

# INTEGRATED

# WATER

# PREDICTION & THE NATIONAL

# WATER MODEL

*Informing Decisions for a Water-Prepared Nation*



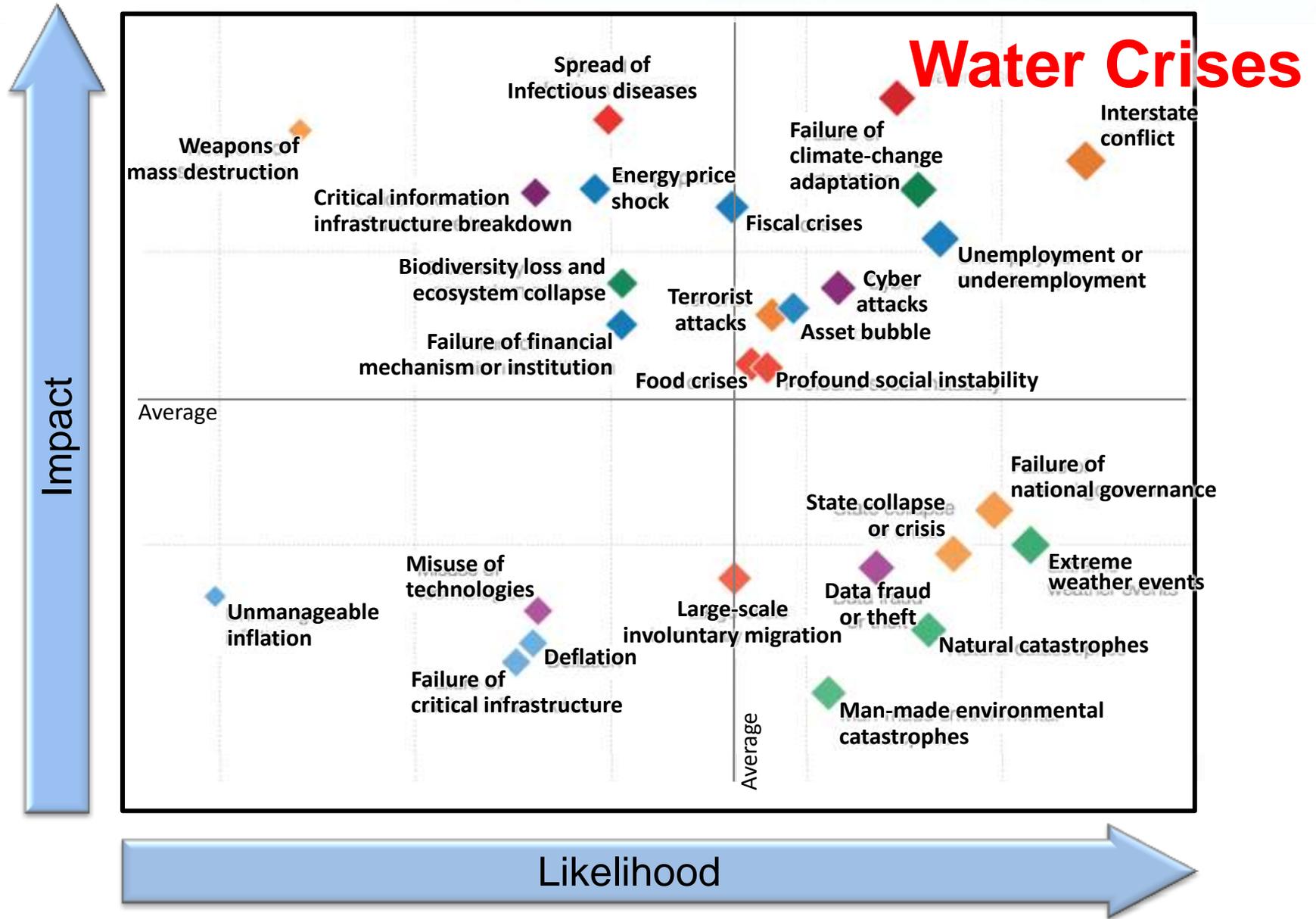
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**National Water Center**

**National Weather Service, NOAA**

# Global Economic Risks Landscape 2015



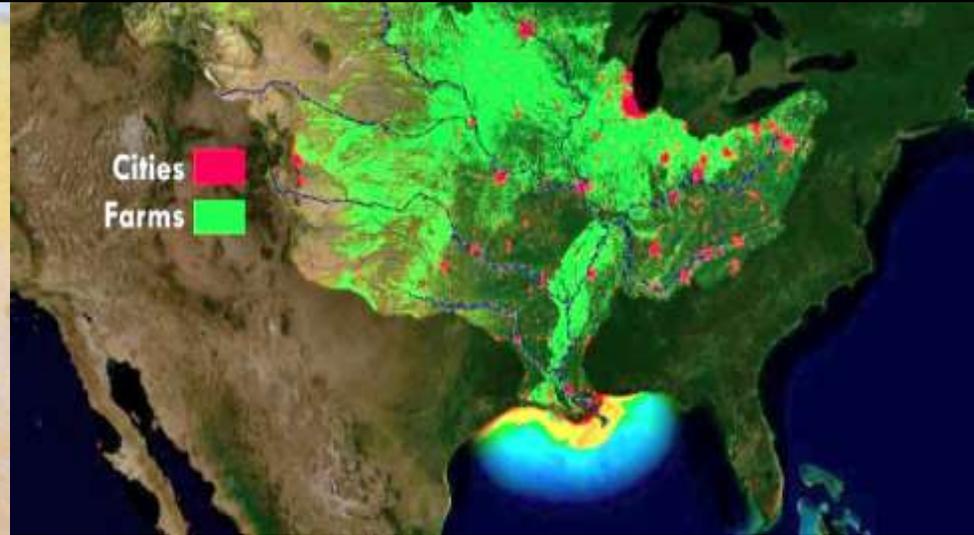
# WATER EXTREMES



## WATER SECURITY



## WATER QUALITY



**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*



# Stakeholder Priorities

**Broader Range of Hydrology  
(Not just Floods)**

## Examples

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

**Detailed Characteristics of Small Watersheds, Hillslopes**

**Easy Access**

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

**Consistent and Coherent across Large Watersheds**

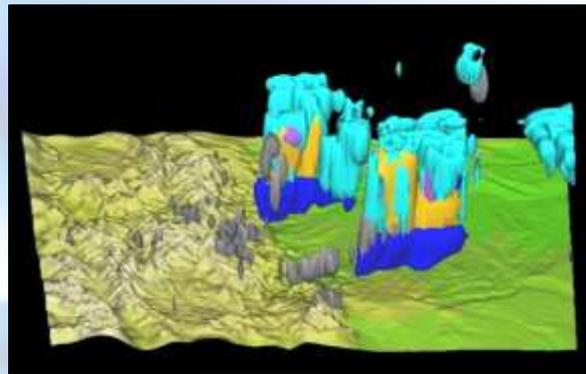
- Relevant to integrated water resource management
- Need the same type of information consistently throughout domain
- Forecasts of full range of hydrologic parameters

# WRF-HYDRO System

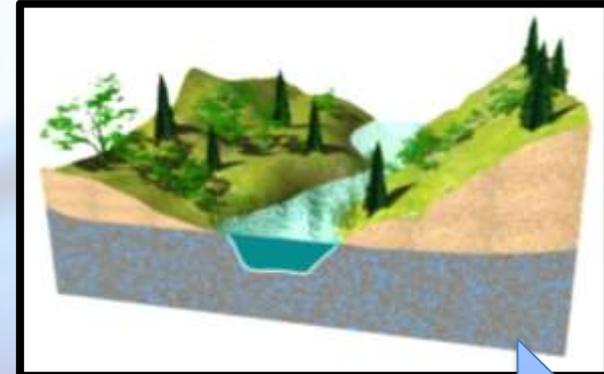
- Developed by **National Center for Atmospheric Research (NCAR)**
- Community-based and supported
- Architecture to couple multi-scale, multi-physics models of the atmosphere and terrestrial hydrology



10,000 m



1000 m



100 m

1 m

HYDROLOGIC  
SCIENCE ADVANCES

*ensemble methods*

Forcing data

Remote sensing

Geospatial products

LSM  
(Noah-MP, etc.)

Parameter estimation

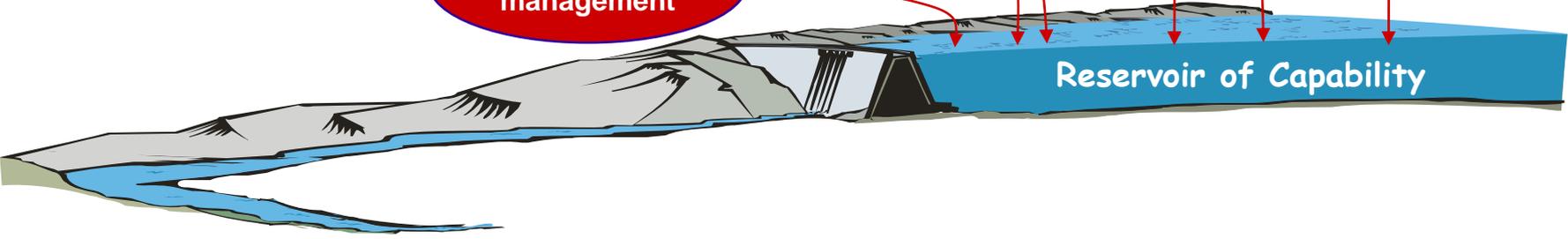
Terrain routing

Routing  
(RAPID, etc.)

Data assimilation

Model evaluation

Water management



Reservoir of Capability

TECHNOLOGY

WRF HYDRO COMMUNITY MODEL

• Algorithm development      • System demonstration      • Validation      • End User

NATIONAL WATER MODEL

LAND-ESTURARY COUPLING

LAND-ATMOSPHERE INTERACTIONS

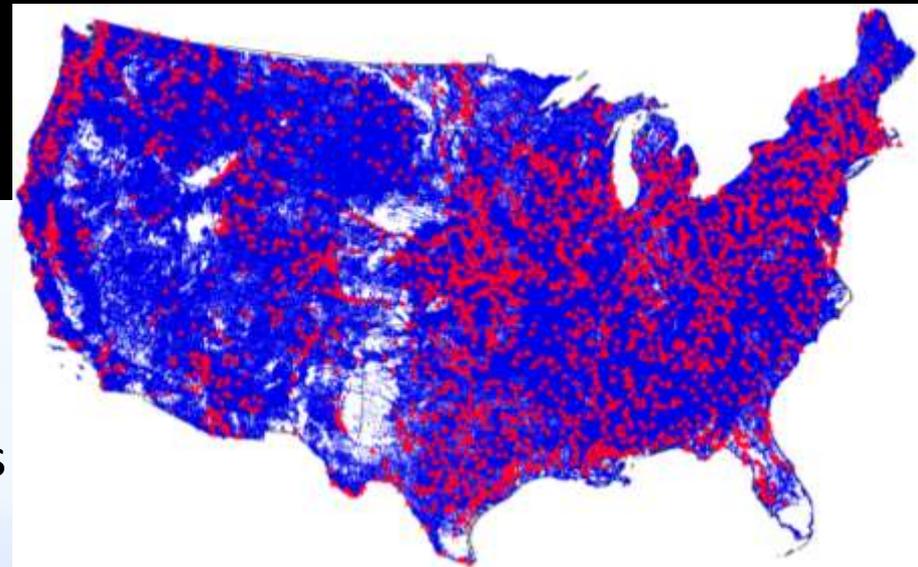
MORE...

APPLICATIONS

# WRF-Hydro Operational Configuration

Analysis & Assimilation	Short-Range	Medium-Range	Long-Range
<b>Cycling Frequency</b>			
Hourly	Hourly	Daily	Daily (16 mem)
<b>Forecast Duration</b>			
- 3 hrs	0-18 hours	0-10 days	0-30 days
<b>Meteorological Forcing</b>			
MRMS blend/ HRRR/RAP bkgnd.	Downscaled HRRR/RAP blend	Downscaled GFS	Downscaled & bias-corrected CFS
<b>Spatial Discretization &amp; Routing</b>			
1km/250m/NHDPlus Reach	1km/250m/NHDPlus Reach	1km/250m/NHDPlus Reach	1 km/NHDPlus Reach
Assimilation of USGS Obs			
Reservoirs (1615 water bodies parameterized with level pool scheme)			

# National Water Model IOC Experimental Output (FY16)



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

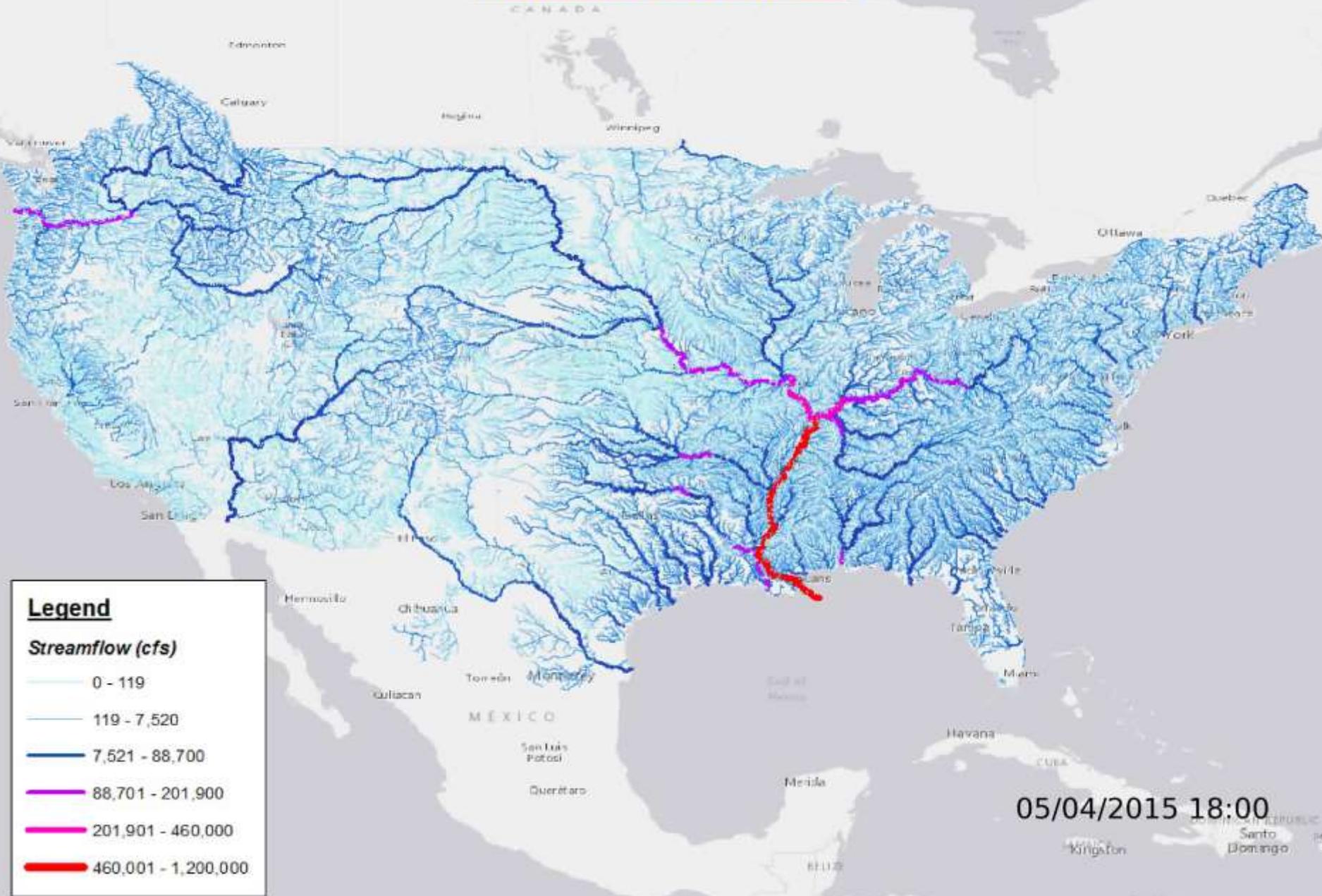
- **Hydrologic Output**
  - River channel discharge and velocity at 2.7 million river reaches
  - Surface water depth and subsurface flow (250 m CONUS+ grid)
- **Land Surface Output**
  - 1km CONUS+ grid
    - Soil and snow pack states
    - Energy and water fluxes
- **Data Services**
  - Public-facing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

## Howard County, Maryland (300k People)



Current River Forecast Points: Zero  
WRF-Hydro Forecast Points: 300+

# National Water Model



## Legend

### Streamflow (cfs)

- 0 - 119
- 119 - 7,520
- 7,521 - 88,700
- 88,701 - 201,900
- 201,901 - 460,000
- 460,001 - 1,200,000

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