Using the National Water Model at the Northeast River Forecast Center

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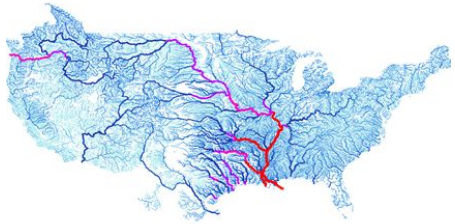
Evolving NWS Hydrologic Services



Water Prediction Services - Centralized summit to sea water prediction capability through the establishment of the National Water Model.

Water Resources Data Services – Spatial and temporal data services providing access to multidimensional hydrologic datasets and value added information.

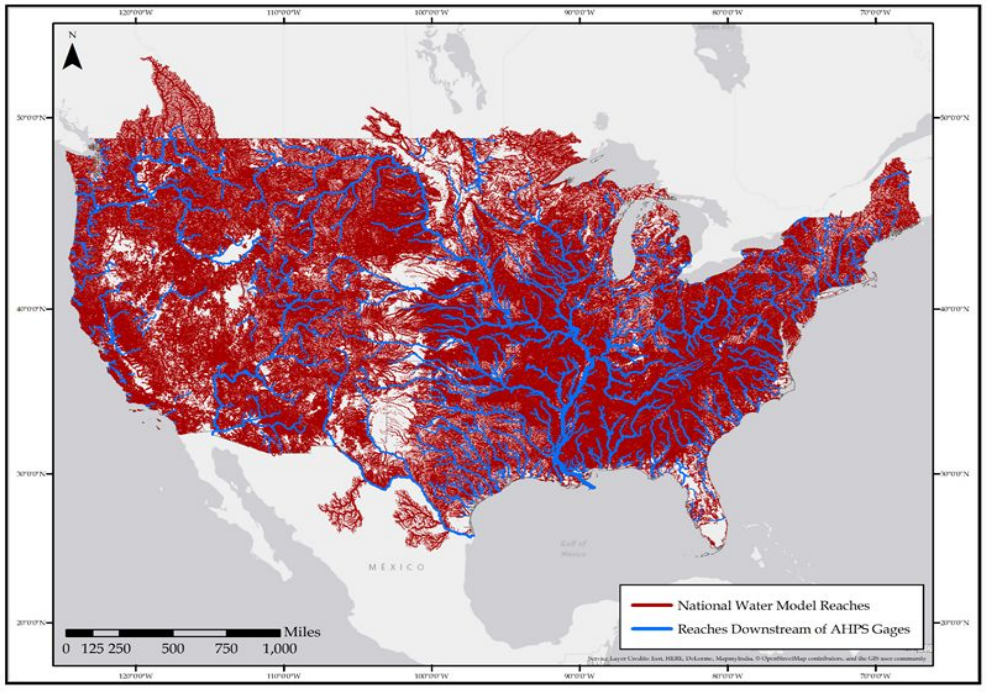
Impact Based Decision Support Services – Operational support helping partners understand depth of hydrologic forecast across scales of space and time.

National Water Model Basics

- **Continental-scale water resources model providing high resolution, spatially continuous estimates of major water cycle components**
- **Operational forecast streamflow guidance for currently underserved locations: 110,000 River miles to nearly 5,000,000 River miles**

Blue: NOAA-NWS AHPS Forecast River Reaches

Red: NWM Hydrography *Medium Resolution NHDPlusV2*



A Little History

- The National Water Model (NWM) is still a relatively ‘young’ system
  - But like all technological advances, it is evolving quickly!

2015	2016	2017 - 2018	2019	2020	2021
NWM Prototype Efforts Begin	**NWM v1.0 Operational**	**NWM v1.1 & 1.2**	**NWM v2.0 Operational**	**Visualization Improvements**	**NWM v2.1 Operational**
In May 2015, the National Water Center in Tuscaloosa, Alabama opened. A prototype version of the National Water Model was developed that summer.	Version 1.0 of the National Water Model became operational in August 2016.	Additional updates and enhancements were made to the model	Significant upgrades were made to the model; Hawaii added; Medium-Range moved to an ensemble format	Efforts were undertaken to enhance viewing of NWM output both internally and externally; these continue to be evaluated today	Version 2.1 of the National Water Model becomes operational, adding coverage of Puerto Rico, USVI, and completing the Great Lakes basins

Putting the Conclusion First

- Largely, at NERFC, our interactions with the NWM are currently focused on the visualizations (and derived visualizations) of the model output

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National Water Model Version 2.1: Cycling Overview

Lookback Range 3-28 hrs

New for V2.1…open loop (non-DA) member

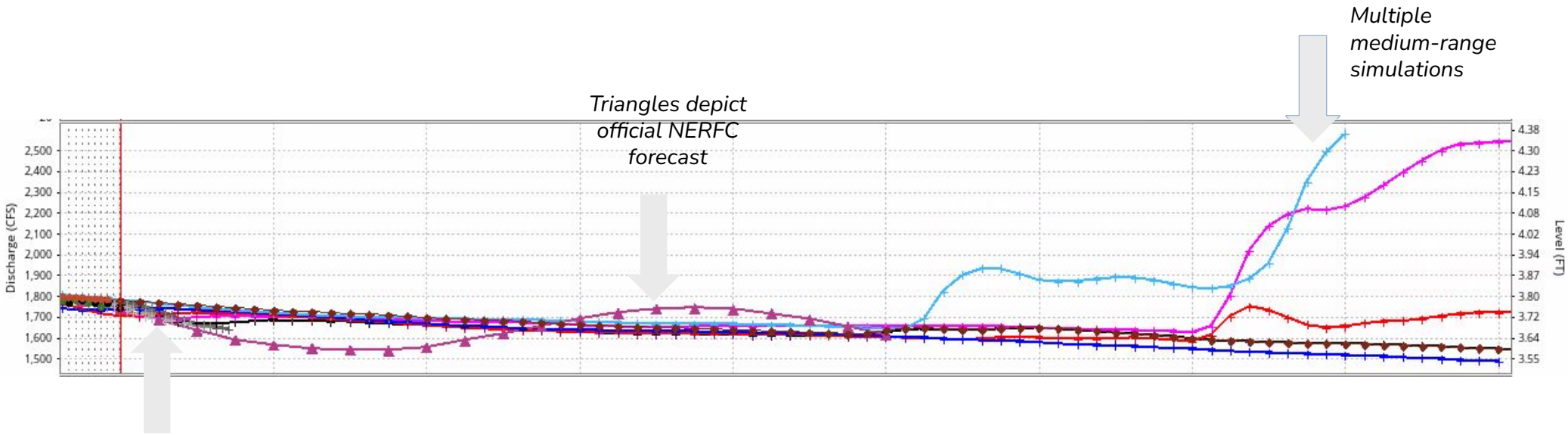
18 Hour Forecast

~10 Day Ensemble Forecast

30 Day Ensemble Forecast

Model Output - Internal View

NERFC forecasters can view raw NWM output for our river forecast locations in our Community Hydrologic Prediction System (CHPS) software.



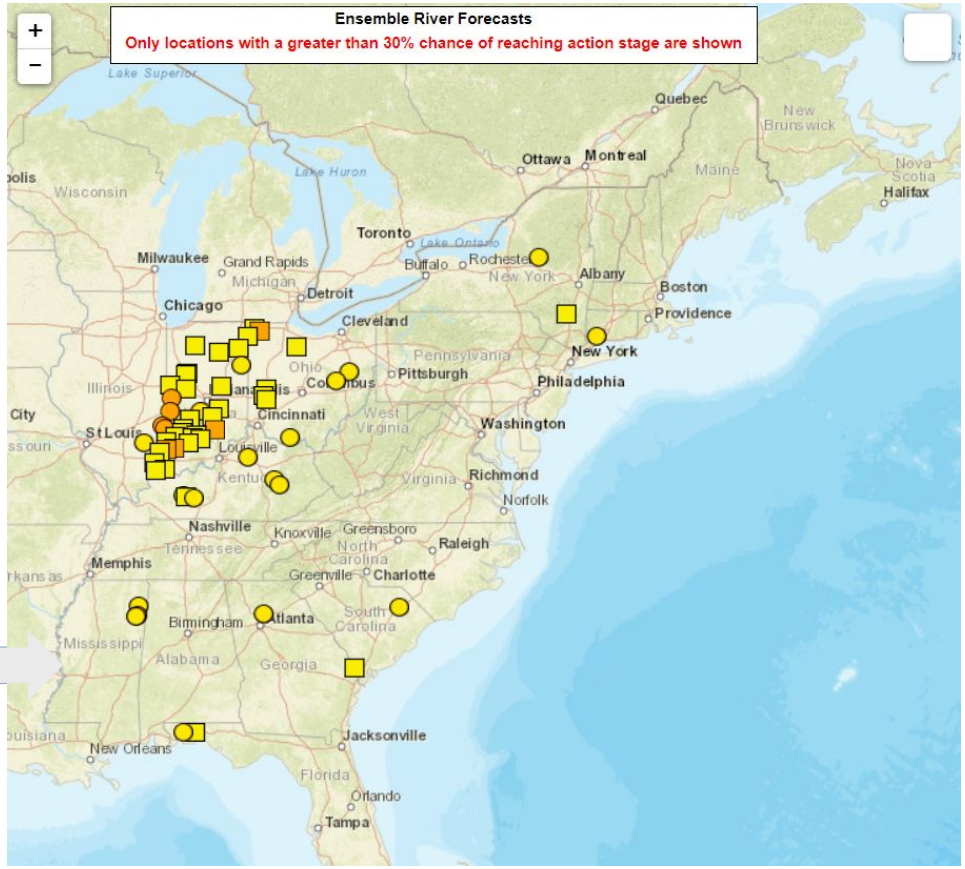
Model Output - Ensembles

Ensemble output is not new to us at the RFC.

The Meteorological Model Ensemble Forecast System (MMEFS) and Hydrologic Ensemble Forecast System (HEFS) have been in use for years.

https://www.weather.gov/erh/mmefs

Overview map allows for a quick view of locations with at least a 30% probability of reaching a threshold (circles) or at least a 70% probability of reaching a threshold (squares)



Usage In Practice

On a day-to-day basis, NERFC remains focused on calibrating & modifying our in-house river modeling systems. NWM guidance is static guidance and, like any model output, has known
(and being-discovered)
biases that must be
accounted for and
overcome.

Achievement Statement: By September 30, 2021, NOAA National Weather Service will improve its flood related decision support services by expanding the **demonstration** of a new flood inundation mapping capability ***to at least an additional 10% of the U.S. continental population residing in flood-vulnerable freshwater basins***.

Additional coverage includes population served with National Water Model hydrography downstream from a subset of ***NWS official forecast locations*** throughout the continental U.S., **plus populations in the NWS Northeast River Forecast Center *National Water Model domain***.

1. **Including two tabletop exercises:**

2. Rhode Island (February 23, 2021) – late March 2010 Floods

   New York (June 29, 2021) – Tropical Storm Irene in the Schoharie Valley

A huge thank you to WFOs Norton and Albany for their tremendous support!

Key Investment to Becoming a Water-Ready Nation:

Deliver Forecast Driven Inundation Services!

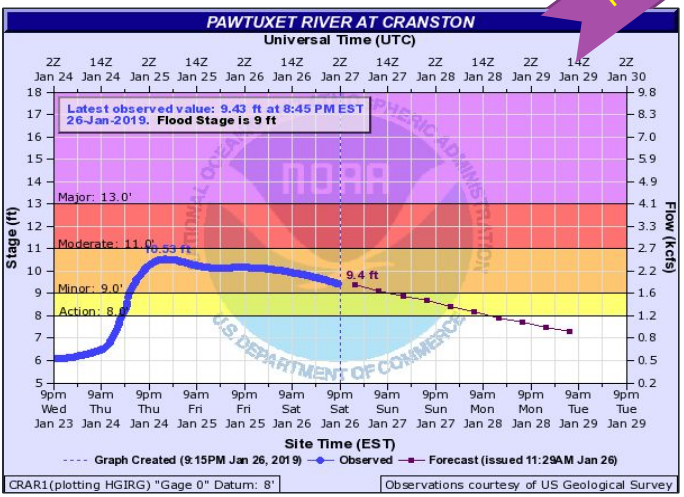
National Water Model
NWM FIM

- ✔ Completely automated process with no forecaster engagement
- ✔ Provides complimentary guidance on ~2.7 million stream reaches nationwide!
  - 10 day run 4x a day (GFS)
  - 18 hour run every hour (HRRR)

NERFC Forecasts (RFC FIM)

- ✔ Forecasters heavily engaged in the forecast production
- ✔ Updated as necessary

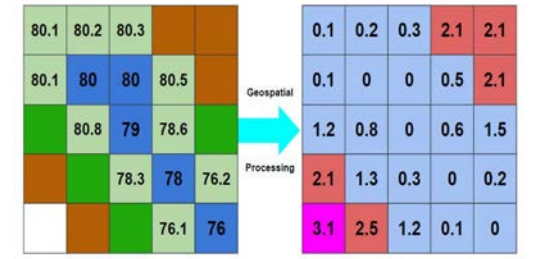
Inundation extents are derived using the HAND method; stage heights are interpolated from RFC or NWM (v2.1) discharges using synthetic rating curves, interpolated stage heights are rounded up to the nearest foot, and corresponding pre-computed inundation extent polygons are displayed.



Replace

Route

Height Above Nearest Drainage (HAND)



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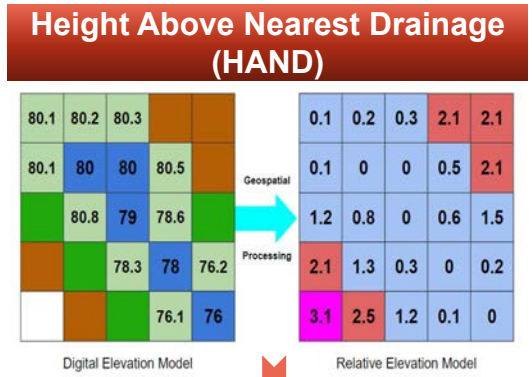
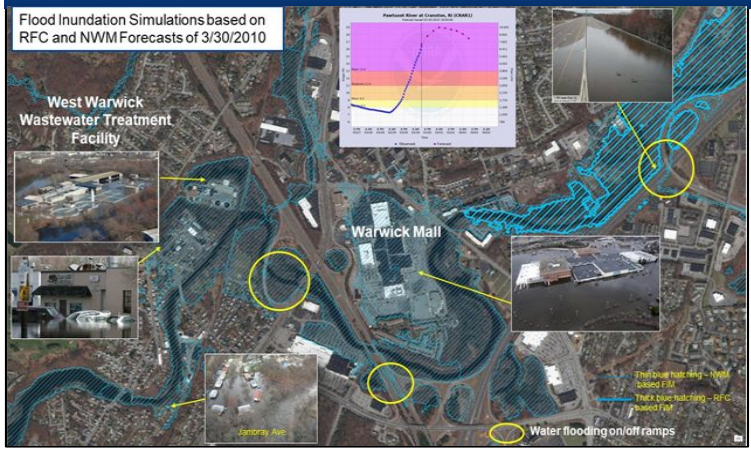


Pawtuxet River Valley West Warwick/Warwick



The Tabletop Exercises

- NERFC leveraged geospatial capabilities to display -- and allow users to directly interrogate -- both ‘flavors’ of inundation mapping

<u>At right:</u>
FIM from Pawtuxet River, 2010 floods, and actual photos of those locations from the event

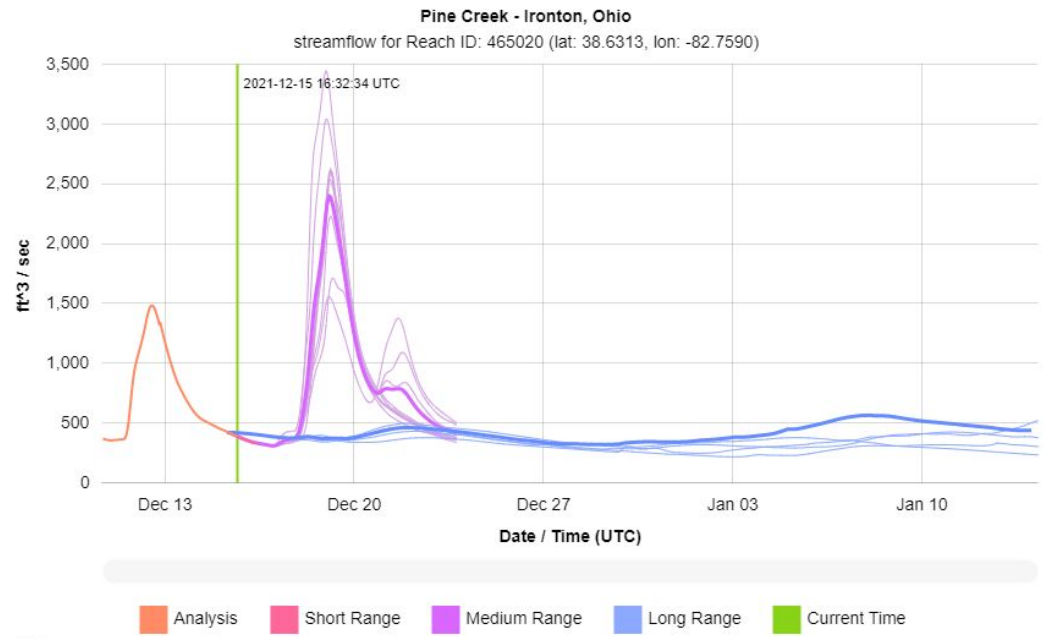
The Tabletop Exercises

- Key findings from these tabletops have been fed back into the process for potential future enhancements, and a concept of operations for FIM is currently under development at a National level, with training ongoing at NERFC also.

The Future...Is Now!

Where are we headed?

- **Today** -- Select NWM information is available at https://water.noaa.gov/map



The Future...Is Now!

Where are we headed?

- **Today** -- Select NWM information is available at https://water.noaa.gov/map
- **2022 (tentative)** -- More NWM visualizations available, including fields such as time to reach bankfull, time to peak, max flow probabilities, etc.; and output for specific gage locations available on the new National Water Prediction Service (NWPS) website
- **2023 (tentative)** -- Inundation Mapping services begin to roll out (coverage of ~10% of the Nation)

Our challenge in the next two years is to get ready for the availability of this new information and to make sure our partners & the public will be able to understand and utilize it -- this is the IDSS piece of the puzzle on the first slide!!

Thank You!

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Join us in March for our Spring Flood Outlook presentation!