INTEGRATED WATER
PREDICTION & THE NATIONAL WATER MODEL

Informing Decisions for a Water-Prepared Nation

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Global Economic Risks Landscape 2015

Interrelated Grand Challenges
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
Over 100 million people live in the white space near the coast that don’t get a water forecast today.
Stakeholder Priorities

Broader Range of Hydrology (Not just Floods)

- Total Water Level along Nation’s coasts
- Climate Change
- Low Flows, Droughts
- Prediction Uncertainty
- Risk-informed

Detailed Characteristics of Small Watersheds, Hillslopes

- Relevant to scales of local decision making and infrastructure
- Forecast inundation maps depicting street level impacts

Consistent and Coherent across Large Watersheds

- Relevant to integrated water resource management
- Need the same type of information consistently throughout domain
- Forecasts of full range of hydrologic parameters

Easy Access

Examples

- Total Water Level along Nation’s coasts
- Climate Change
- Low Flows, Droughts
- Prediction Uncertainty
- Risk-informed
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
Reservoir of Capability

- LSM (Noah-MP, etc.)
- Terrain routing
- Routing (RAPID, etc.)
- Water management
- Icing and Related Cloud Physics

- Algorithm development
- System demonstration
- Validation
- End User

Forcing data
- Geospatial products
- Parameter estimation
- Data assimilation
- Model evaluation
- Remote sensing

HYDROLOGIC SCIENCE ADVANCES

WRF HYDRO COMMUNITY MODEL

- NATIONAL WATER MODEL
- LAND-ESTUARY COUPLING
- LAND-ATMOSPHERE INTERACTIONS
- MORE...
WRF-Hydro Operational Configuration

**Analysis & Assimilation**
- Short-Range
  - Cycling Frequency: Hourly
  - Forecast Duration: 0-18 hours
  - Meteorological Forcing: MRMS blend/HRRR/RAP bkgnd.
  - Spatial Discretization & Routing: 1km/250m/NHDPlus Reach
- Medium-Range
  - Cycling Frequency: Daily
  - Forecast Duration: 0-10 days
  - Meteorological Forcing: Downscaled HRRR/RAP blend
  - Spatial Discretization & Routing: 1km/250m/NHDPlus Reach
- Long-Range
  - Cycling Frequency: Daily (16 mem)
  - Forecast Duration: 0-30 days
  - Meteorological Forcing: Downscaled GFS
  - Spatial Discretization & Routing: 1 km/NHDPlus Reach

**Assimilation of USGS Obs**
- Reservoirs (1615 water bodies parameterized with level pool scheme)
National Water Model
IOC Experimental Output (FY16)

• 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

Howard County, Maryland (300k People)