Transforming NOAA Water Prediction
Informing Decisions for a Water-Prepared Nation

AMS Washington Forum
Water Resources Session
Tuesday April, 2016
Washington, D.C.

Tom Graziano, Ph.D.
Acting Director, National Water Center
National Weather Service, NOAA

Outline

• Impetus for Change
  – Economic Security
  – Grand Challenges in Water
  – Stakeholder Priorities

• NWC Status and Plans

• Deep Dive into New Prediction Capabilities

• Partnering to Accelerate R2O

• Summary

Global Economic Risks Landscape 2015


Interrelated Grand Challenges

Example of Grand Challenge: Mississippi River Above Memphis, TN

Hurricane Sandy

WATER EXTREMES

WATER SECURITY

WATER QUALITY
Over 100 million people live in the white space near the coast that don't get a water forecast today.

Stakeholder Priorities

- Flooding
- Water Quality
- Water Availability
- Drought
- Climate Change

Need integrated understanding of near- and long-term outlook and risks

Actionable Water Intelligence

High Resolution, Integrated Water Analyses, Predictions and Data

Transform information into intelligence by linking hydrologic, infrastructural, economic, demographic, environmental, and political data

National Water Center

Initial Operating Capacity: May 26, 2015

A catalyst to transform NOAA’s water prediction program

Mission: Nationally Integrated Water Prediction

- Earth system modeling and geo-intelligence for water prediction
- Decision Center for water resources common operating picture
- Decision support services for spectrum of water stakeholders
- Proving ground to accelerate research to operations
- Interagency and Academia Collaboration

TODAY

- Approximately 4000 forecast locations at points
- Forecast river flow/stage, from summit to coastal zone
- Driven by large catchment "lumped" modeling
- Average basin size greater than 420 square miles
- 13 River Forecast Centers (RFCs) developing separate versions of the same regional model
- RFC-generated river forecasts coordinated with Weather Forecast Offices (WFOs) to deliver Impact-based forecasts at selected points

THE FUTURE

- Approximately 2,700,000 forecast stream reaches
- Forecast all hydrologic parameters which define the water budget, from summit-to-sea
- Driven by high/hyper resolution Earth System modeling
- Average basin size ~1 square mile
- 13 RFCs, NWC, academia, and federal partners developing/evolving same state-of-the-science national model
- National Water Model-based predictions coordinated among NWC, RFCs, and WFOs and linked with detailed local infrastructure data to communicate street-level impacts

National Water Model (NWM)

IOC Experimental Output (FY16 Q4)

- 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
  - Soil moisture on 1km CONUS+ grid

- Data Services
  - Public-facing NWC website
  - Data feed to River Forecast Centers
  - NOMADS data service (NOAA National Operational Model Archive & Distribution System)

Southern Plains Observed Precipitation

May 2015

Howard County, Maryland (300k People)

Current River Forecast Locations: zero

NWM Forecast Locations: 300+
Current Advanced Hydrologic Prediction Services (AHPS)

Streamflow Information

- Austin, TX
- New Braunfels, TX
- San Antonio, TX

Experimental Flood Depth and Extent Mapping

Converting High Resolution Forecasts into Actionable Water Intelligence

- Austin, TX

National Water Model Model Streamflow Analysis and Forecast

- Plum Creek (TX) Hydrograph and Demand

Experimental

NWC Innovators Program

- Partnership between NSF and the academic community
  (Interagency Agreement between NSF and NOAA)

- Two Thematic Goals
  - Provide a framework for collaboration between the federal and academic communities that fosters innovation and creativity, and enables a pathway for that innovation to transition into operational water prediction
  - Target emerging technologies such as advanced water resources modeling capabilities, cutting edge data and interoperability services, or interdisciplinary techniques aligned with NOAA and the NWC’s strategic Science and Service

National Flood Interoperability Experiment (NFIE)

(Sept 2014 to August 2015)

- First instance of the NWC Innovators Program
- Included a Summer Institute for 44 graduate students from 19 Universities at the National Water Center, June 1 to July 17, 2015 on the University of Alabama Campus and NWC
- Demonstrated ability to simultaneously model the entire continental United States river network at high spatial resolution, in near real-time for 2.7 million stream reaches
- A more elaborate version of this prototype is being made operation as the National Water Model in June 2016 at the National Water Center
Summary

• **NOAA’s Water Services are Evolving**
  - Deliver comprehensive, integrated actionable water intelligence
  - Compliment current services with new information spanning Summit-to-Sea, Floods to Droughts, Treetops to Bedrock

• **Implementing State-of-the-Art Technical Approach**
  - Water prediction through state-of-the-science earth system modeling
  - Impact-based decision support services underpinned by geo-intelligence

• **Scale Change: Orders of Magnitude More Data**
  - Reach-based “Street Level” prediction
  - High Performance Computing

• **New Organization, Cornerstone Facility and Philosophy**
  - National Water Center
  - Collaborative, cross-NOAA, interagency, academic partnerships