National Flood Interoperability Experiment

A CUAHSI Webinar, presented by:

Donald Cline, Acting Director, Office of Hydrologic Development, National Weather Service

David Maidment, University of Texas at Austin

Richard Hooper, President and CEO, CUAHSI

Andrew Ernest, University of Alabama

10 December 2014
National Flood Interoperability Experiment (NFIE)

Don Cline
Office of Hydrologic Development
National Weather Service, NOAA

CUAHSI WEBINAR
December 10, 2014
Water Challenges
Stakeholder Priorities

- Academia
- City Planners
- Community Councils
- Conservation Commissions
- Emergency Management Services
- Federal Agencies
  - NOAA, USGS, USACE,
  - FEMA, EPA, NPS, USFWS
- Port Authorities
- Power and Energy Administrations
- Private Sector Companies and NPOs
- River Basin Commissions
- River Compact Associations
- State Climatologists
- State, County and City Agencies
  - Agriculture
  - Environment
  - Natural Resources
  - Sanitation
  - Water Management
  - Water Supply
Stakeholder Priorities

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

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

Actionable Water Intelligence
Water Prediction

WEATHER
- Precipitation
- Evaporation
- Snowmelt
- Runoff
- Channel Flow
- River Flooding
- Flash Flooding
- Drought
- Storm Surge
- Tides
- Sea Level Rise

HYDROLOGY

COASTAL
Environmental Intelligence: Total Water Prediction

The National Water Center and the Transformation of NOAA’s Water Prediction Services
Develop and implement the next generation integrated physical earth system prediction capability at weather and longer time scales, to support hours-to-seasonal global prediction including the atmosphere, ocean, land, cryosphere and space.
WRF-HYDRO System

- Developed by National Center for Atmospheric Research (NCAR)
- Community-based and supported
- Architecture to couple multi-scale, multi-physics models of the atmosphere and terrestrial hydrology
- Support and leveraging of existing ‘Earth System’ modeling enterprise
  - WRF, CESM, ESMF
  - High performance computing platforms
  - Modular and extensible
Scientific excellence and innovation driving water prediction and decisions for a water-resilient nation.

• Collaborative R&D, Operations
  – Support mission-oriented research and development
  – Proving Ground Facility
    • Science and Technology Transition
  – Operations Center
    • Socioeconomic Sector Desks
    • Regional Desks
    • Science Desks
• Interagency Staffing
NOAA Research and Development Funnel

Operational System Development and Implementation

Science and Technology Transition

Test Beds

Operational System Development and Implementation

Requirements and Operational Concepts

Advances in Science and Technology

Science and Technology Specific to NOAA Operational and Information Services

Current Operations

2 Years

5 Years

20 Years

All of atmospheric and oceanic science and technology
National Water Center

- Located on Tuscaloosa Campus of University of Alabama
- Operated by National Weather Service to support IWRSS partners (NWS, USGS, Corps of Engineers, with FEMA joining)
Nationally Synthesize Operations of Regional River Forecast Centers

Creates an opportunity to rethink how hydrology is done at the national scale for the United States
National Flood Interoperability Experiment

Presented by:

Donald Cline, Acting Director, Office of Hydrologic Development, National Weather Service

David Maidment, University of Texas at Austin

Richard Hooper, President and CEO, CUAHSI

Andrew Ernest, University of Alabama
National Flood Interoperability Experiment (NFIE) Research Questions

1. How can near-real-time hydrologic simulations at high spatial resolution, covering the nation, be carried out?

2. How can this lead to improved emergency response and community resilience?

3. How can an improved interoperability framework support the first two goals and lead to sustained innovation in the research to operations process?
Scope of NFIE

What we are doing: building a national scale research platform for flood data, modeling, forecasting and mapping consistently across the country supported by federal water data and forecasting services, and geospatial information. This is an “interoperability experiment”.

What we are not doing: building an operational flood forecasting system.

The NFIE is an initiative of the academic community in collaboration with government and commercial partners.
Open Water Data Initiative

• Subcommittee on Spatial Water Data leads this effort

• This reports to both FGDC and ACWI

• Initiated in August 2014

Anne Castle, Asst Secretary for Water and Science, Dept of Interior
NHDPlus Version 2

Geospatial foundation for a national water data infrastructure

2.67 million catchments, average area 3 km², reach length 2 km

National Elevation Dataset

National Hydrography Dataset

Watershed Boundary Dataset

National Land Cover Dataset
NFIE-Geo for National Flood Interoperability Experiment

Enhanced geospatial database for a national water data infrastructure

NFIE-Geo

9 feature classes
• 5 from NHDPlus
• 4 from IWRSS

USGS Water Watch Points

NWS Basins and Forecast Points

National Flood Hazard Layer

Feature classes:
Subwatershed
Catchment
Flowline
Waterbody
Dam

NHDPlus
NFIE-Geo as Data Packages in Geoplatform

Enhanced geospatial database for a national water data infrastructure

A data package for each USGS Water Resource Region

Publish this in the federal Geoplatform as part of the Open Water Data Initiative
Water Modeling and Forecasting Services

NWS CHPS Modeling Units: 12 CONUS RFCs

Experimental WRF-Hydro

PI-XML to WaterML2

Data Services

RAPID model flow simulation on NHDPlus

River flow in the Mississippi River Basin

2008/03/01

NHDPlus
NFIE-Hydro: Computing flows on 2.67 million stream reaches

WRF-Hydro Model

NHDPlus to RAPID Conversion

Grid to Catchment Linking

Forecast services

NFIE-Hydro
Four Themes

**Science** – how can we better connect storm hydrometeorology with flood hydrology?

**Technology** – how can we create a high spatial resolution, near real-time flood forecasting model for the continental United States?

**Decision Support** – How is the gap closed between national flood forecasting and local emergency response?

**Applications** – how can the knowledge and tools created in the first three phases be applied in specific local circumstances to particular flood events?
National Flood Interoperability Experiment

Presented by:

**Donald Cline**, Acting Director, Office of Hydrologic Development, National Weather Service

**David Maidment**, University of Texas at Austin

**Richard Hooper**, President and CEO, CUAHSI

**Andrew Ernest**, University of Alabama
Timeline for NFIE Student Program

- **Overview Webinars**
- **NFIE Program Announcement**
- **Technical Webinars**
- **Applications Open**
- **Applications Close**
- **Awards Announced**
- **Summer Institute Kickoff**
- **Abstracts Due**
- **Summer Institute Capstone Conference**

Dec 2014

Jan 2015

Feb

Mar

Apr

May

Jun 1 – 5

Jul 15 – 17
NFIE Structure

Webinars – Overview of NFIE goals and structure (January) and technical description of resources available (February)

Kick-off Event – Weeklong conference with details of data resources including software carpentry and data carpentry training

Residential Institute – Summer institute at Tuscaloosa with curriculum around four themes

Non-residential Program – Projects performed at students’ home institute

Capstone Event – Projects presented from residential and non-residential students
Application Process

**Eligibility**– Open to graduate students (including incoming first-year) at US universities; non-US citizens can apply.

**Application**– One-page statement of interest; letter of support from advisor; brief CV

**Award**– Travel grant to kick-off and/or room/board/tuition for summer institute. Additional travel grants to Capstone event for non-residential students who submit an abstract to present paper.

**Timing**– Details finalized in January with awards announced by April.
National Flood Interoperability Experiment

Presented by:

Donald Cline, Acting Director, Office of Hydrologic Development, National Weather Service

David Maidment, University of Texas at Austin

Richard Hooper, President and CEO, CUAHSI

Andrew Ernest, University of Alabama
University of Alabama, Tuscaloosa
Conclusions

• Goal is to produce national high spatial resolution stream and “street level” water predictions

• The National Weather Service is inviting the academic community to be a partner

• This is an experiment – what is important are the insights it produces

• Everything is open to change and variation. Your ideas, innovation, and contribution are very welcome

Next NFIE Webinar Weds Jan 7