OWP | OFFICE OF WATER PREDICTION

Website: https://water.noaa.gov
Email: nws.nwc@noaa.gov
Locations: Tuscaloosa, AL – Silver Spring, MD – Chanhassen, MN

FIM10:
Public FAQ Document

TABLE OF CONTENTS

INTRODUCTION TO INUNDATION MAPPING

What is a Flood Inundation Map (FIM)?

A flood inundation map depicts the areal extent of water that has overtopped the banks of a river, creek or stream. Flood inundation maps are used to communicate where water has been, where water is at present or where water may be in the future. Flood inundation map information can be shared in many ways. The information can be presented as a static paper (i.e. printed) or digital (e.g. PDF) map, can be viewed via a web-based mapping application, or consumed as a "map service" that can be ingested into your own geospatial application. Individuals who view maps via web-based mapping applications can zoom-in to the neighborhood scale and see where water covering the land surface may be present or where it is forecast to occur.

How can I get a quick summary of the different Flood Inundation Map (FIM) services from the National Weather Service (NWS)?

Information on NWS FIM services is available on the NWS Office of Water Prediction website at https://www.weather.gov/owp/operations, where there is a document with a table summarizing the (3) experimental inundation maps being provided (i.e. latest conditions derived from the National Water Model output, 5-day maximum derived from the National Water Model forecast, 5-day maximum derived from the River Forecast Center forecast).

How can I learn more about the individual types of Flood Inundation Maps (FIMs)?

Information on National Weather Service (NWS) flood inundation maps is available on the NWS Office of Water Prediction website at https://www.weather.gov/owp/operations. A document is available for each of the three inundation services:

1) National Water Model Analysis and Assimilation (latest conditions based on estimated rainfall to date)
2) National Water Model 5-Day Maximum Flood Inundation Forecast
3) River Forecast Center 5-Day Maximum Flood Inundation Forecast

Your local NWS Weather Forecast Office (WFO) and River Forecast Center (RFC) can also assist in learning how to utilize the experimental inundation maps. These maps can be viewed through a web-based application or through the integration of a map service, as explained in information sheets also available on this website.

What areas of the country have National Weather Service (NWS) Flood Inundation Maps (FIMs)?

The NWS has begun a multi-year effort to expand the availability of high-resolution FIM datasets to provide near real-time FIM analyses and FIM forecasts for freshwater locations. Starting September 26, 2023, FIMs are provided for an area that encapsulates 10% of the United States population. The 10% area includes portions of Texas, Pennsylvania, and New York State and is collectively referred to as the "FIM10" area. For more information on the availability of FIM, click here. These new maps cover the complete river and stream network in a given area, complementing the maps for about 200 locations around the country already available at: https://water.weather.gov/ahps/inundation.php.

Are Flood Inundation Maps (FIMs) generated for all rivers and streams within an area?

The National Weather Service's (NWS) FIMs depict predicted inundation along rivers and streams. Inundation maps generated from the National Water Model (NWM) forecasts cover every stream or river segment as defined by the National Hydrography Dataset-Plus (NHDPlus) river network. Some small basin areas may never depict inundation because the basin does not contain any stream channel within its boundaries. This can occur in urbanized areas (e.g. areas in Albany west of the Hudson). Inundation maps generated from NWS River Forecast Center (RFC) forecasts cover the river segments downstream from the RFC forecast locations, extending until the river encounters an influential confluence with another river or the river enters a reservoir or major water body.

Are Flood Inundation Maps (FIMs) generated for all streams or rivers all the time?

Inundation is only computed and shown when the flow through a river or stream is above a predefined threshold. If the estimated flow level is not above the threshold for the river segment of interest, inundation will not be shown. For inundation based on National Weather Service (NWS) River Forecast Center forecasts, the threshold flow is based on the "action" flood level defined for the given location. For inundation based on the National Water Model (NWM) forecasts, the threshold flow is the flow associated with a regionally varied annual exceedance probability (AEP) (e.g. 65%, 70%, 80% etc.) that is derived from the 40-year retrospective simulation of the NWM.

Moreover, inundation is only presented for areas served by the initial September 2023 release, which focuses on areas around Texas, parts of the Mid-Atlantic, and Western New England.

How can National Weather Service (NWS) Flood Inundation Maps (FIMs) be consumed?

NWS FIMs can be visualized using the NWS National GIS Map Viewer, "the Viewer", or by integrating the NWS FIM services into your own geospatial web or desktop application. Instructions can be found on the NWS Office of Water Prediction website, https://www.weather.gov/owp/operations.

How are the National Weather Service (NWS) Flood Inundation Maps (FIM) produced?

Estimated precipitation and forecasted precipitation are used along with a hydrologic model, to predict streamflow along rivers and streams. The models used for these inundation maps include the regional NWS River Forecast Center (RFC) model and the National Water Model (NWM). Modeled streamflow conditions or forecasts are used in conjunction with information defining the elevation of the land adjacent to the river or stream, through use of a terrain index. The terrain index is generated using a geospatial process referred to as the Height-Above-Nearest-Drainage (HAND) method. The relationship between the stream level and the surrounding land elevation is used to generate flood inundation coverage that estimates the spatial extent of water over the terrain.

Do these Flood Inundation Maps (FIMs) use data from established local monitoring stations?

Yes, the inundation derived using River Forecast Center (RFC) and National Water Model (NWM) forecast models incorporates observed discharge or flow rates measured at stream gages, particularly gages maintained by the United States Geological Survey (USGS). This assimilation of observational data improves the model accuracy which then reduces the overall uncertainty associated with the spatial extent of inundation. Moreover, along each river segment, Synthetic Rating Curves (SRCs) are computed by resolving Manning's equation with river or stream channel properties (i.e. the size and shape of the river or stream channel) derived from a Digital Elevation Model (DEM). These rating curves, which relate stream discharge or flow to stream water level, are derived from in-situ observations at USGS gages, which improves extent uncertainty for all FIMs at these locations.

What does it mean for a map to be labeled as "experimental"?

Before NWS products and services are implemented operationally, they are designated as "experimental" to collect feedback from the public and partners. The "experimental" label also indicates that the capabilities may not be available 24x7 if outages or issues occur. Using the feedback collected, "experimental" services are actively evaluated and improved. Feedback on the "experimental" FIM services is encouraged. Visit https://www.weather.gov/owp/operations to provide feedback.

How often are the National Weather Service (NWS) Flood Inundation Maps (FIMs) produced/updated?

The FIMs derived from the National Water Model (NWM) Analysis and Assimilation configuration update every hour as the NWM updates. The FIMs derived from the NWM Medium Range Forecast (i.e. 5-day max FIM) update every 6 hours. Finally, the FIMs derived from the River Forecast Center (RFC) forecasts update every hour.

When will the National Weather Service (NWS) Flood Inundation Mapping (FIM) services be available for other portions of the country?

A FIM overview document is available on the Office of Water Prediction website at https://www.weather.gov/owp/operations. This document contains a map which shows the scheduled implementation of services across the nation through 2026.

INUNDATION MAP INTERPRETATION

How do I interpret a National Weather Service (NWS) Flood Inundation Map (FIM)?

NWS FIM services are experimental visualizations that contain inherent uncertainty regarding the presence and location of predicted inundation. Inundation accuracy can be impacted by errors in precipitation estimates and forecasts, limitations of the hydrologic model and subsequent inundation methods, or other factors, all of which should be considered when interpreting the information. NWS FIM services show the predicted extent of flooding. At this time the services do not depict depth of flooding, but NWS plans to depict depth as part of a future release of this new service. Although some levee information is incorporated into the FIM capabilities, the services may not account for all local levees and do not account for coastal flooding and storm surge. Coastal flooding and storm surge will be incorporated into the FIM services at a later date.
If you have further questions, please contact your local Weather Forecast Office (WFO) or your regional River Forecast Center (RFC). Visit https://www.weather.gov for more information from your local office. Additional information is available on the Office of Water Prediction website at https://www.weather.gov/owp/operations.

Can I use these Flood Inundation Maps (FIMs) to help make decisions during ice jam flooding?

No, National Weather Service (NWS) FIM services rely on models which perform hydrologic routing that do not account for obstructions to flow such as those that occur during ice jams. Therefore, these services should not be used to infer potential impacts during ice jam flooding.

I see on the map that my street/neighborhood is flooded. How should I respond?

The National Weather Service (NWS) Flood Inundation Maps (FIMs) are considered experimental guidance products. If your house or street is an area that depicts flooding on an NWS FIM map, it does not necessarily mean you are or will experience flooding, but does mean that heightened attention and awareness is needed.

If you are viewing the NWS FIM Inundation Extent Analysis map and note that your area is flooded, there may be flooding nearby. If you use the FIM National Water Model (NWM) or River Forecast Center (RFC) Forecast map and note flooding in your area, you should prepare for possible flooding.

Pay attention to NWS watches and warnings and river forecasts in your community. Always listen to and heed advice from local officials. To fully understand the NWS recognition of the flood threat, review any NWS watches or warnings for your area on https://www.weather.gov, or your mobile device through a Wireless Emergency Alert, or via your local media outlets. If your area is under a Flash Flood Warning, consider taking immediate action based on the situation. Flash Flood Warnings are the most severe flooding warning the NWS issues, as they represent areas where rapid onset flooding is occurring or imminent.

What level of accuracy can be assumed from these maps?

The accuracy of the Flood Inundation Maps (FIMs) depends on several factors including the accuracy of the precipitation forecast, the accuracy of the hydrologic forecast, the accuracy of the FIM model and the resolution of the terrain used to derive FIM. As such, please visit https://www.weather.gov and your local Weather Forecast Office's (WFO) webpage or social media profile for official forecast information and guidance. In general, these FIMs

should be used as guidance to raise awareness and to support neighborhood level decision making.

Pay attention to NWS watches and warnings and river forecasts in your community. Always listen to and heed advice from local officials. To fully understand the NWS recognition of the flood threat, review any NWS watches or warnings for your area on https://www.weather.gov, or your mobile device through a Wireless Emergency Alert, or via your local media outlets.

Which of the three Flood Inundation Maps (FIMs) should I use?

The specific FIM that should be used in a particular situation depends on the location of interest and also the time period of interest. For forecast inundation downstream of an official National Weather Service (NWS) river forecast point, the River Forecast Center Maximum Inundation is recommended as it will likely correspond most closely with the official RFC forecast. For forecast inundation along ungauged rivers or streams, the National Water Model 5-Day Maximum Inundation offers the only forecast inundation extent information. If an analysis of the latest inundation extent is sought, regardless of location, the NWM Analysis inundation is likely best-suited, since USGS streamflow observations and best available precipitation observations are incorporated.

What level of decision do you feel can be made using this product?

At this time these National Weather Service (NWS) Flood Inundation Mapping (FIM) services remain experimental and should not be used for critical support decisions without consulting your regional River Forecast Center (RFC) or local Weather Forecast Office (WFO). They can be used as guidance to determine where flooding may be occurring, raise awareness of potential flood threats and support neighborhood level decision making.
Pay attention to NWS watches and warnings and river forecasts in your community. Always listen to and heed advice from local officials. To fully understand the NWS recognition of the flood threat, review any NWS watches or warnings for your area on https://www.weather.gov, or your mobile device through a Wireless Emergency Alert, or via your local media outlets.

INUNDATION MAPPING LIMITATION

How is inundation extent defined between adjacent river basin boundaries?

Inundation is determined within each basin area containing a river reach by using the derived river elevation at the location where the river reach exits its basin, or watershed, boundary. There may be cases where adjacent basin boundaries spatially limit the inundation by not naturally representing overland flow that may occur across basin boundaries. This may occur at the confluence of two rivers or streams. Viewing the inundation with an overlay showing the basin boundaries can be helpful to interpret where the inundation coverage is limited by the use of basin boundaries.

Do National Weather Service (NWS) Flood Inundation Map (FIM) services account for coastal inundation?

This current release does not fully reflect the flood impacts along the coast. This is due to the “backwater effect” that occurs at coastal locations in part as a result of storm surge. When this occurs, water flowing from multiple directions converges at one location, creating an effect where water flows upstream or isn’t able to move downstream. The model currently used to generate the NWS FIM services does not fully capture these backwater effects. Improvements to the model are planned in future upgrades that will account for these impacts.

What is the Coastal Modeling Zone?

The Coastal Modeling Zone represents the area of terrestrial flooding influenced by coastal processes (tides, waves, and storm surge). In these areas, caution should be used when interpreting the inundation extent predicted by the

FIM services as it may not reflect the comprehensive impact of the flood threat. This zone is currently defined by the 10-meter elevation contour above the zero reference point defined by the NAVD88 datum.

How are levees represented in the Flood Inundation Map (FIM) services?

Levees that have elevations defined in the United States Army Corps of Engineers (USACE) National Levee Database (NLD) are “burned” into the digital elevation model used to derive the FIMs. Areas defined as ”levee protected areas” (i.e. leveed areas) in the NLD are “masked” in the FIM in most cases no matter the forecast. However, it is possible that a smaller stream, not protected by the levee, produces inundation within a levee protected area. As such, use caution when interpreting NWS FIMs around levees. Consult your regional River Forecast Center (RFC) and local Weather Forecast Office (WFO) for official forecast information.

What are the differences between floodwalls and embankments?

A floodwall is constructed of concrete or steel and an embankment is earthen material. Both types of levees serve to shield adjacent floodplains from fluvial flooding (i.e. flooding from rivers or streams). Oftentimes embankments will have much larger footprints than floodwalls.

Do the National Weather Service (NWS) Flood Inundation Mapping (FIM) capabilities account for channel shape, depth and bathymetry?

In general, it depends on the size of the river or stream being modeled as well as the resolution of the terrain data feeding the 10-meter Digital Elevation Model (DEM) used to support the NWS FIM capabilities; in some cases, high resolution LiDAR terrain information (e.g. 1-meter) informs the 10-meter DEM and in these cases channel shape information around the channel banks is captured, in particular for larger rivers and streams.

In most cases, true bathymetry information is currently not informing the FIM capabilities today as LiDAR terrain measurements typically do not penetrate the water surface during collection. The NWS is working on incorporating bathymetric information in a comprehensive manner into the FIM capabilities leveraging internal NOAA data sources as well as external data sources, such as the data made available by the U.S. Army Corps of Engineers via the eHydro system. An example of this is reflected in portions of the Ohio River, the lower Allegheny River and the Monongahela River.

What flow is used for the River Forecast Center 5-Day Maximum inundation map (RFC FIM) when the crest in the RFC forecast is beyond 5 days?

The 5-day RFC FIM shows the maximum inundation extent forecasted by the RFC only within the next 5 days. If an RFC issues a longer forecast with a crest beyond the 5 days, it will not be reflected in the 5-day RFC FIM.

What does a River Forecast Center (RFC) 5-day Maximum flood inundation map show if the RFC forecast is only for 3 days?

The 5-day RFC FIM shows the maximum inundation extent of the RFC 3-day forecast. The final forecast value of the 3-day forecast period is extended to the end of the 5-day period and then used to route the flows downstream.

Do the Flood Inundation Mapping (FIM) services show the valid time range for the prediction?

The RFC and NWM derived FIMs are valid for 120 hours (i.e. 5 days) after the forecast issuance time in the case of the RFC forecast and the reference time in the case of the NWM forecast. For example, an RFC FIM issued on September 27, at 00Z (Coordinated Universal Time, UTC), the mapping service displays the maximum water surface extent from September 27 at 00Z through October 2 at 00Z. The forecast issue time and the forecast reference time can be found in the metadata of the individual features within the FIM services.

Can water depth be inferred based on the inundation extent map?

Current FIM services only display the extent of flooding, not the depth. Any inference of depth should not be made. Future versions of NWS flood inundation services are planned to include depth of inundation.

Please explain the limitation of use of inundation mapping in the urban environment where there may not be defined streamflow lines and overly large catchment areas.

The NWM and RFC FIM is of limited applicability for urban areas that are not adjacent to stream and river reaches. The NWS FIM services depict the extent of flooding caused by flow in rivers and streams. Pluvial flooding, or ponding of water in natural or constructed depressions, is not represented in the current FIM capabilities.

HOW TO ASK QUESTIONS AND REPORT FEEDBACK

Who can answer my question in real-time during a flood event?

Your local Weather Forecast Office (WFO) or your regional River Forecast Center (RFC) are available to answer questions during flood events. Visit https://www.weather.gov for more information from your local office. The National Water Center Water Prediction Operations Division (WPOD) can also be contacted at nws.nwc.ops@noaa.gov.

How can I provide general feedback on the Flood Inundation Map (FIM) services?

General comments on the NWS FIM services should be provided via the survey (SurveyMonkey) given in the NWS Public Information Statement (PNS) announcing the experimental services deployment. This allows users to assess the services provided and include supporting comments.

Where are training materials I can use?

Basic information on National Weather Service (NWS) Flood Inundation Map (FIM) services is available on the Office of Water Prediction website at https://www.weather.gov/owp/operations. Your local Weather Forecast Office and River Forecast Center can also assist you in learning how to utilize the experimental FIM Services.

COMPARISONS OF SELECTED INUNDATION MAPS

What are the differences between these Flood Inundation Map (FIM) services?

There are several differences between existing FIM Services. One service provides an analysis of FIM extent based on the latest NWM hourly analysis of streamflows. The other two services represent 5 day forecast maximum extent FIM. Specifically, the National Water Model FIM is based on the maximum flow forecast by the NWM over the next 5 days, while the RFC FIM is based on the maximum flow forecast by the RFCs over the next 5 days. Comparing the NWM analysis FIM with either of the forecast FIM can help distinguish between possible current flooding and forecast future flooding conditions.

How do these flood inundation maps (FIMs) compare to FEMA flood inundation maps?

FEMA Digital Flood Insurance Rate Maps (DFIRMs) for Special Flood Hazard Areas represent the 100-year and 500-year floodplain. They are designed to be used as a regulatory product for the purpose of floodplain management. In contrast, the NWS FIM services are event based products that represent a translation of current and future weather conditions to the response of the rivers when the water level within the rivers overtop the river banks. These maps are not regulatory and should not be interpreted as such. For more information about FEMA DFIRMs, visit the FEMA Flood Maps website.