

# BAYOU BULLETIN

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## Welcome to the Lower Mississippi River Forecast Center Newsletter!

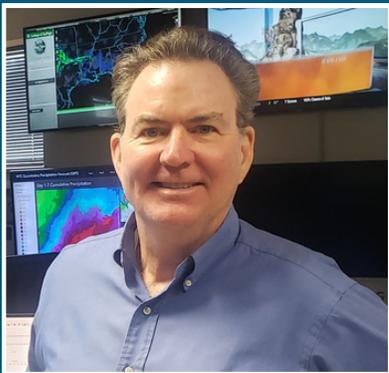
### INSIDE THIS ISSUE

- A Note From the HIC, page 1
- Overview of the 2023 MS River Drought, pages 2-3
- NWPS Replaces AHPS For Water Data, pages 3-4
- Flood Inundation Mapping, page 5
- WaterAware Hydrology Outreach Initiative, page 6
- HEFS Probabilistic River Forecasting, page 7
- LMRFC About Us Storymap, page 8

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### A NOTE FROM NEW LMRFC HYDROLOGIST-IN-CHARGE, KEVIN KOTUN



One of our past presidents once said that the nine most terrifying words in the English language are “I’m from the government, and I’m here to help”, but at the National Weather Service, that’s what we do. Our mission is to help our fellow citizens get the information they need to protect themselves, their loved ones and their property. It’s an easy mission to buy-in to and I am proud to be one of the newest members of this world-class team.

I’ve had a wide range of experience over the course of 33 years working at the US Geological Survey, National Park Service, Miami-Dade County as well as a short time in the Engineering consulting world. Some of the areas of expertise

that I have developed over the years include hydrologic monitoring, groundwater and surface water modeling, database management and administration, computer programming and data analysis. Most recently, for the last 5 years, I was the director of the Hydrologic Instrumentation Facility where I managed several calibration laboratories as well as a warehouse distribution facility.

Of course, at the LMRFC, our main focus is on issuing forecasts for over 300 sites in the greater lower Mississippi basin, but there are several other projects and initiatives that we are working on too. These include flood inundation mapping (FIM), developing hydrologic ensemble forecasts (HEFS), and updating model calibrations to name a few. We are also engaged with the president’s diversity and equity initiatives and look forward to the upcoming transition of our public facing web-site from the legacy Advanced Hydrologic Prediction Service to the new and improved National Water Prediction Service.

Over the years I have been associated with many groups of talented technical professionals, and after only a month on duty here at the LMRFC, I can tell that this group ranks with the best I have ever had the pleasure of working with. In the coming weeks my goals are to get to know the staff members and further my understanding of forecasting operations. In the coming months, I look forward to contributing to the excellence in forecasting that is the standard at the LMRFC.

# OVERVIEW OF THE 2023 MISSISSIPPI RIVER DROUGHT

by David Welch, LMRFC Development and Operations Hydrologist

For the second year in a row the Lower Ohio and Mississippi Rivers experienced record level low flows and stages. New record low levels that were set in 2022 for locations between Cairo, IL and Memphis, TN were broken again in 2023 with even lower stages. The record low stages in the Fall 2022 were brought about by a flash drought over the Ohio River basin that occurred coincident with seasonally low stages in the September through November timeframe. The low stages caused significant impacts to the navigation industry on the lower Ohio and portions of the lower Mississippi River, creating a backlog of barges waiting to navigate through channel restrictions and dredging. On the Lower Mississippi River, persistent low flow conditions also resulted in salt water intrusion that required the United States Army Corps of Engineers (USACE) to construct a low water sill on the bottom of the Mississippi River near river mile 64 below Belle Chasse, LA for the 4th time. The Mississippi River channel bottom is lower than the Gulf of Mexico and during periods of prolonged drought the momentum of the low flow allows the denser saltwater to encroach up the river affecting salt water intakes from the river used for municipal and industrial use.



Mississippi River, Riverside Park, Memphis, TN, 2023  
Image: Scott Olson, Getty Images



Mississippi River at Memphis, TN, 2023. Image by Scott Martin

In 2023 the Ohio and Mississippi River basin experienced many months of excessive heat and lack of rainfall that caused record setting low stages and flows for the second year in a row, breaking all time records that were set the previous year. Impactful low flow and stages began earlier in 2023 than the 2022 drought, starting in June and persisting into December 2023. Drought conditions resulted in record low stages for a 360 mile stretch of river extending from the lower Ohio River at Cairo down to near the confluence of the Arkansas River. Low stages caused significant impacts to navigation, restricting barge draft and navigable channel lanes causing the USACE

to spend millions of dollars dredging the river to maintain a navigable channel. The plot (**Figure 1**) shows the prior low water stages for low flow events on the Mississippi River at Memphis, TN for 1988, 2000, 2012, 2022 and 2023. While the 2023 low flow year was significant and did set record low stages, the duration and magnitude was still not as impactful as the 1988 year.

For an unprecedented second year in a row the New Orleans USACE had to again construct a low water sill on the Lower Mississippi to prevent the encroachment of salt water further up river for the 5th time in history. An initial sill was constructed beginning July 11, 2023 at river mile 64 to prevent the encroachment of a salt water wedge upriver. After prolonged low flow, the sill was in danger of being overtopped and had to be augmented on September 20, 2023 to a higher elevation, leaving a notch in the sill for a 55 feet deep navigation channel 620 feet wide. Following that, concerns about persistent low flow, additional over-topping of the sill and upstream migration of the salt wedge also lead the USACE to develop contingencies for barging in water to mix with municipal water intakes further up river through New Orleans to prevent impacts to municipal water use.

Mississippi-Memphis (MVDhist-rev)  
 Memphis-Mississippi.Stage.Inst.-1Day.0.MVDhist-rev  
 POR Date 01-JAN-1885 to 19-DEC-2023

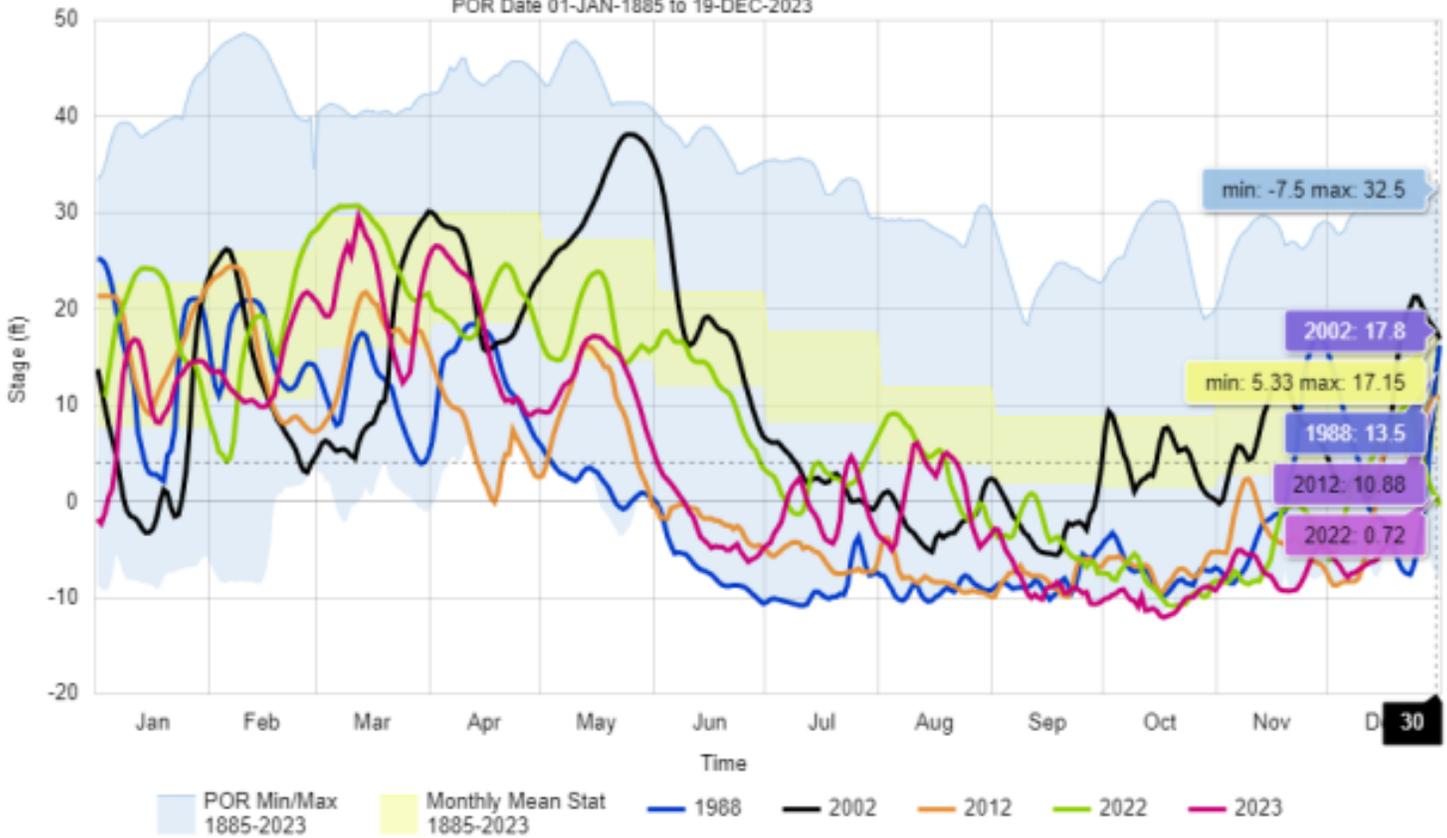


Figure 1. USACE Mississippi Valley Division, low water stages for low flow events on the Mississippi River at Memphis, TN for 1988, 2000, 2012, 2022 and 2023

## NATIONAL WATER PREDICTION SERVICES (NWPS) TO REPLACE AHPS by Alexis Highman, LMRFC Hydrologist

The National Weather Service has delivered water resource forecast products and services via the Advanced Hydrologic Prediction Service (AHPS) for over 20 years. The National Water Prediction Service (NWPS) is a new Next Generation gateway to NWS water data and river forecast information. It has more flexible options and layers to help you analyze the hydrologic situation in any area. New features will include real-time river observations and forecasts, precipitation estimates, and improved meteorological and hydrological data. The NWPS webpage (**Figure 2**) will be fully operational by Spring 2024.

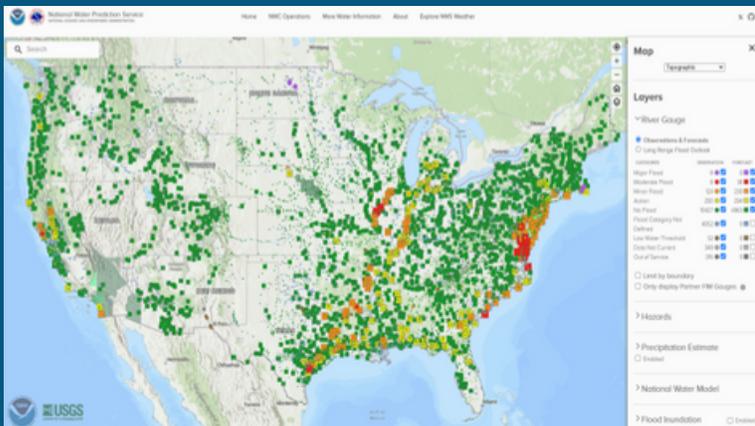


Figure 2 - Modernized NWPS (National Water Predictions Service)

By default, the NWPS map depicts current NWS river gauge location observations shown as circles and color-coded by their current flood category. The default map also displays any river gauge locations that are forecast to exceed the action stage as squares, color-coded by the highest flood category they are forecast to reach.

There are a variety of functions and information throughout this modernized website. NWPS incorporates a new dynamic display for a given river gauge location (**Figure 3**). Below the hydro-

graph display, there are more options to choose from; the user can scale the hydrograph's vertical axis to show all flood categories. The hydrograph is feature-rich, with a data readout of current and forecast values provided by the U.S. Geological Survey shown in **Figure 3**. The user can also choose to turn off the observed, the forecast, and the record flood stage listing. The table in the bottom right of **Figure 3** lists the values of action, minor, moderate, and major flood stages for that gauge location.

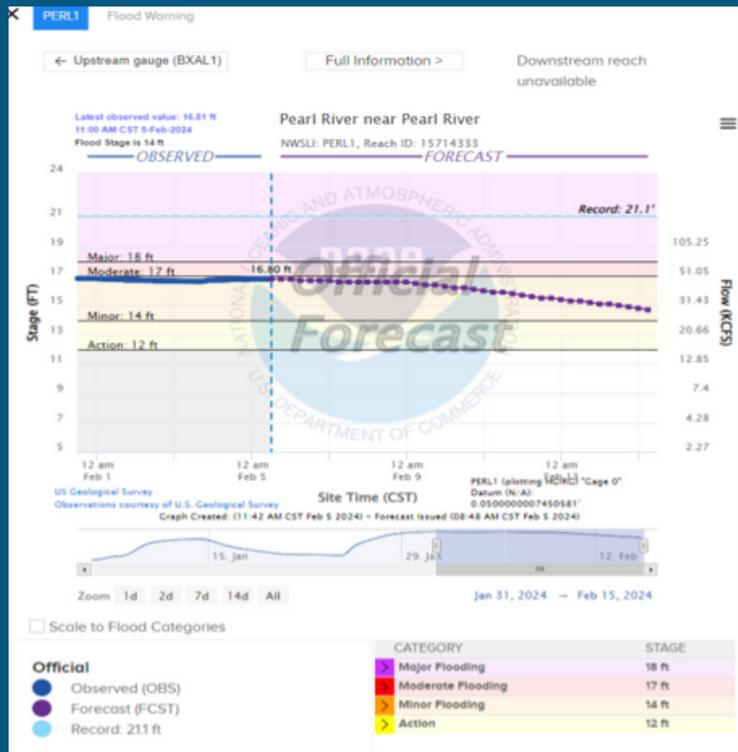


Figure 3 - Hydrograph display when a gage location is selected

Several map choices and layers are available to include in the main map display (right side of **Figure 3**). The user can select different hydrologic layers to provide a custom viewing experience. The choices available include River gauge, Hazards, Precipitation estimation, National Water Model, Flood Inundation, National Snow Analysis, and Administrative Boundaries. Under the Hazards layer, users can choose to display all NWS products currently in effect (**Figure 4**).

In addition, all NWPS data is available via the new NWPS Application Programming Interface (API), which allows users to include NWPS information directly into their applications and services (**Figure 5**).

In conclusion, NWPS is a valuable tool for daily River Forecast Center (RFC) operations for hydrology and meteorology. Its real-time river observations and forecasts, improved meteorological and hydrological data, and dynamic display options make it an indispensable resource. Additionally, the NWPS API allows users to include information directly into their applications and services, making it even more accessible and useful. New NWPS users can confidently make informed decisions about hydrological and meteorological situations in their area.

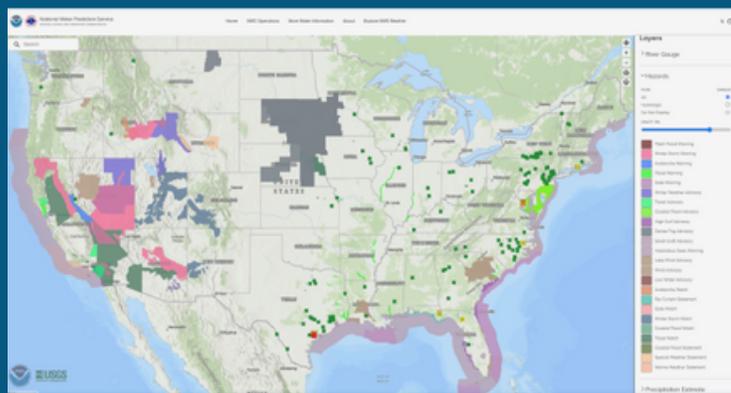


Figure 4 - Modernized NWPS (National Water Predictions Service)

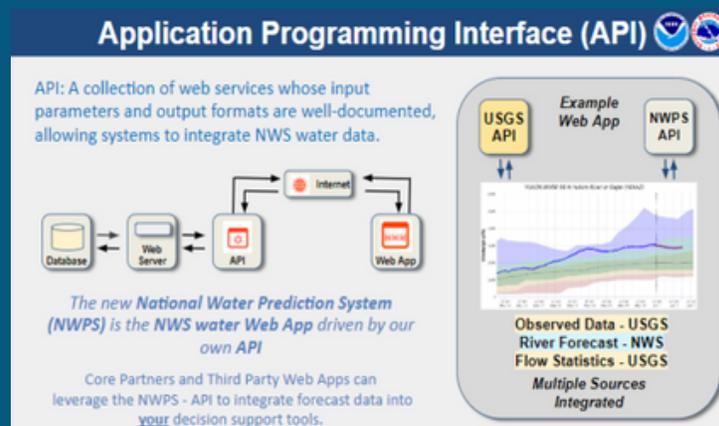


Figure 5 - The NWPS API Interface

# FLOOD INUNDATION MAPPING (FIM)

by Taylor Barnhart, LMRFC Hydrologist, and Emilie Nipper, LMRFC Senior Hydrologist

One of the most critical and sought after pieces of information by emergency and water resource managers and local governments before, during and after flooding events are maps depicting the spatial extent and depth of flood waters.

There has been a growing need for real-time, detailed, actionable, street-level flood inundation maps (FIM) to show the areal extent, depth, and infrastructure impacted by flood waters. LMRFC is lucky enough to be part of the initial release of National Water Center Flood Inundation Mapping (FIM) services.

A small portion of our forecast area in Northeast Texas, including the forecast locations of the North Sulphur River near Cooper (CPPT2) and the South Sulphur River near Cooper (COPT2), were included in the initial release of public FIM services in September 2023. A majority of our area is included in the next implementation area, which will have access to FIM services in October 2024.

There are 3 FIM services available:

1. National Water Model (NWM) Latest Analysis
2. River Forecast Center (RFC) 5-Day Maximum Inundation Forecast
3. NWM 5-Day Maximum Inundation Forecast.

The NWM Latest Analysis shows any current flooding, while the NWM 5-Day Maximum Inundation shows the highest potential flooding over the next 5 days using only the National Water Model. The RFC 5-Day Maximum Inundation Forecast utilizes our river forecasts to show the maximum extent of flooding over the next 5 days. These services can be viewed on the [National Weather Service GIS Viewer](#). Further information regarding these FIM services can be found on this [StoryMap](#).



# WATERAWARE - A NWS HYDROLOGY OUTREACH INITIATIVE

by Amanda Roberts, LMRFC Senior Hydrologist



Flooding and drought are responsible for more fatalities and are more costly than any other weather related phenomena. The best way to diminish damage to life and property due to these disasters is to provide education to all ages on flood safety, drought mitigation, and the science behind NWS river and flood forecasts. WaterAware serves as the new national NWS hydrology outreach program. The initiative supports a oneNWS posture for a water ready public with outreach materials spanning the temporal scales of water resource issues; from flash flooding, flood inundation, and dam breaks to drought, snowmelt runoff, and water supply. The collaboration maintains a volunteer base across the NWS for a mutual-aid like group of on-demand hydrology outreach representatives who are scheduled for in-person or virtual events across the country for ages K-adult.

The idea for a NWS hydrology outreach team began right here at LMRFC, where senior hydrologist Amanda Roberts saw a need to solidify, simplify, and synthesize hydrology outreach for NWS field offices, encourage the recruitment of minorities in water science degrees and careers, and educate students and the public on water resources. Amanda put out a call for interested parties, and ultimately teamed up with the very talented West Gulf River Forecast Center (WGRFC) Senior Hydrometeorologist, Belkys “Bel” Melendez, to co-lead the national team. The team now consists of 28 members from across the nation. In just a little over one year, WaterAware has used their team member’s subject matter expertise to create educational presentations for ages K-adult on a variety of hydrology related topics (see fliers below) and has led live sessions to educate over 3,000 students and adults! We are also proud to announce that WaterAware received a National Cline Award for our hard work and innovation in creating a unique team that has set the stage for hydrology outreach success across the NWS!

**WATERAWARE**  
A National Weather Service Hydrology Outreach Initiative

**FREE**  
FOR ALL AGES!  
SCAN TO BOOK NOW!

**HYDROLOGY**  
& Water Resources Educational Programs

Junior Hydrologist Grades 7-12	Hydro Hotseat Ages 12-Adult	Independent Topics Ages K-Adult
<p>Attend 4 sessions in 6 months for a certificate!</p> <p>Choose from topics like:</p> <ul style="list-style-type: none"> <li>River Basics</li> <li>Floods &amp; Flood Safety</li> <li>Drought</li> <li>Water Supply</li> <li>River Forecasting</li> <li>Flash Flooding</li> <li>Dams and Dam Breaks</li> <li>And Much More!</li> </ul>	<p>Learn about all the tools hydrologists use to forecast rivers, then become the forecaster yourself with our Hydro Hotseat forecaster simulation!</p> <p>You'll use a real-life flooding scenario to forecast river stages!</p>	<p>Select one or more topics:</p> <ul style="list-style-type: none"> <li>River Basics</li> <li>The Water Cycle</li> <li>Floods &amp; Flood Safety</li> <li>Drought</li> <li>Water Supply</li> <li>Dams and Dam Breaks</li> <li>Flash Flooding</li> <li>Probabilistic Forecasting</li> <li>Ice Jams/Snowmelt</li> <li>River Forecasting</li> <li>And Much More!</li> </ul>

Register Anytime for Virtual or In-Person Sessions!

Questions? Email [amanda.roberts@noaa.gov](mailto:amanda.roberts@noaa.gov) or [belkys.melendez@noaa.gov](mailto:belkys.melendez@noaa.gov)

**JUNIOR TRIBAL HYDROLOGIST PROGRAM**

**WATERAWARE**  
A National Weather Service Hydrology Outreach Initiative

- FREE virtual courses provided by professional hydrologists for ages 12+
- Attend 4 training sessions to earn a certificate!
- Start your path to becoming a tribal hydrologist for your Native community!

Scan the code or email [amanda.roberts@noaa.gov](mailto:amanda.roberts@noaa.gov) to sign up!

Learn about rivers, the water cycle, floods & flood safety, river forecasting, and more!

**HYDRO HOTSEAT**

**YOU'RE THE FORECASTER!**

Learn about the tools needed to forecast rivers, then create your own forecast with the help of our professional hydrologic forecasters!

Scan to Schedule

Student and adult levels available!

Hydro Hotseat is part of WaterAware, a National Weather Service Hydrology Outreach Initiative

# HYDROLOGIC ENSEMBLE FORECAST SERVICE (HEFS) AT THE LMRFC

by Kai Roth, LMRFC Senior Hydrologist

The National Weather Service Hydrologic Ensemble Forecast Service (HEFS) is an ensemble approach to river forecasting. HEFS has the capability of generating forecasts that span anywhere from hours to months seamlessly. It attempts to correct for total flow uncertainty and biases in meteorological forcings. HEFS provides not just one deterministic forecast but a range of possible forecasts. By providing a range of outcomes, an ensemble approach can help decision makers plan for upcoming flood events and prepare appropriately.

The LMRFC HEFS runs daily, using 12Z data in the late morning and posts to the web around 2:00 PM. We are considering adding a 00Z initialization to run overnight to capture more current trends. We currently use WPC QPF out to 3 days, GEFSv12 out to 15 days, and climatology beyond that out to 90 days as the meteorological inputs. The LMRFC HEFS uses a historical range from 1990-2021. The HEFS on the Mississippi, Red and Arkansas Rivers use an ensemble range from 1990-2011 which are dependent upon upstream handoffs, but may update later depending upon available upstream forcings. The HEFS Mississippi short-range plots display a 28 day forecast while the rest of our HEFS short range plots have a 10 day plot.

The short range graphics can be found on the LMRFC's [website](#) in several locations. First there is a link to CBRFC's [ensemble map](#) on our homepage under "River Observations and Forecasts" (**Figure 7**). The default status map displays the 50% chance of exceedance for flows, but allows the user a wide range of functionality to select (10, 30, 50, 70 and 90% exceedances for 5, 10, 15 and 20 days for both Stage and Flow). The HEFS graphics are also located on the AHPS [hydrograph pages](#) under the "Probability Information" and click "Short-Term Probability Guidance (Experimental)" tab (see **Figure 8**).

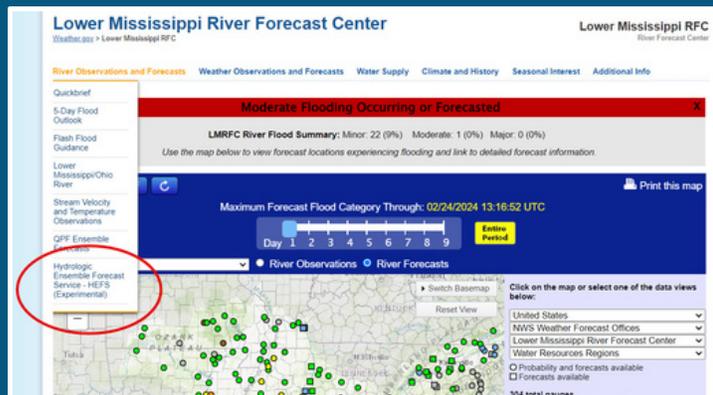


Figure 7 - Accessing HEFS from LMRFC's Front Page



Figure 8 - Accessing HEFS from an AHPS Hydrograph

When looking at **Figure 9**, there is a 50% chance of the river rising to within the blue shaded area. There is an 80% chance that the river will be within the blue and green shaded area with a 10% chance that the river will exceed the green shaded area. There is a 90% chance that the river will rise to be within the blue, green, or tan shaded area, with a 5% chance that the river will exceed the tan shaded area. The gray dotted line is the official single valued deterministic forecast. For more information, refer to the [HEFS Fact Sheet](#).

Single valued deterministic forecasts are known to be imperfect with inherent errors and biases. The HEFS attempts to account for biases and create a range of forecasts to help decision makers and property owners prepare for a flood event.

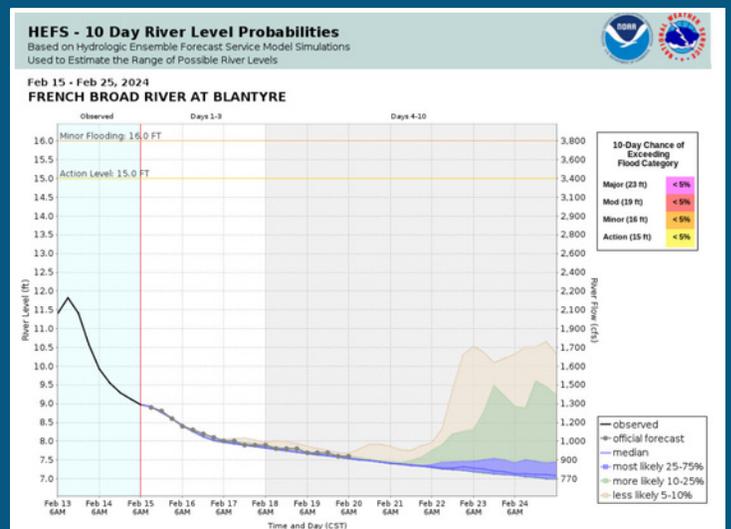
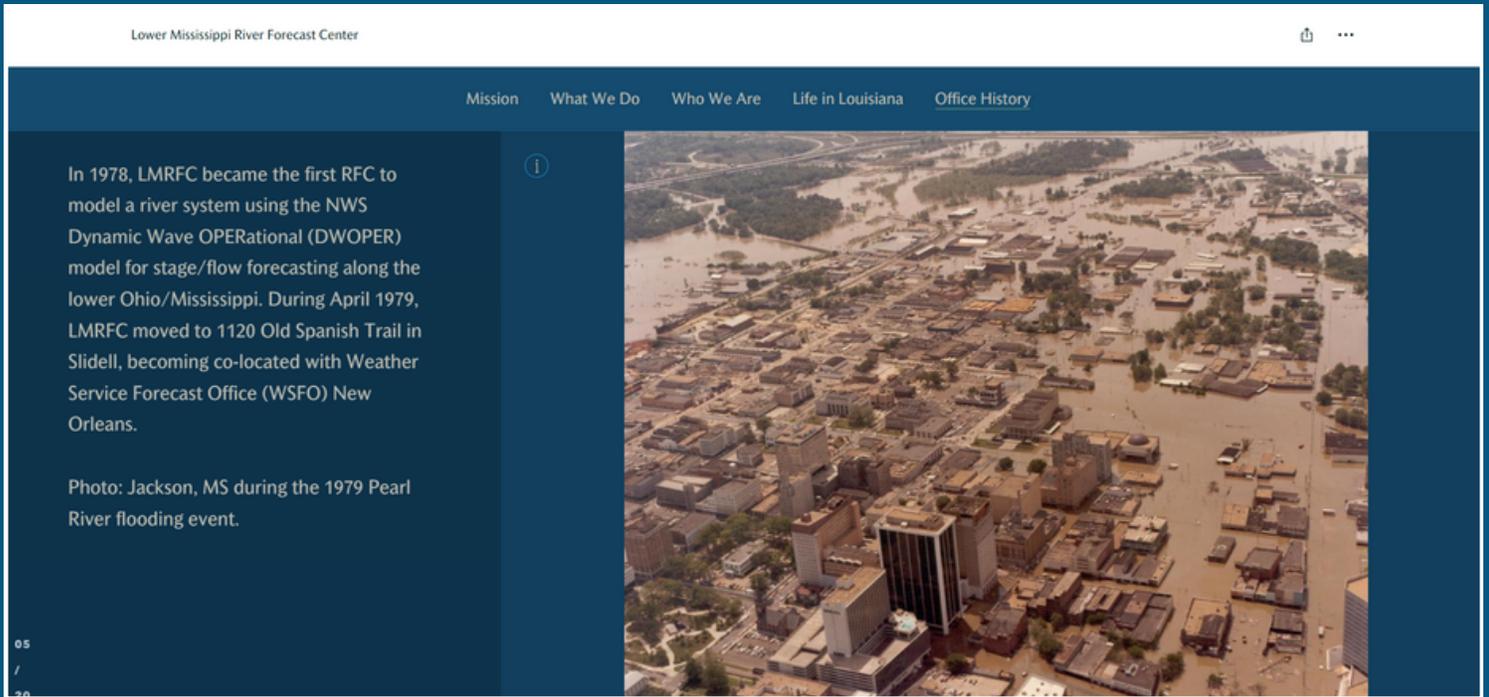


Figure 9 - Sample HEFS Plot for Blantyre, NC

# LMRFC ABOUT US STORYMAP

by Taylor Barnhart, LMRFC Hydrologist

In an effort to help showcase the great people, offices, and spectacular locations the National Weather Service (NWS) has to offer, an agency-wide effort to create ArcGIS Online storymaps for each NWS office was undertaken this past year. The goal of these storymaps is to help with recruitment purposes, and to showcase our offices. All of these storymaps, as well as links to hiring resources, are consolidated into a [single storymap](#) that links to each individual office's. A storymap about LMRFC was finalized on January 7, 2024 and can be found at this [link](#). This storymap includes sections on our mission, what we do, who we are, life in Louisiana, and office history. We hope that this storymap allows everyone to learn a bit more about LMRFC - and it may even convince you to come work with us.



*Thanks for reading our newsletter! Stay tuned for our next issue!*

UNTIL  
NEXT  
TIME!

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