NWS River Forecast Operations
Current Status and Future Plans

Briefing to Subcommittee on Disaster Reduction

February 4, 2016

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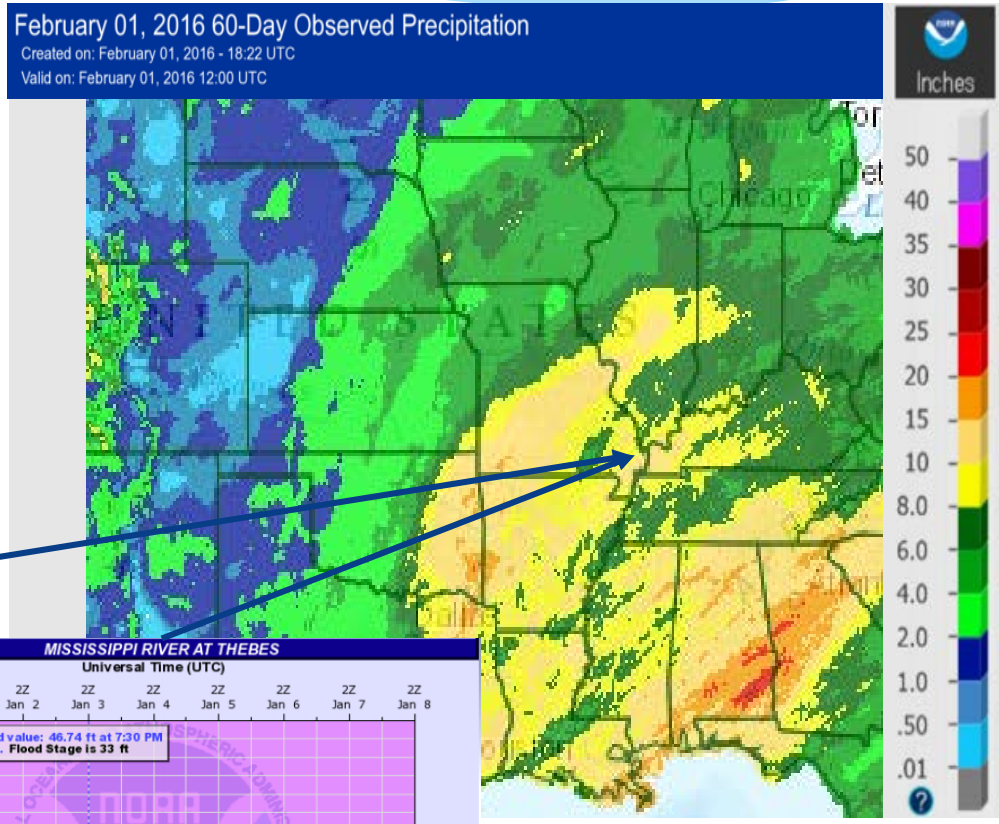
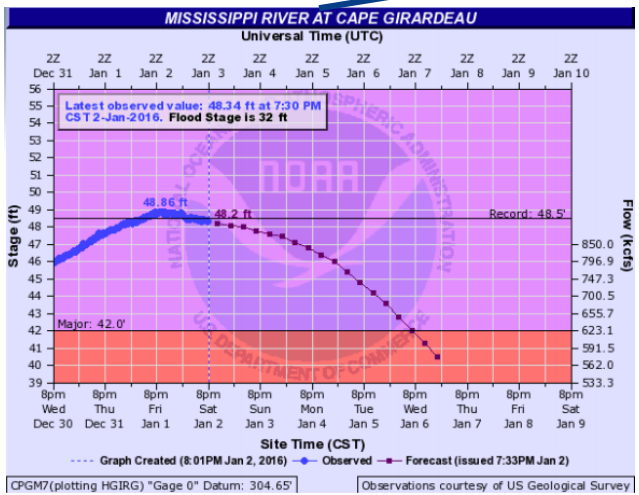
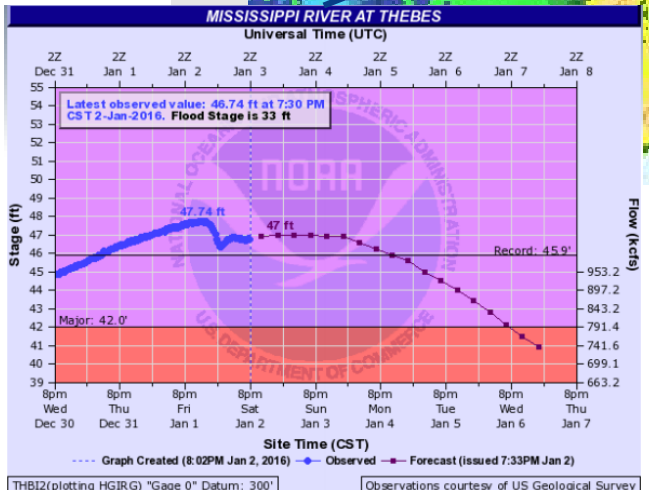
Midwest Flooding - Background

- **Repeated rain events in December led to major flooding on the Mississippi, Illinois, Ohio, Meramec, Arkansas Rivers from December to late January**
- **Record high crests on the Meramec and Mississippi Rivers**



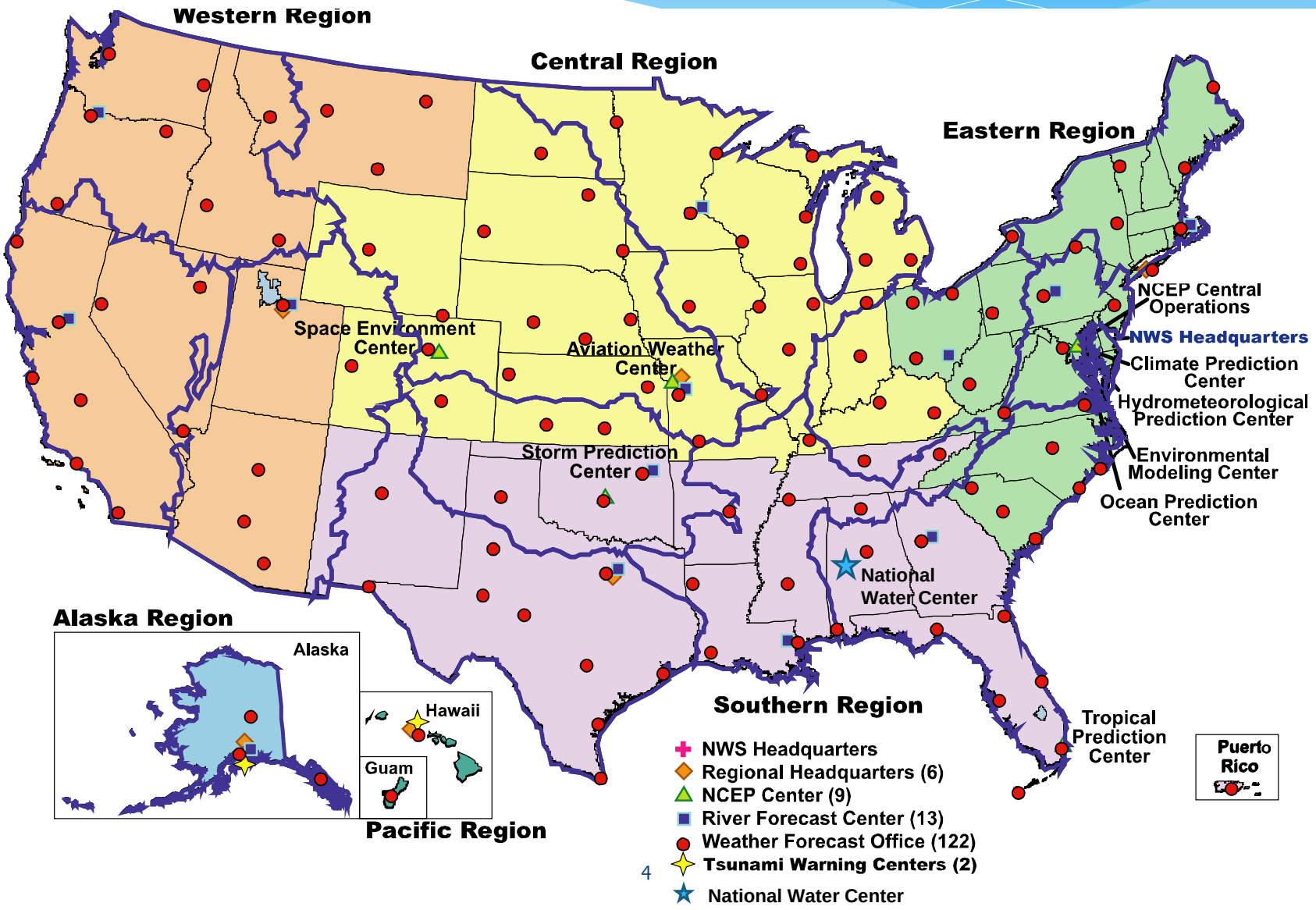




Midwest Flooding: NWS Decision Support Services

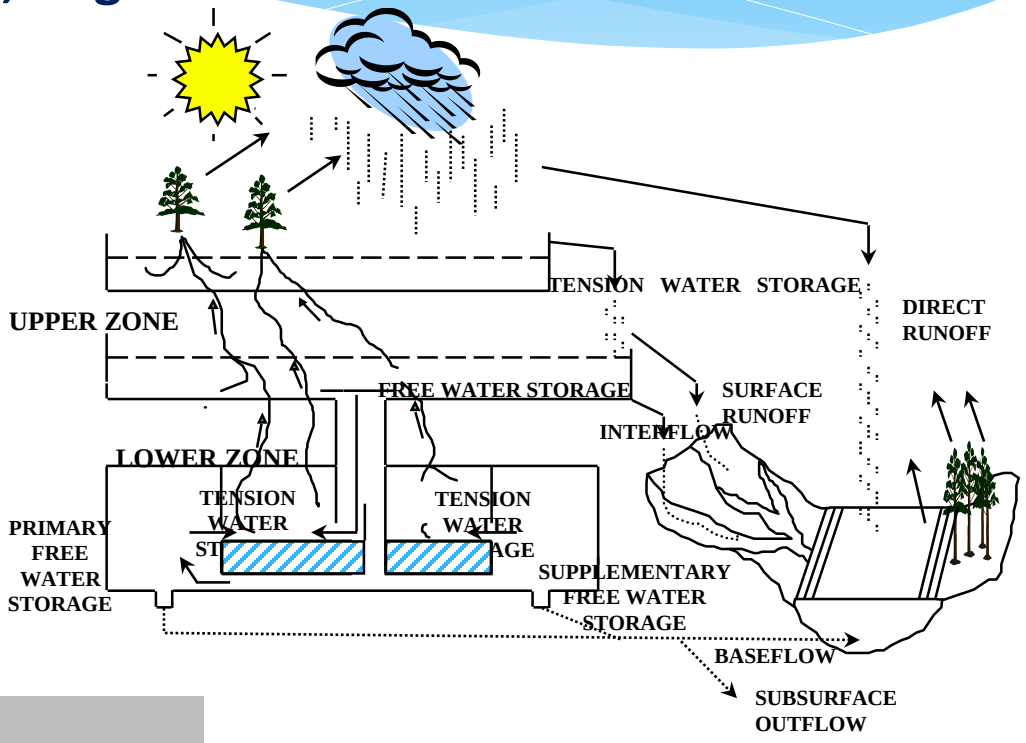
- River Forecast Centers (RFCs) supporting Mississippi River Forecasting went to 24 hour operations.
  - West Gulf River Forecast Center (WGRFC), Arkansas Red-Basin RFC (ABRFC) and North Central RFC (NCRFC)
- Daily conference calls with state of LA Governor's Office of Homeland Security and Emergency Preparedness (GOSHEP)
- Daily Lower Ohio / Mississippi River Flood Coordination Call among NWS, USGS, and USACE districts.
- The NOAA liaison to FEMA provided decision support to FEMA HQ leadership and interagency partners and worked closely with geospatial personnel at FEMA HQ to support internal predictive flood analytic products.
- Local Weather Forecast Offices routinely engaged in briefings with state and local emergency managers.

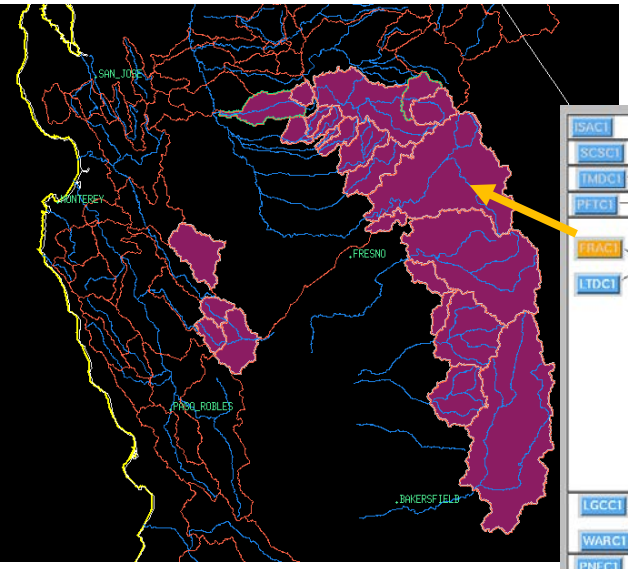
NWS Operational Infrastructure

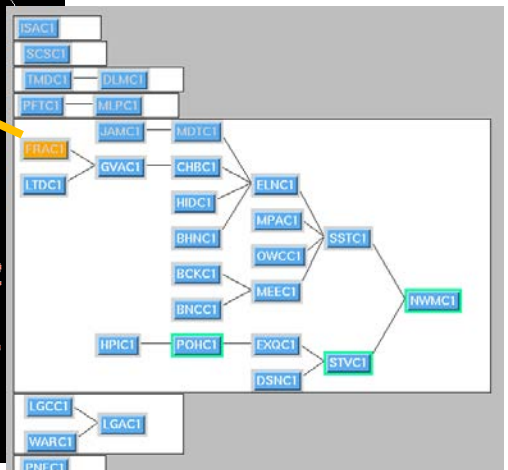


Current RFC Forecasting Modeling Capability

- **Rainfall-Runoff Models - Lumped, large basin**
  - Soil Model (SAC-SMA)
  - Snow-17
  - Unit Hydrograph
- **Reservoir Models**
- **River Routing Models**
  - Hydrologic
  - Hydraulic Models (HEC-RAS)







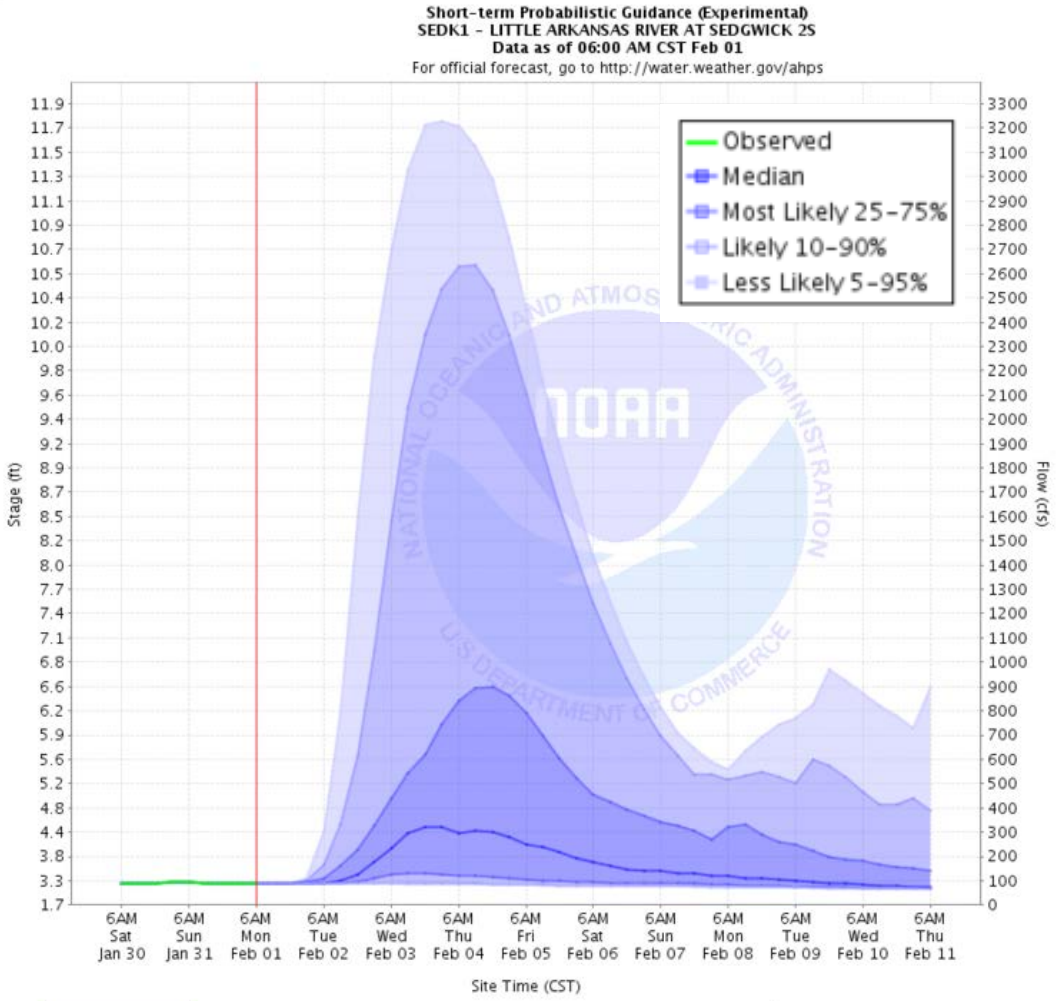
Preprocessing	Processing	Post-processing
• Data collection • Data QC • Mean Areal computations	• Run model(s) Routine: 6 hour time step, 5-10 day forecast Ensemble Streamflow Prediction to 30+ days • Make adjustments • Route flow downstream	• Text Forecast • Graphical Forecast •Available via AHPS Web Page

Enhancing Current Forecasting System

Hydrologic Ensemble Forecast System (HEFS)

Probabilistic information to support risk-based decisions

- Incorporates both atmospheric and hydrologic uncertainties
- 123 locations have experimental product for short-range river forecasts
- Testing and evaluation ongoing; collecting feedback via web
- New river service locations will expand throughout 2016



Stakeholder Priorities

Case for Change

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

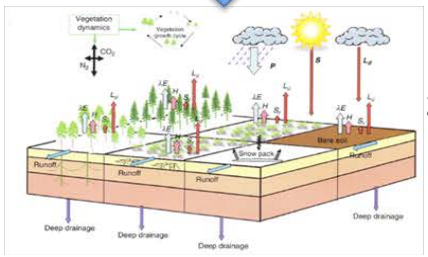
Transform information into intelligence by linking hydrologic, infrastructural, economic, demographic, environmental, and political data

National Water Model V1.0

- Based upon WRF-Hydro, a community-based hydrologic modeling *framework* supported by NCAR
- *Not dependent* on a particular forcing data source or choice of LSM
- Able to operate over multiple scales and with multiple physics options

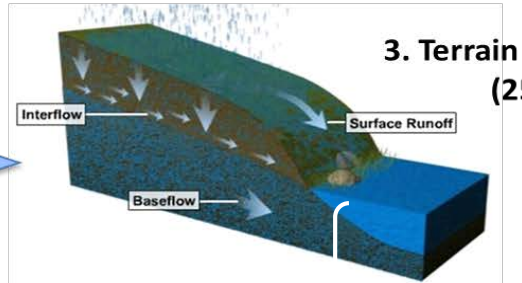
Initial Operating Capability System Flow

1. WRF-Hydro Forcing Engine (1 km grid)



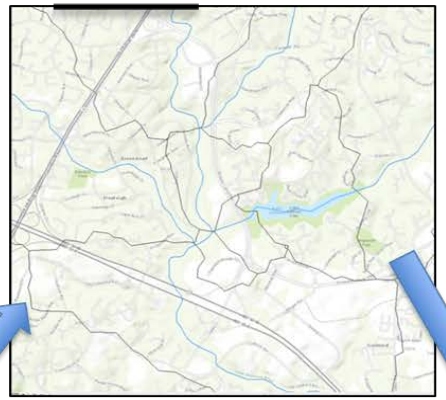
2. NoahMP LSM (1 km grid)

2-way coupling



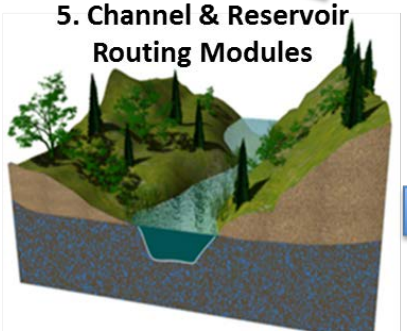
3. Terrain Routing Module (250 m grid)

4. NHDPlus Catchment Aggregation



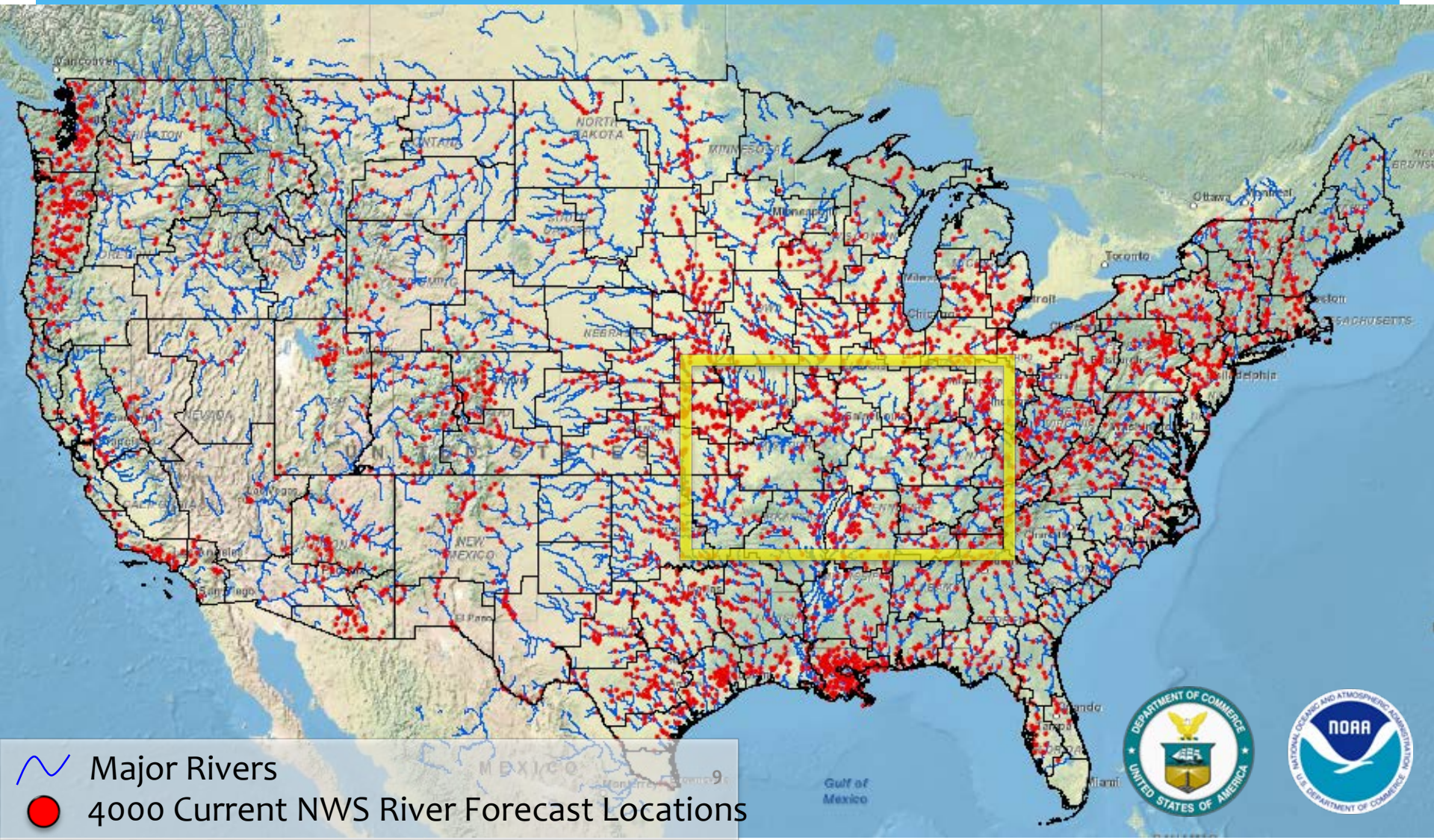
(avg. size ~3km^2)

5. Channel & Reservoir Routing Modules



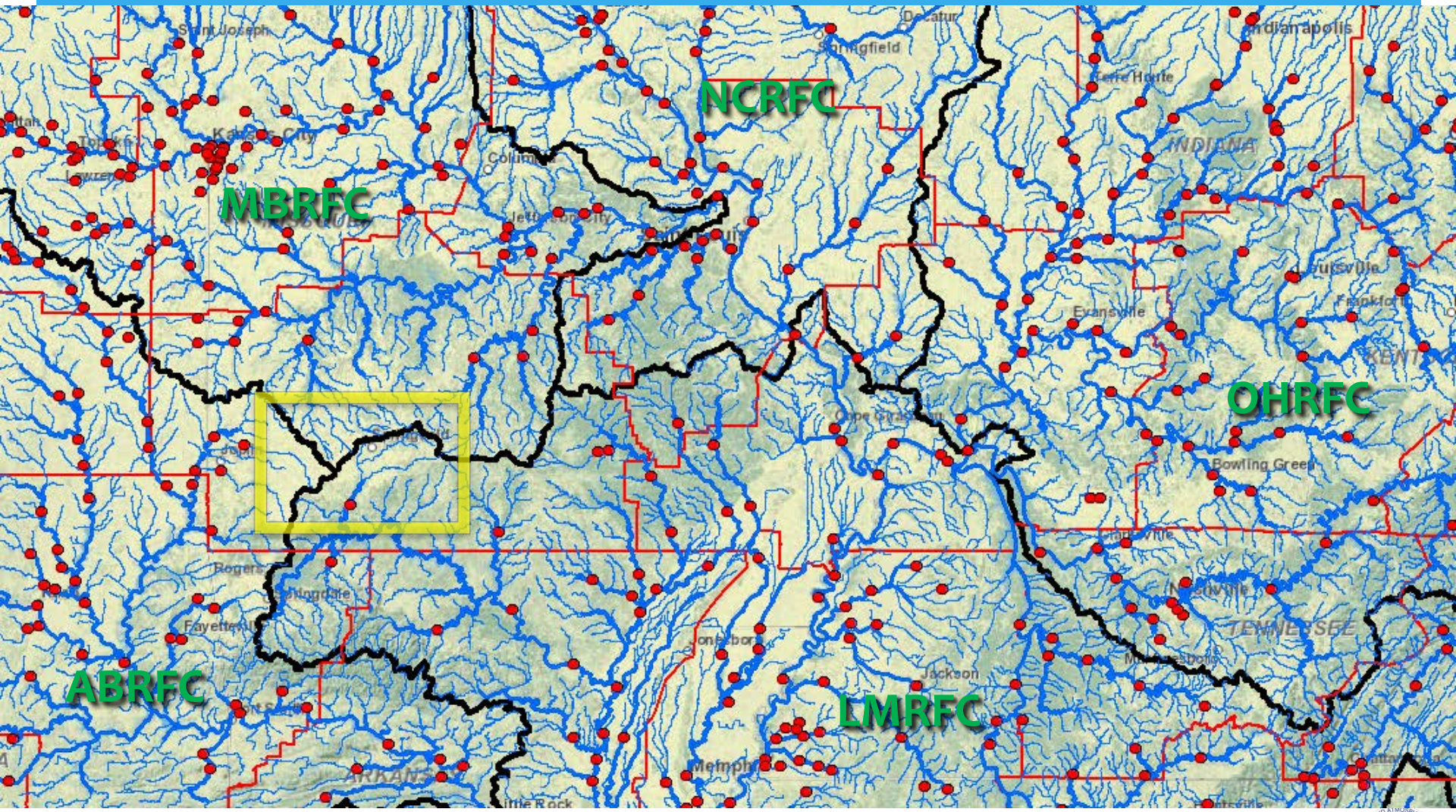
Forecasts

Major Rivers and NWS Hydrologic Forecast Points (Today)



Major Rivers and NWS Hydrologic Forecast Points (Today)

Middle Mississippi River



Full Resolution National Hydrography Dataset NHD+

Forecasts for every stream reach (2.7 million across U.S.)

WATER PREDICTION + NATIONAL INFRASTRUCTURE

Springfield, Missouri

Current NWS Hydro Forecast Point
James River at Galena, MO
(40 miles downstream)

150 km

Hospitals EMS Fire

Infrastructure Data from National Geospatial Intelligence Agency

Transforming NOAA Water Prediction

TODAY

* Approximately 4000 forecast locations at points
* Driven by large catchment "lumped" modeling
* Impact-based forecasting at selected points

TOMORROW

* Approximately 2,700,000 forecast stream reaches
* Driven by high/hyper resolution Earth System modeling
* Predictions linked with detailed local infrastructure data to communicate street level impacts and provide information at the scale needed by local decision makers
* Fully integrated decision support for multiple socioeconomic sectors, in all regions, from summit to sea

Multi-Year Strategic Science and Services Plan

Total Water Prediction and National Water Center

FY 15-20

Core Capability

Centralized Water Forecasting

- **National Water Model (NWM) operational May 2016**
  - *Water forecasts for 2.7 million stream reaches in U.S.*
  - ***100 million people get a terrestrial water forecast for first time***
  - *National Water Center (NWC) begins providing daily situational awareness and guidance to NWS field offices*

FY 16-21

Key Enhancement

Flash Flood and Urban Hydrology

- **Enhance NWM with nested hyper- resolution zoom capability and urban hydrologic processes**
  - *Heightened focus on regions of interests (e.g. follow storms)*
  - *Street level **flood inundation forecasts** for selected urban demonstration areas*
  - *NWC increases guidance to NWS field offices to improve consistency and services for flash floods*

FY 17-22

Major Integration

Coastal Total Water Level

- **Couple NWM with marine models to predict combined storm surge, tide, and riverine effects**
  - *More complete picture of coastal storm impacts*
  - *Water prediction information linked to geospatial risk and vulnerability*
  - ***New service delivery model implemented** – increased stakeholder engagement and integrated information*
  - ***NWC operations center opens** and provides national decision support services and situational awareness*

FY 18-23

Key Enhancement

Dry Side: Drought and Post-Fire

- **Couple NWM with groundwater and transport models to predict low flows, drought and fire impacts**
  - *Add NWM processes that affect subsurface water movement and storage during dry conditions*
  - *Add NWM ability to track constituents (e.g. sediment, contaminants, nutrients) through stream network*
  - *New decision support services for water shortage situations and waterborne transport*
  - ***NWC operations center expands to include drought and post-fire decision support services***

FY 19-24

Major Integration

Water Quality

- **Integrate enhanced NWM with key water quality data sets, models and tools to begin water quality prediction**
  - *Incorporate water quality data from federal and State partners into NWM*
  - *Link NWM output to NOAA ecological forecasting operations*
  - *New decision support services for predicting water quality issues such as Harmful Algal Blooms*
  - *New decision support services for emergencies such as chemical spills*
  - ***NWC operations center expands to include water quality decision support services***