

Operational Use of NOAA's National Water Model for Flood Risk and Impact Forecasting for the U.S.

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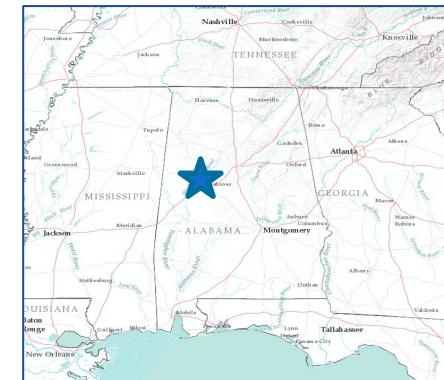
*Water Prediction Operations Division, National Water Center
National Weather Service, NOAA
Tuscaloosa, AL, USA*

AWRA Spring Conference, April 2022
Session 12 | Advances in Flood Modeling, Mapping & Forecasting III

National Water Center: Roles and Responsibilities

A Catalyst to Transform NOAA's Water Prediction Program

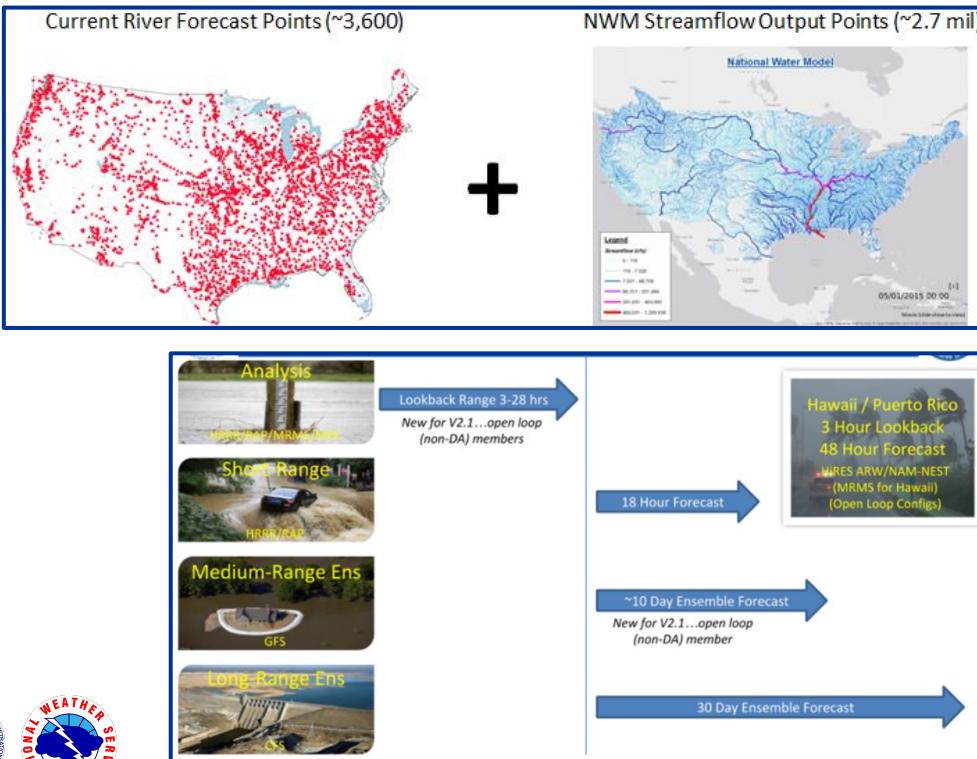
- In collaboration with NOAA field offices and other federal water agencies, NWC is responsible for the delivery of forecast guidance, analyses, and inundation information - as well as other information that augments services provided at local, regional or national levels - for the United States¹. This includes:
 - Flash Flooding
 - Riverine Flooding
 - Flood Inundation Mapping
 - Winter Hydrology
 - Water Resource Outlooks
 - Decision-support services for emergency and water resources management



- **Vision** – A “water-ready” nation, capable of addressing the nation’s challenges relating to water extremes, water scarcity, and water quality through improved water prediction and related decision support services
- **Mission** – Collaboratively research, develop and deliver timely and consistent, state-of-the-science national hydrologic analyses, forecast information, data, guidance, and decision-support services to inform essential emergency management and water resources decisions across all time scales.

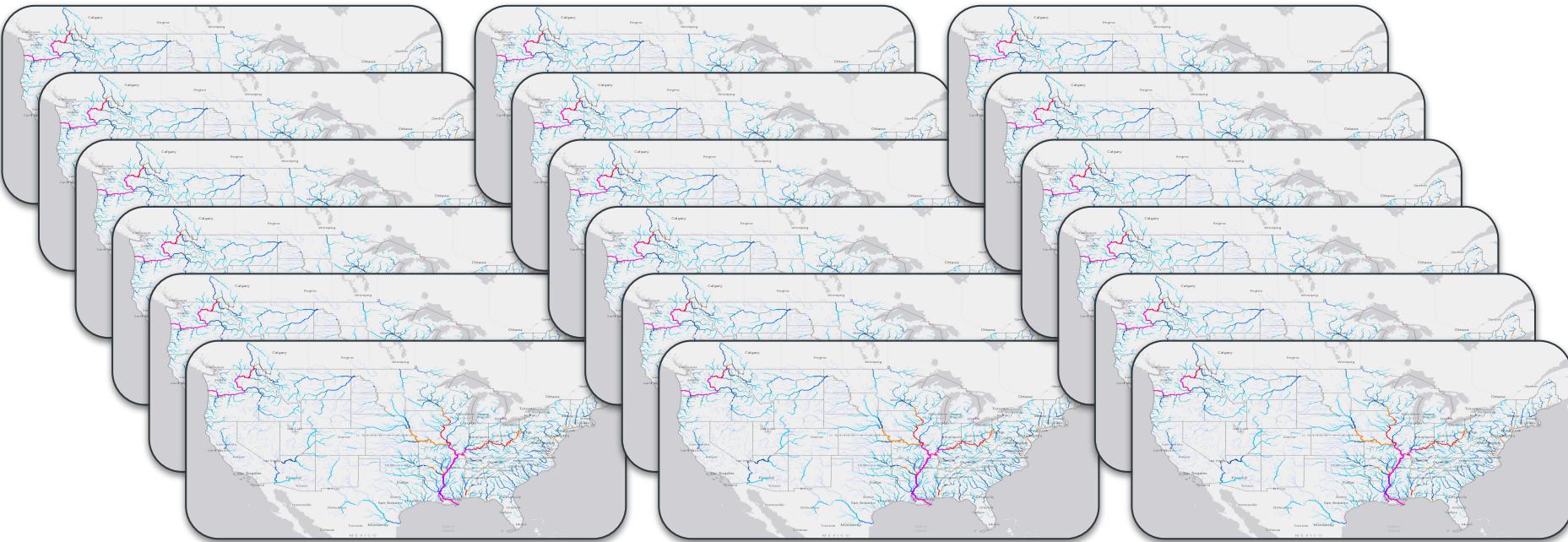
¹ Concept of Operations (CONOPS) National Oceanic and Atmospheric Administration, National Weather Service, Office of Water Prediction, National Water Center, Water Prediction Operations Division

National Water Model (NWM)



- The National Water Model (NWM) revolutionizes how hydrologic guidance is developed and delivered, providing both complementary and first-time spatial coverage and product type
- **NWM: Guidance at 2.7 million/(3.4 million river miles) NHDPlus river segments, filling in coverage**
- **River Forecast Centers: Authoritative forecasts at ~3,600 RFC Points**
- **What's next from the NWM?**

1TB/Day



18 time steps x 24 forecasts for
the NWM Short Range Forecast
per day

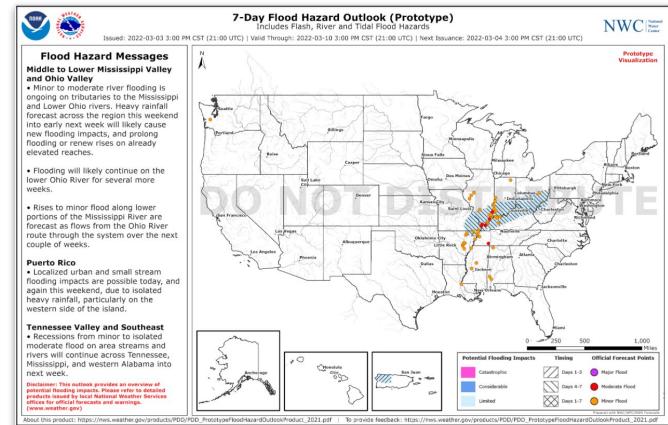
- **How do we extract actionable intelligence from that much of data?**
- **70+ services**
- **How do we communicate the NWM output to forecasters and decision-makers?**



Flood Hazard Outlook (FHO)

Status: Prototype

- High-level, “heads up” infographic conveying potential flood impacts over the next seven days. Intended to provide comprehensive and consistent messaging for various flood hazard impacts (e.g., flash, urban, small stream, riverine, and tidal flooding).
- **Two versions:** National and Tropical (as needed for Atlantic-basin storms)
- **Audience:** National and regional-level briefers and water partners
- **Future availability:** website 2x a day
 - GIS service / static graphic
- Experimental and publicly available: Fall 2022



Flood Hazard Outlook (FHO)

Impact Categories

Limited

Base flash flooding and/or minor river flooding is expected

- Flash flooding with base to isolated considerable IBW tags. Minor to isolated moderate river flooding. In general, minimal or no widespread property damage, but possibly some public threat (e.g., inundation of roads). Local water rescues may occur, but are limited to evacuations of cutoff areas or isolated swift water rescues.

Considerable

Significant flash flooding and/or moderate river flooding is expected

- Flash flooding with numerous considerable IBW tags, along with widespread moderate to scattered major riverine flooding possible. Impacts include widespread inundation of roads and structures, evacuations of people and/or transfer of property to higher elevations. Numerous swift/high water rescues may be possible.
- Messaging of widespread, life threatening flooding that may occur and that urgent actions may be needed to prepare for flooding.

Catastrophic

Exceedingly rare and widespread flash flooding and/or major river flooding is expected

- Flash flooding with numerous considerable IBW tags is likely, with multiple catastrophic tags possible. Widespread major riverine flooding, with "floods of record" possible. Impacts include extensive inundation and/or destruction of roads and structures, significant evacuations of people and/or transfer of property to higher elevations. Water rescues of a significant number of persons is likely and overwhelming of area and regional resources is possible (i.e., rooftops rescues).
- Messaging includes high end, life-threatening flooding, with significant disruptions to daily life likely.





Issued: 2022-04-23 04:00 PM CDT (21:00 UTC) | Valid Through: 2022-04-30 04:00 PM CDT (21:00 UTC) | Next Issuance: 2022-04-24 04:00 PM CDT (21:00 UTC)

NWC National Water Center

Flood Hazard Messages

Northern Texas through Ozarks

- Across parts of eastern OK, northern AR, and southern MO, considerable flash, urban, and small stream flooding is possible Monday into Monday night.
- Heavy rainfall Sunday into early next week will cause flash, urban, small stream, and isolated riverine flooding impacts.

Northern Plains and Upper Midwest

- Across the Red River of the North Basin, considerable flooding impacts, including moderate to major river flooding, is likely into early next week.
- Snowmelt and rainfall are expected to produce flooding along rivers and streams through this weekend.

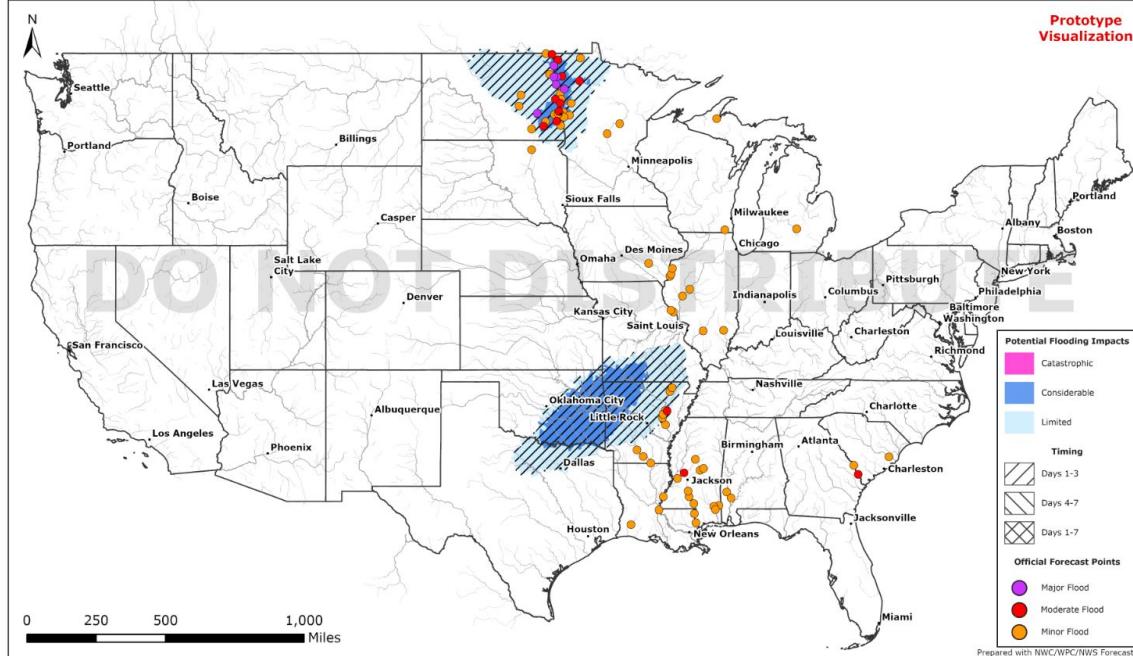
Middle and Lower Mississippi Valley

- Widespread river flooding impacts are ongoing from previous heavy rainfall, with additional rises expected into next week.

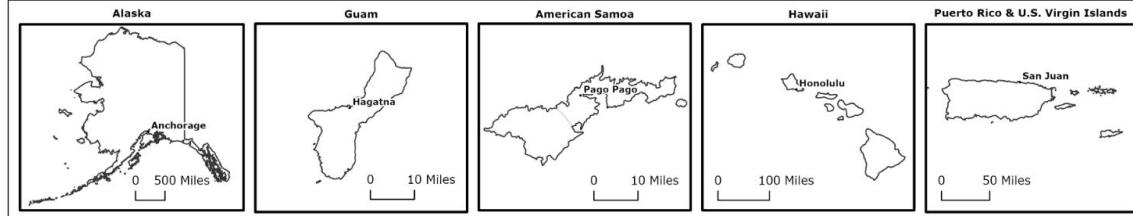
7-Day Flood Hazard Outlook (Prototype)

Includes Flash, River and Tidal Flood Hazards

Prototype Visualization



Disclaimer: This outlook provides an overview of potential flooding impacts. Please refer to detailed products issued by local National Weather Services offices for official forecasts and warnings.
www.weather.gov





Hurricane Ida 7-Day Flood Hazard Outlook (Prototype)

Includes General Flash and River Flood Hazards

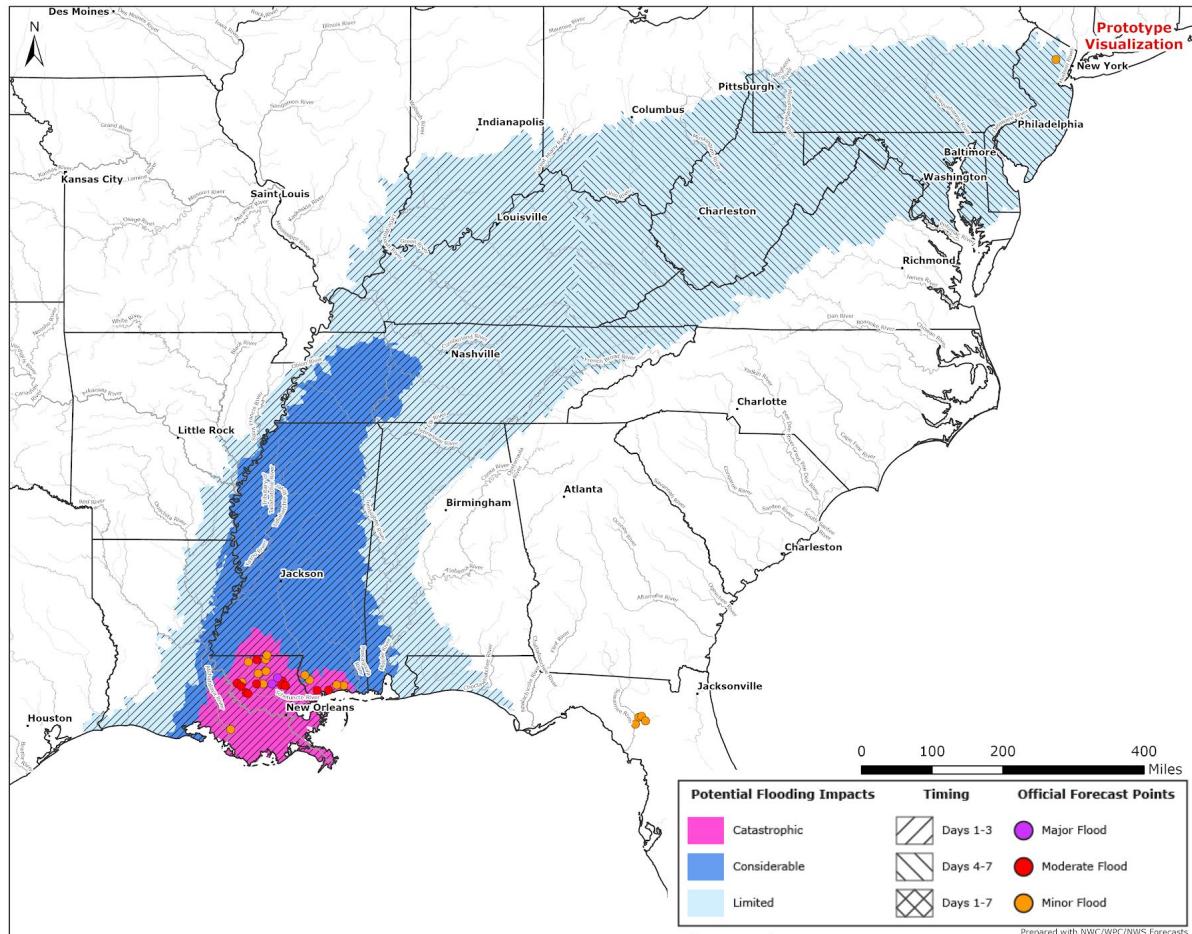
NWC
National Water Center

Issued: 2021-08-28 4:00 PM CDT (21:00 UTC) | Valid Through: 2021-09-04 4:00 PM CDT (21:00 UTC) | Next Issuance: 2021-08-29 6:30 AM CDT (11:30 UTC)

Flood Hazard Messages

- Catastrophic, life-threatening flash and urban flooding impacts and significant riverine flooding impacts are possible Sunday through Monday in southeastern Louisiana and coastal Mississippi in response to 8 to 16 inches of rainfall, with isolated amounts of 20 inches from Hurricane Ida.
- The National Hurricane Center (NHC) is forecasting the possibility of dangerous, life-threatening inundation from storm surge along the central Gulf Coast. For a depiction of areas at risk, please see the Storm Surge Watch/Warning graphic available at [hurricanes.gov](#).
- Considerable flash, urban, small stream and riverine flooding impacts are expected across inland portions of Louisiana, Mississippi and far southwestern Alabama Sunday through Monday.
- As Ida continues to move inland across the Lower Mississippi Valley and into the Tennessee Valley, considerable flash and riverine flooding impacts are likely Monday through Tuesday in response to 4 to 8 inches of heavy rainfall.
- In the Ohio Valley, southern and central Appalachians, and into the Mid-Atlantic, limited flash and riverine flood impacts are possible Wednesday through Saturday.

Disclaimer: This graphic is intended to provide a general flash and river flood hazard outlook. It is not intended to depict coastal flood risk due to storm surge. Please refer to the detailed products issued by local National Weather Service offices for official forecasts and warnings ([www.weather.gov](#)).



Flood Hazard Outlook (FHO)

Future



- Experimental product
 - AHPS Maximum Forecast Trend service
 - Allows for limited zooming, display of days 1-3, 4-7 and 1-7, AHPS points toggle on/off
 - Eventually will be daily breakdown
 - Static National and Tropical maps still available
 - Rest services available
- Re-introduce ongoing flooding service
- Sunset NWS Significant River Flood Outlook Product
- Drive the NWS Graphical Hazardous Weather Outlook for flooding



National Hydrologic Discussion (NHD)

Status: Prototype

- Forecast **discussion** for observed, modeled, and expected hydrologic conditions for the United States days 1-10
 - NOT a National Water Model (NWM) diagnostic discussion
 - Uses all available resources and forecaster knowledge to produce
- **Audience:** internal and external water information users
- **Future Availability:** website 1-2 per day
- Experimental and publicly available: Fall 2022

PROTOTYPE DISCUSSION

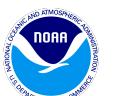
National Hydrologic Discussion #0075
NWS National Water Center Tuscaloosa AL
Issued 10:15 AM CDT Wednesday, March 16, 2022
Valid 03160600Z - 03270600Z

Synopsis...
Ongoing river flooding with potential new flooding impacts late week across the [Gulf Coast and Southeast...](#) Minor river and small stream flooding possible across portions of the [Northeast...](#) River flooding persists in the [Middle to Lower Mississippi and Ohio Valleys...](#) Snowmelt and new bankfull signals this week in the [Upper Midwest and Great Lakes...](#)

Discussion...

Gulf Coast and Southeast...
Minor flooding is ongoing or forecast across portions of the Calcasieu (LA), Pearl (MS/LA), Yazoo (MS), Big Black (MS), St. Mary's (FL), and Santa Fe (FL) rivers in response to recent rounds of rainfall. Most rivers will remain in minor flood through early next week.

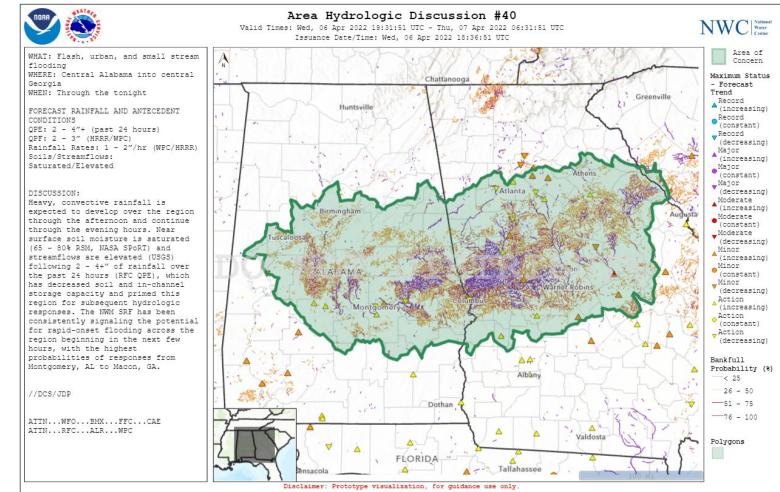
Another system will move across the region days 2 - 3 (Thu - Fri) bringing an additional 1.0 - 1.5" of rain (WPC). While little hydrologic impacts are expected from its passage, the system will keep soils primed for a second, more hydrologically significant system that may affect rivers and streams beginning day 6. The National Water Model (NWM) Medium Range Forecast (MRF) continues to indicate a potential for new and renewed rises along with bankfull and higher flows beginning day 6 (Mon) across portions of the Southeast in response to a slow-moving system that may bring 2 - 4" of rain (WPC). While confidence is increasing in the occurrence of an event, there is uncertainty in the placement of the signals. Latest GFS-forced NWM MRF data suggests that the more sensitive areas across northern MS and AL may be



Area Hydrologic Discussion (AHD)

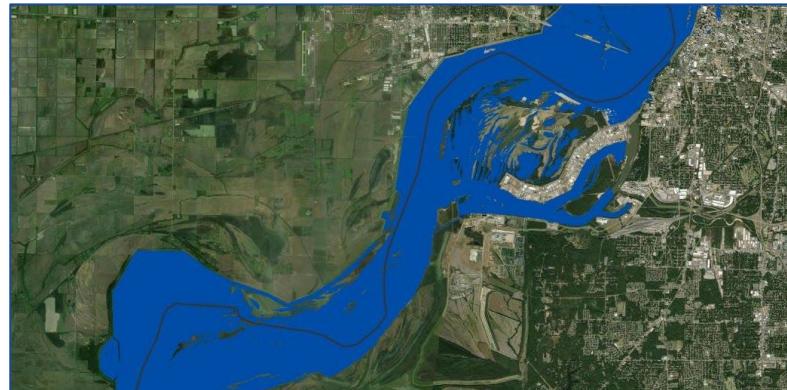
Status: Internal Prototype

- The AHD provides short term guidance for locations that may experience rapid-onset flooding, with an ideal lead time of 2-6 hours in advance of most flash, urban, and small stream flood events.
- Audience:** NWS field offices to aid in the flash flood watch and warning decision making process.
- Future availability:** NWC website (as-needed)
- Experimental and publicly available: ~Fall 2022

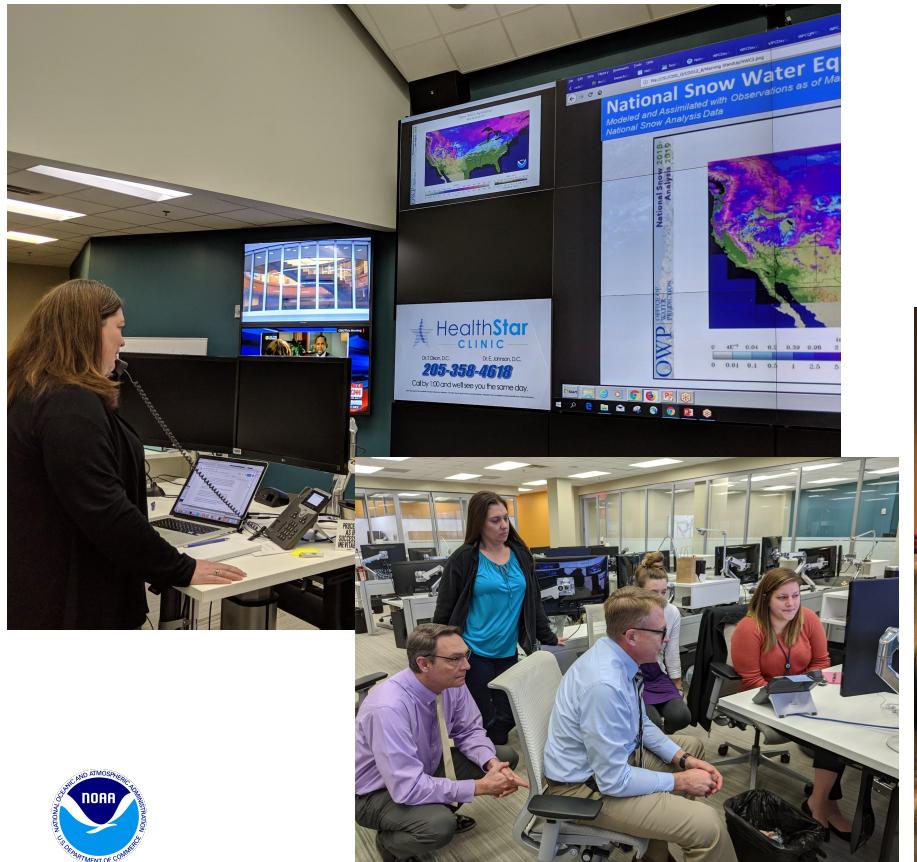


Flood Inundation Mapping

Model Source	Spatial Resolution	River Miles
RFC	At and downstream of ~3800 RFC forecast points	104K
NWM	NHDPlus stream network	3.4M



Being the First



Summary

- Marching towards full operating capability (24/7 operations)
 - We are hiring ([usajobs.gov](https://www.usajobs.gov)).
- NWM map services and NWC products are vital for flood impact-based forecasting.
 - “Experimental” products becoming available to the public in 2022 to collect comments and feedback.

Additional AWRA talks about NWM and amazing work conducted at NWC:

- **Computing Height Above Nearest Drainage with Lower Resolution Stream Networks Improves the Performance of Flood Inundation Maps**, Fernando Aristizabal, April 27, 10:30 am - 12:00 PM, Rast B
- **Using GIS to Evaluate National Water Center FIM in Real-Time**, Monica Stone, April 27, 10:30 AM - 12:00 PM, Rast B



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