives for new partnerships catalyze investment to advance water data products and services;
  - Building trust among country stakeholders is critical for sustainable transboundary water resources management, which begins with sharing data and building capacity through water data tools and analytics; and
  - Collaborating across federal agencies and with partners outside government ensures shared water data goals and increases the scale of impact.

# National Water Center

## University of Alabama – Tuscaloosa, AL



**VISION:** Scientific excellence and innovation driving water prediction to support decisions for a water resilient nation; involves the UCAR visiting scientists program.

### **BENEFITS:**

- State-of-the science modeling for global to street level predictions (*from 4,000 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*)
- Data integration and service backup

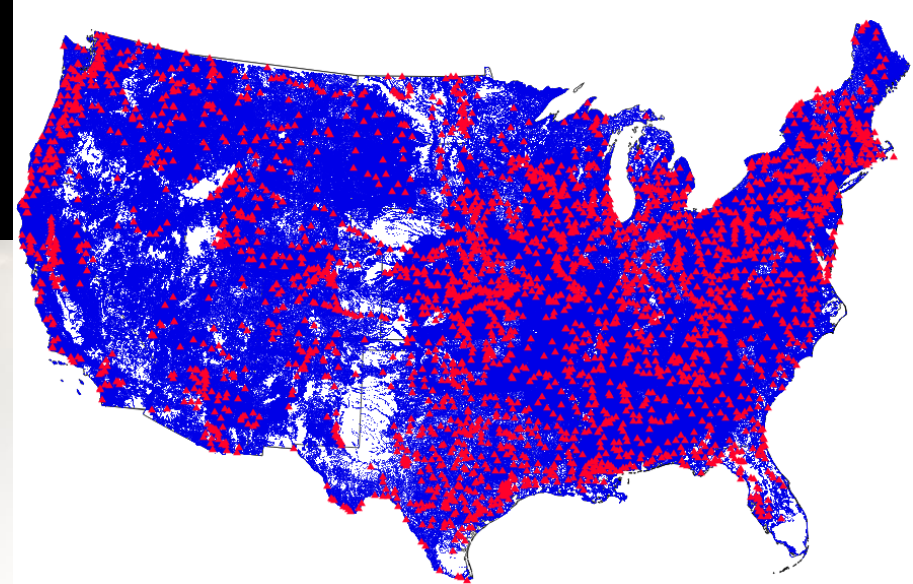


# National Water Model (NWM)

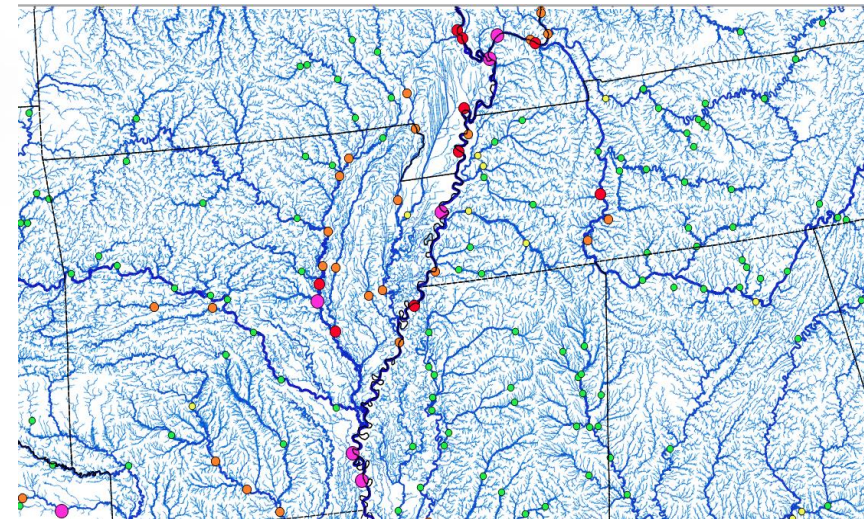
IOC Experimental Output (FY16)

Based on NCAR WRF-Hydro

- **Hydrologic Output**
  - River channel discharge and velocity at 2.7 million river reaches
  - Surface water depth and subsurface flow (250 m CONUS+ grid)
- **Land Surface Output**
  - 1km CONUS+ grid
    - Soil and snow pack states
    - Energy and water fluxes
- **Data Services**
  - Public-facing NWC website
  - Data feed to River Forecast Centers
  - NOMADS data service



Current NWS AHPS locations (red)  
NWM output locations (blue)



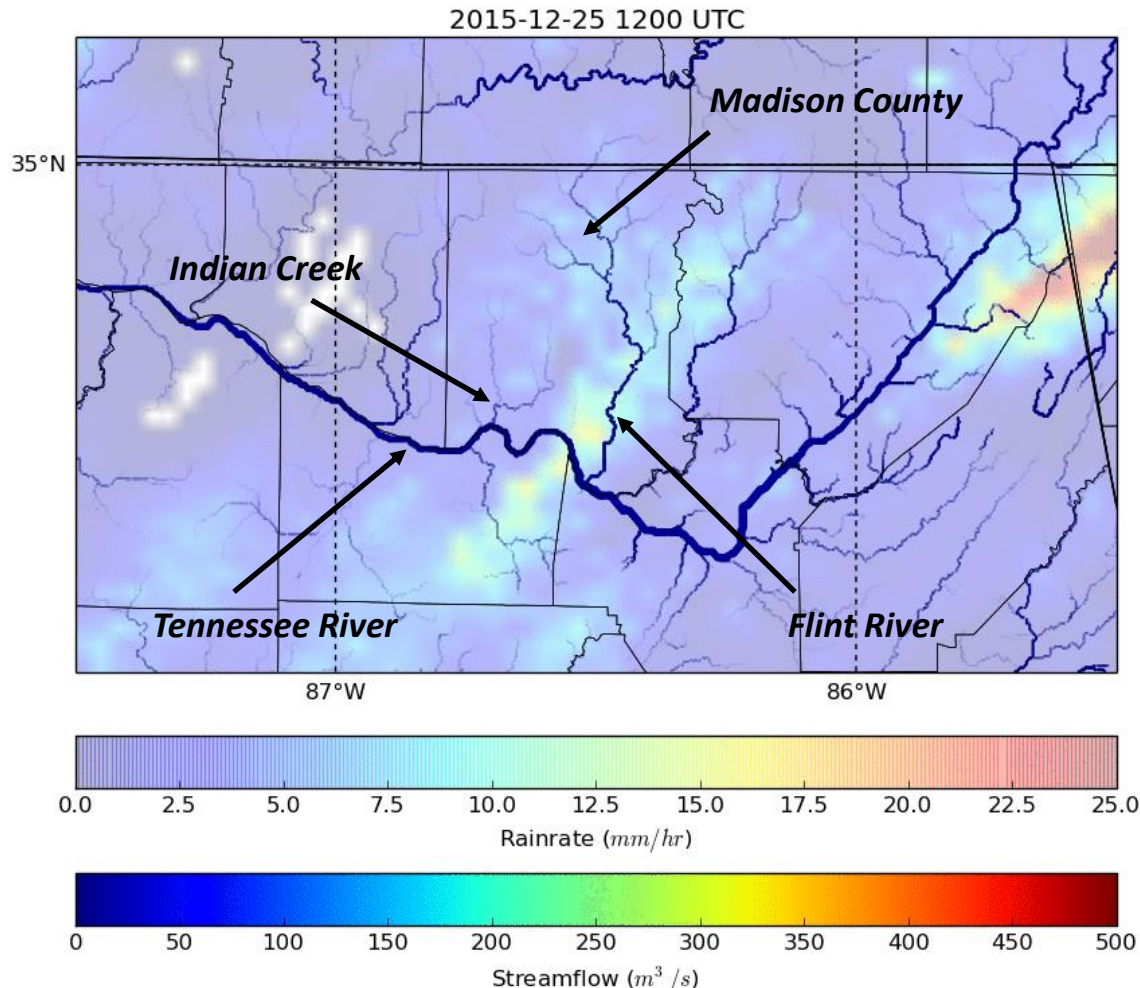
Current NWS River Forecast Points (circles)  
Overlaid with NWM Stream Reaches



# Evaluating NASA Data in National Water Model

*NWM initialized with LIS soil moisture and MRMS precipitation for  
Christmas Day 2015 flooding*

- Collaborations with the NWC have enabled local configuration of National Water Model (NWM)
- NASA has many of current and near-future missions focused on ground/surface water and land use that could improve hydrologic modeling
- NASA/SPoRT plans to perform offline simulations of the NWM to determine optimal assimilation strategies and evaluate data impacts to support NWC operations

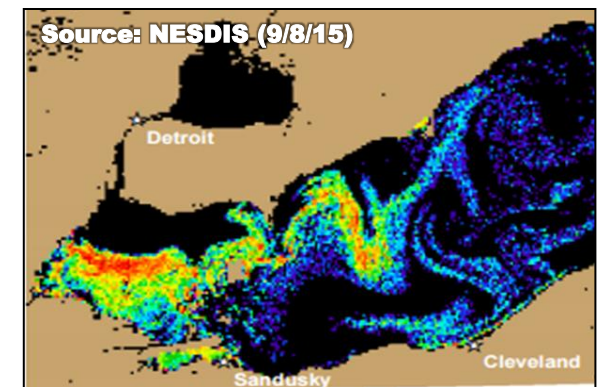
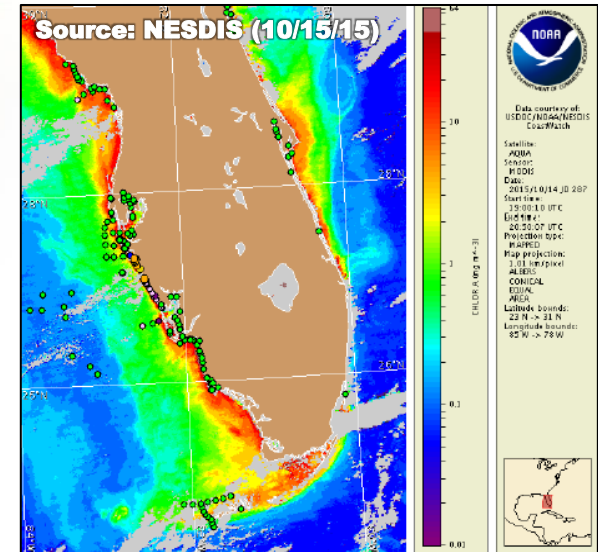


Slide Credit: Nicholas Elmer (UAH/SPoRT)

Bradley Zavodsky (NASA/MSFC/SPoRT)

# 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, capable of issuing Beach Hazard Statements for high respiratory irritation from HAB
  - **Lake Erie** (status: experimental)
    - **NWS**: WFO Cleveland hosts Lake Erie HAB web page;
    - **New in 2016**:
      - **WFO CLE** provides decision support [dashboard](#) to NOS HAB analysts
      - **OHRFC** to provide HAB analysts CFS 45-day flow forecasts for 2 points on Maumee River
      - **WFO CLE/OHRFC** provide River Forecasting 101 webinar for Ohio state agencies, GLERL, and NOS HAB analysts



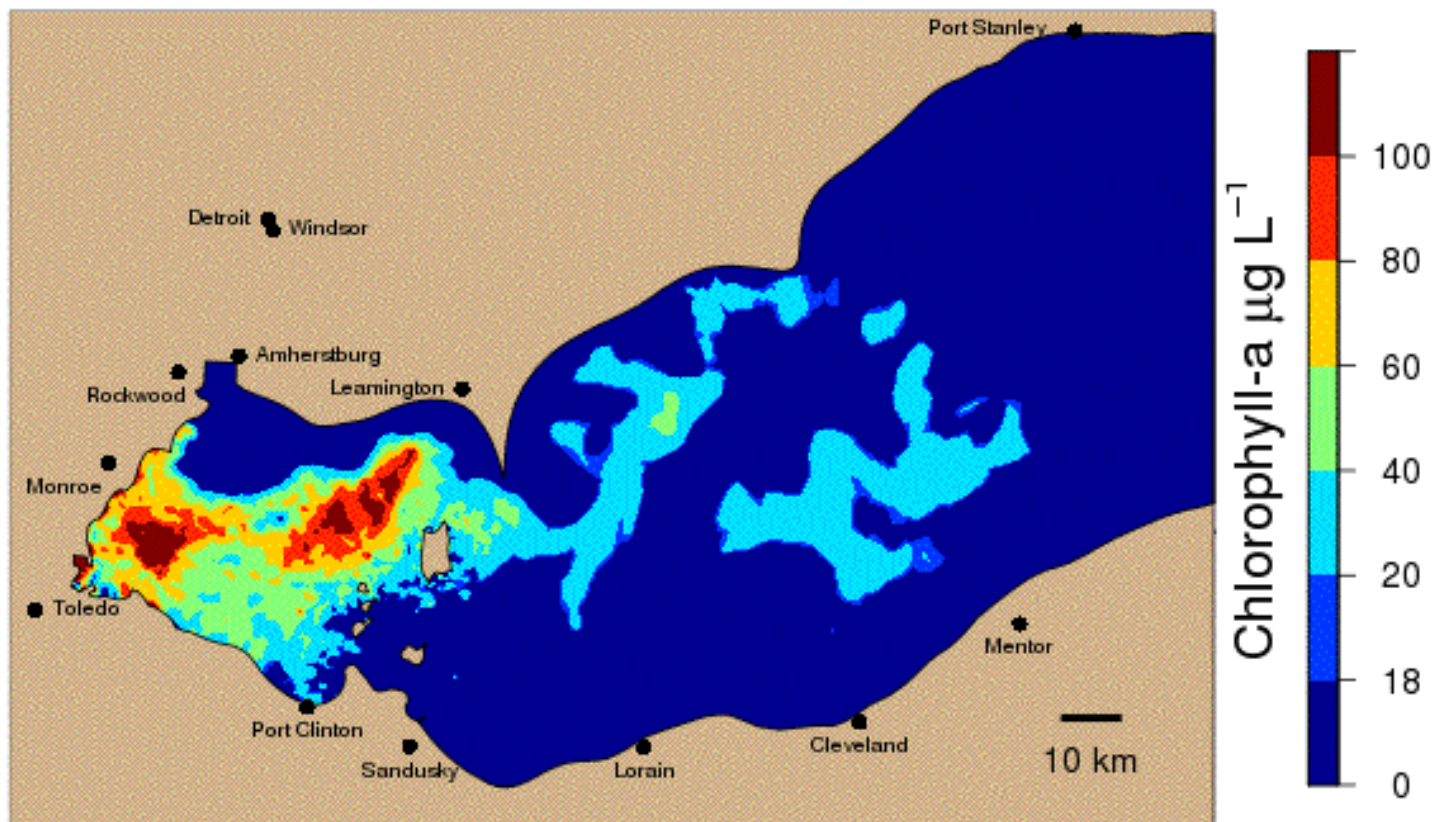
*Success is based on TRUST and recognition that we all could gain in serving this predictive need*



# Predicting Harmful Algae Bloom

## OAR - NOS - NWS Partnership

2015-09-01 20:00 EDT



# Vision Becoming Reality

- Still working on the Open Environmental Information Services requests
  - Progress being made: One hour GFS out to Day 5!
- The success of building a Weather-Ready Nation depends on successful IDSS and requires:
  - Improved forecasts/warnings with decreased uncertainty
  - Linking those forecasts to decision makers for desired results (saving lives and mitigating property loss)
- The Weather Enterprise is poised to take prediction to other fields for societal impact, e.g., water/agriculture/energy/health
- Advancing our computing capacity, model improvements and dissemination infrastructure – with increase support for R2O (with broader research community) observations and other infrastructure



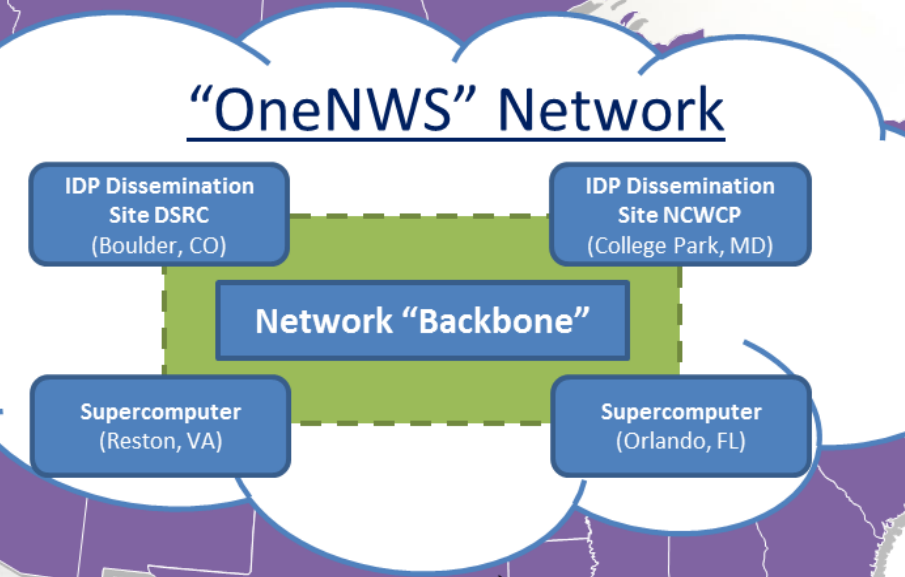


# Appendix

# Integrated Dissemination Program (IDP) OneNWS Network Long-Term Sustainable Solution

**100% Dissemination Backup with College Park and Boulder**

- ✓ Physical Plant fit-up & IT Equip Install for IDP Infrastructure in Boulder
- ✓ NOMADS and FTPPRD backup in Boulder
- 100% backup at College Park and Boulder:
- Sept 2016 – MADIS, MAG, MRMS, Radar Level III, TGFTP, www.weather.gov
- Dec 2016 – NWSSTG Functions Re-architected & NWSSTG Silver Spring and Fairmont retired



**Functionality already in place at IDP College Park (as of July 2016)**

- NOMADS
- FTPPRD
- NWSSTG Switch
- TGFTP\*
- MADIS\*
- MRMS\*
- MAG\*
- GMDSS
- Weather.gov
- nowCOAST
- IRIS/iNWS
- NWS GIS Services
- NOS Chart Tile
- Radar Level II

*\*Boulder Testing in Progress*



The future OneNWS Network will consolidate all operational networks (OPSnet, Regional, etc.) as single managed network under NCEP Central Operations (NCO).