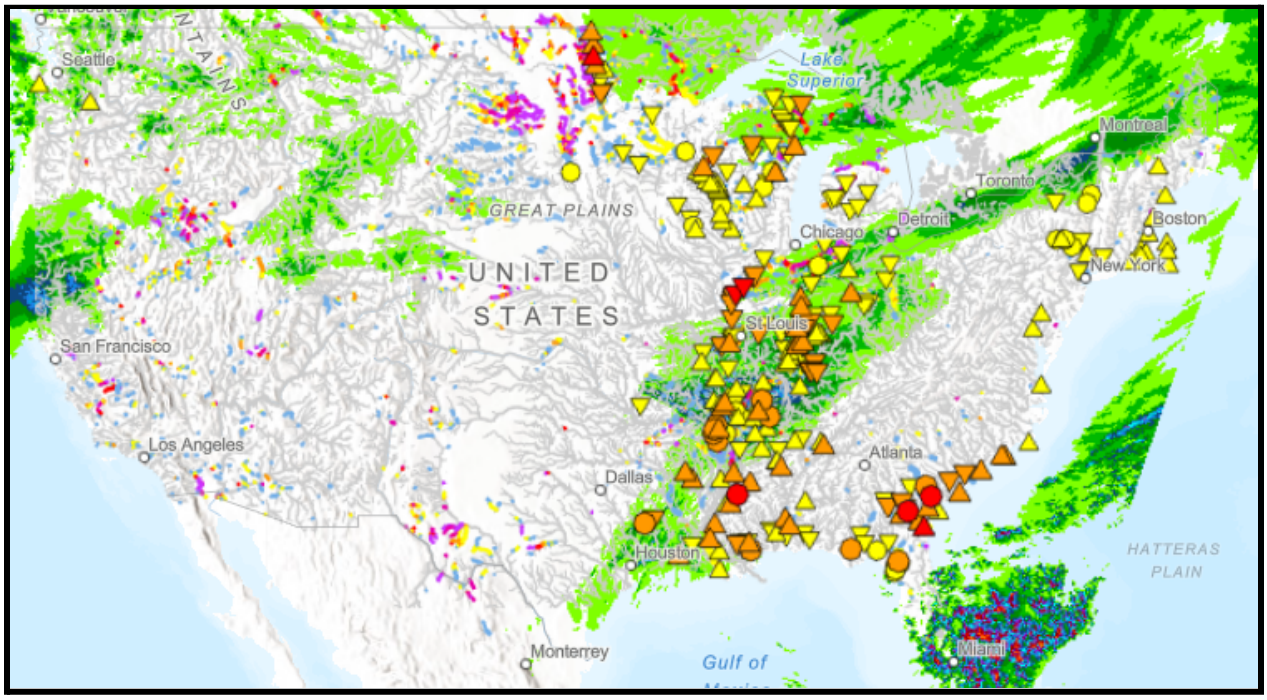
Public Handbook:

National Water Center Visualization Services

Version 2.0



Last updated: May 20, 2022

*Preliminary - Subject to Change

OWP | OFFICE OF WATER PREDICTION

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Introduction

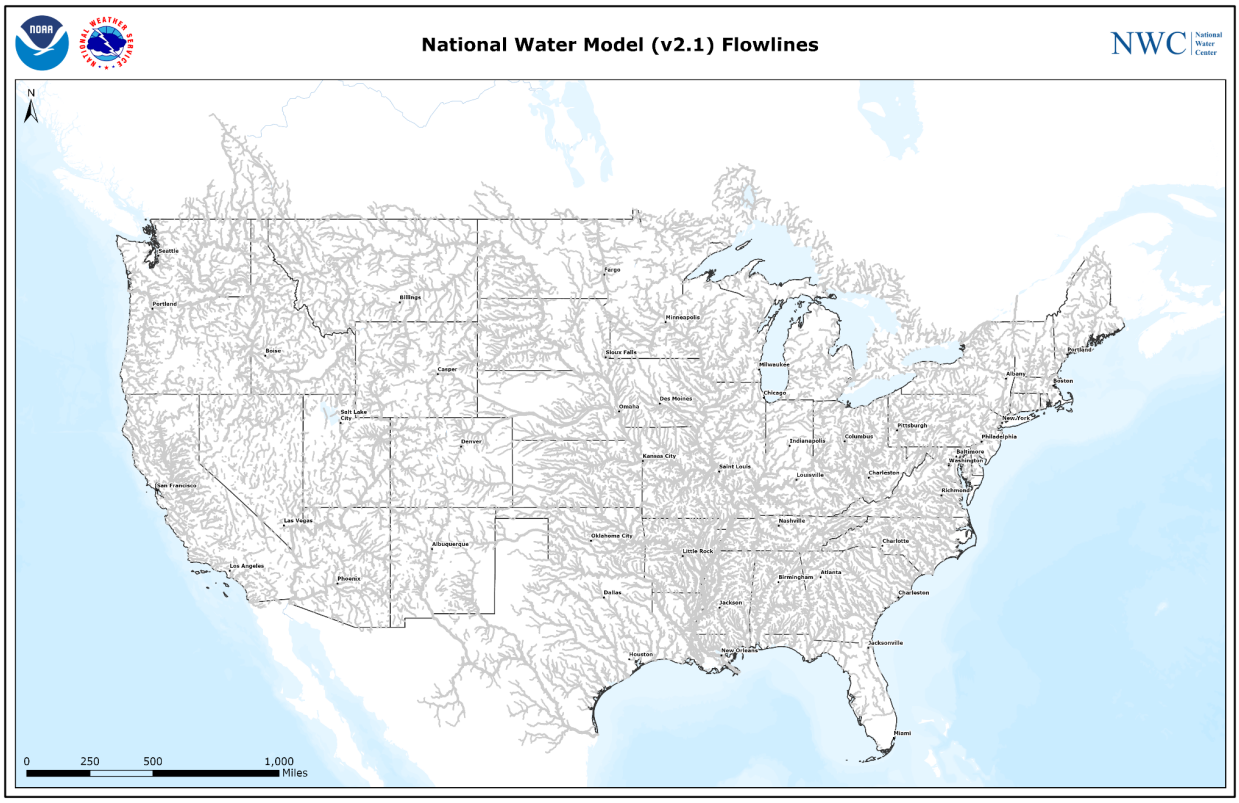
This handbook describes the suite of visualization services developed by the NOAA National Weather Service (NWS) Office of Water Prediction (OWP) in support of NWS and National Water Center (NWC) operations. Most of these static and dynamic services depict value added information derived from River Forecast Center (RFC) official forecasts and forecast guidance from the operational version of the National Water Model (NWM). A brief description of each service, and a summary of the methodology used to derive each service, is included in this handbook.

Services leverage geography information system (GIS) technology and are made available through the NWC's cloud-based Hydrologic Visualization and Inundation Services (HydroVIS) system, which includes an Enterprise GIS for disseminating geospatial services.

Reference Services

Service	Brief Description
NWM Flowlines	Depicts the NWM flowlines within the contiguous U.S.
NWM Flowlines - Hawaii	Depicts the NWM flowlines in Hawaii.
NWM Flowlines - Puerto Rico/U.S. Virgin Islands	Depicts the NWM flowlines in Puerto Rico and the U.S. Virgin Islands.

NWM Flowlines



Service URL

https://maps.water.noaa.gov/server/rest/services/reference/nwm_flowlines/MapServer

Description

Depicts the NWM flowlines within the contiguous U.S.

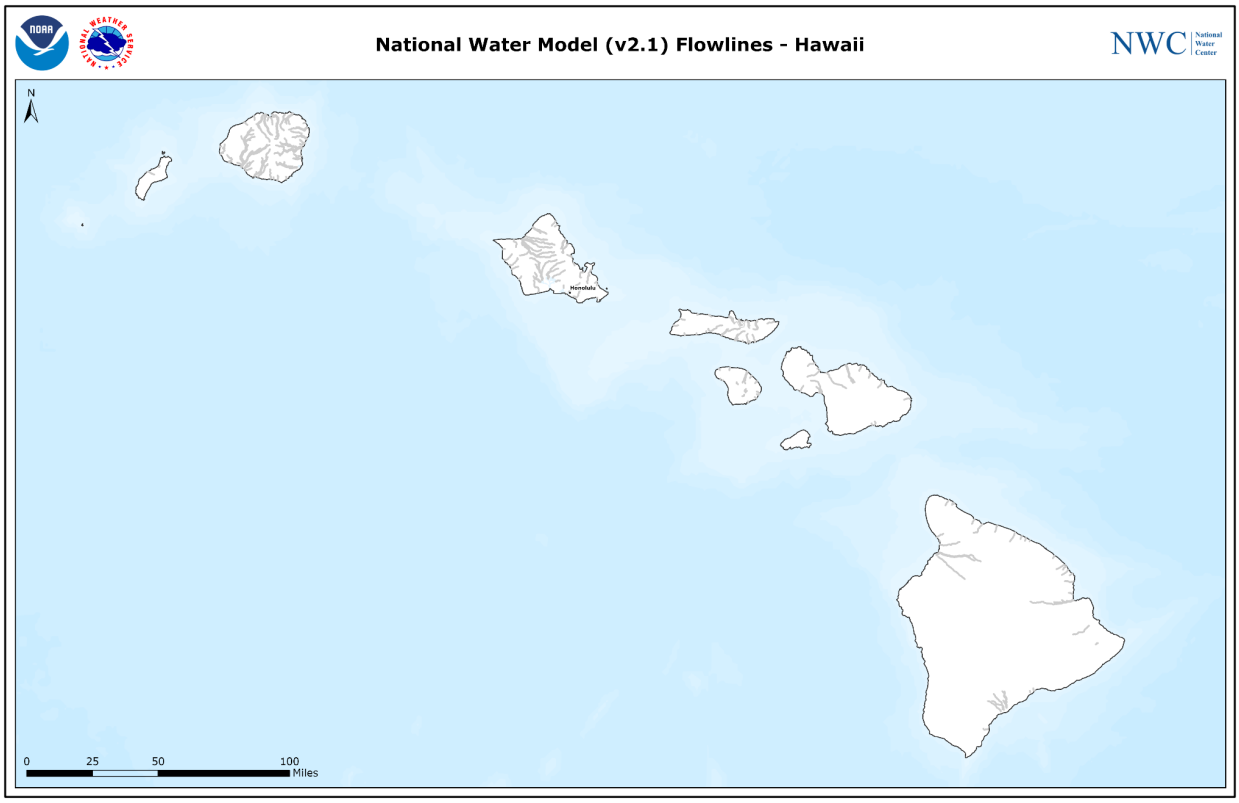
Update Frequency

Static

Methodology

The primary source of this data can be found at https://water.noaa.gov. Several attributes are derived from the NHDPlus-Medium Resolution v2.1 (NHDPlus v2.1) dataset by crosswalking the NWM feature_id with the NHDPlus v2.1 ComID. Streamflow thresholds are derived from the National Water Model reanalysis simulation. See the High Flow Magnitude pages for more details.

NWM Flowlines - Hawaii



Service URL

https://maps.water.noaa.gov/server/rest/services/reference/nwm_flowlines_hi/MapServer

Description

Depicts the NWM flowlines in Hawaii.

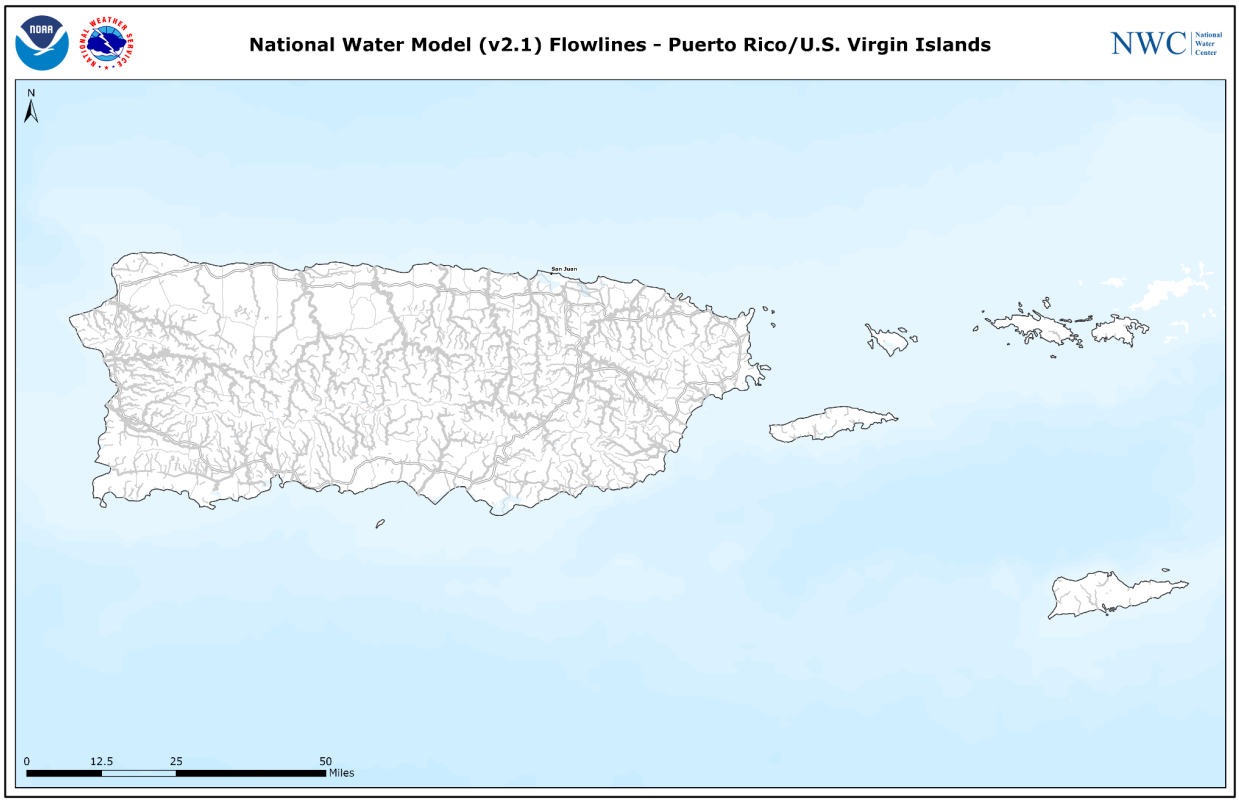
Update Frequency

Static

Methodology

The primary source of this data can be found at https://water.noaa.gov. Several attributes are derived from the NHDPlus-Medium Resolution v2.1 (NHDPlus v2.1) dataset by crosswalking the NWM feature_id with the NHDPlus v2.1 ComID. Streamflow thresholds are derived from USGS regression equations. See the associated High Flow Magnitude pages for more details.

NWM Flowlines - Puerto Rico/U.S. Virgin Islands



Service URL

https://maps.water.noaa.gov/server/rest/services/reference/nwm_flowlines_prvi/MapServer

Description

Depicts the NWM flowlines in Puerto Rico and the U.S. Virgin Islands.

Update Frequency

Static

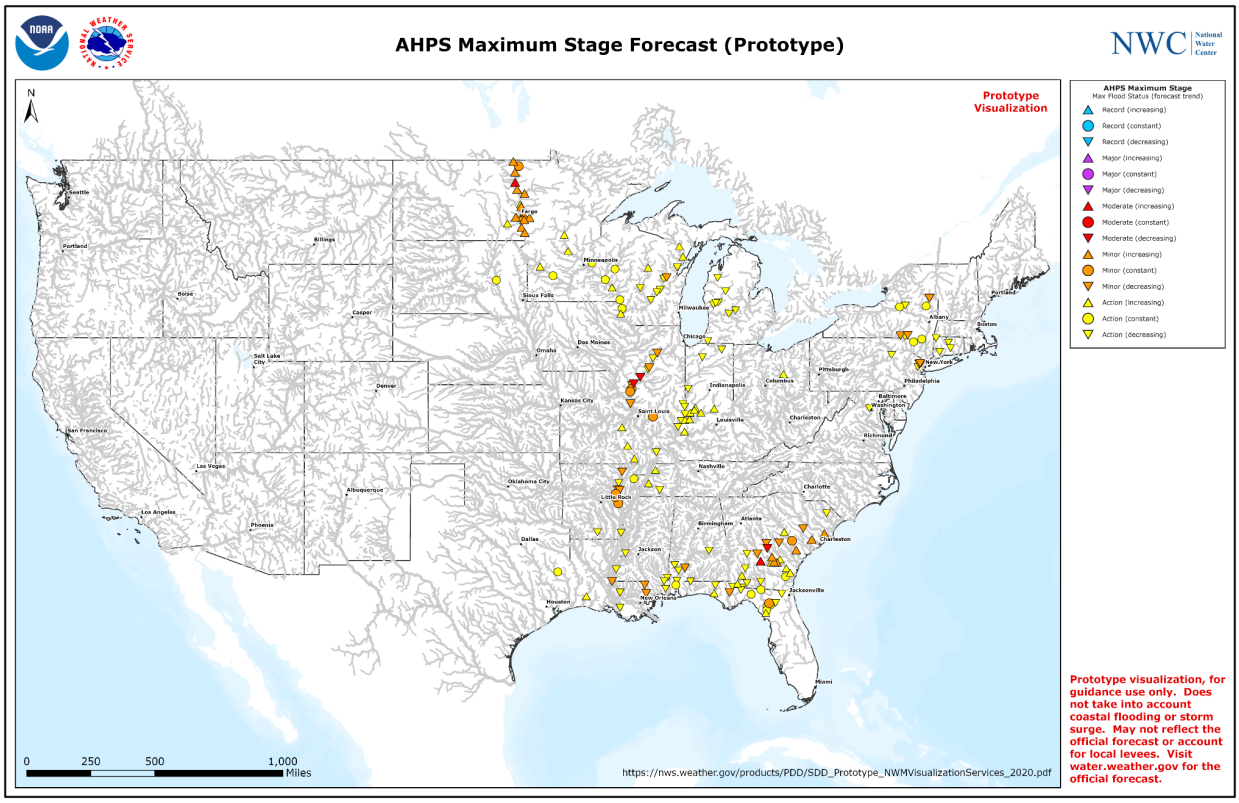
Methodology

The primary source of this data can be found at https://water.noaa.gov. Several attributes are derived from the NHDPlus-Medium Resolution v2.1 (NHDPlus v2.1) dataset by crosswalking the NWM feature_id with the NHDPlus v2.1 ComID. Streamflow thresholds are derived from USGS regression equations. See the associated High Flow Magnitude pages for more details.

River Forecast Center Services

Service	Brief Description
AHPS Maximum Stage Forecast	Depicts RFC forecasts at or above "action" stage.
RFC 5-Day Maximum Streamflow Forecast	Depicts the maximum forecast streamflow over the next 5 days derived from the official RFC forecast routed downstream through the NWM stream network.

AHPS Maximum Stage Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/rfc/rfc_max_stage/MapServer

Description

Depicts Advanced Hydrologic Prediction Service (AHPS) River Forecast Center (RFC) forecast points with forecasts at or above "action" stage. Circles represent forecast points where stages are changing by less than +/- 5% over the entire forecast period. Upward-pointing triangles represent forecast points where a greater than 5% increase in stage is expected sometime during the forecast. If stage increases greater than 5% are not expected, downward-pointing triangles represent forecast points where a greater than 5% decrease in stage is expected sometime during the forecast. Forecast points are colored by their maximum forecast flood category.

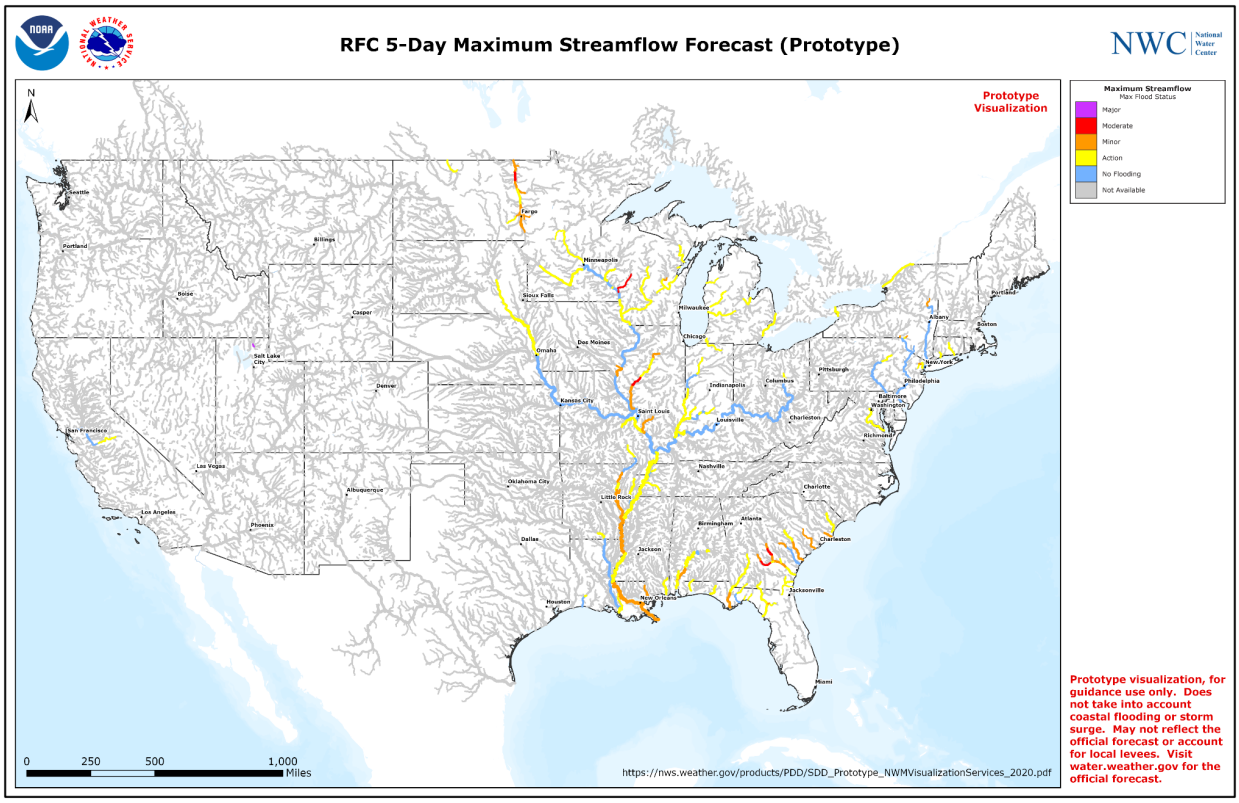
Update Frequency

Every 15 minutes

Methodology

Forecast time series from the RFCs are analyzed to detect changes in flood stage. Change is analyzed between the initial forecast value, and the forecast value with the greatest absolute difference from the initial forecast value. Gauges forecast to change flood category will always be classified with an increasing or decreasing trend, even if the greatest absolute change is less than 5%.

RFC 5-Day Maximum Streamflow Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/rfc/rfc_5day_max_downstream_streamflow/MapServer

Description

Depicts maximum forecast streamflow over the next 5 days derived from the official River Forecast Center (RFC) forecast routed downstream through the National Water Model (NWM) stream network. Maximum streamflows are available downstream of RFC forecast points whose forecast reaches action status or greater.

Update Frequency

Hourly

Methodology

Forecast time series from the RFCs are assimilated into the NWM channel routing module and then routed downstream through the NWM river network. River segments are colored

according to the flood status of the RFC forecast point immediately upstream. If there are several RFC forecast points immediately upstream, the maximum flood status is used to derive the color of the river segment. The NWM Analysis and Assimilation configuration provides the initial streamflow conditions for the routing.

National Water Model Services

This section outlines the suite of visualization services driven by the operational version of the National Water Model (NWM). The NWM provides estimates of current and forecast hydrologic conditions (including streamflow) across the U.S. via several model configurations: Analysis and Assimilation (current conditions), Short-Range Forecast (0 to 18-hours), Medium-Range Forecast (0 to 10-days) and Long-Range Forecast (0 to 30-days); see **Figure 1** below. For more information about the NWM, visit https://water.noaa.gov.

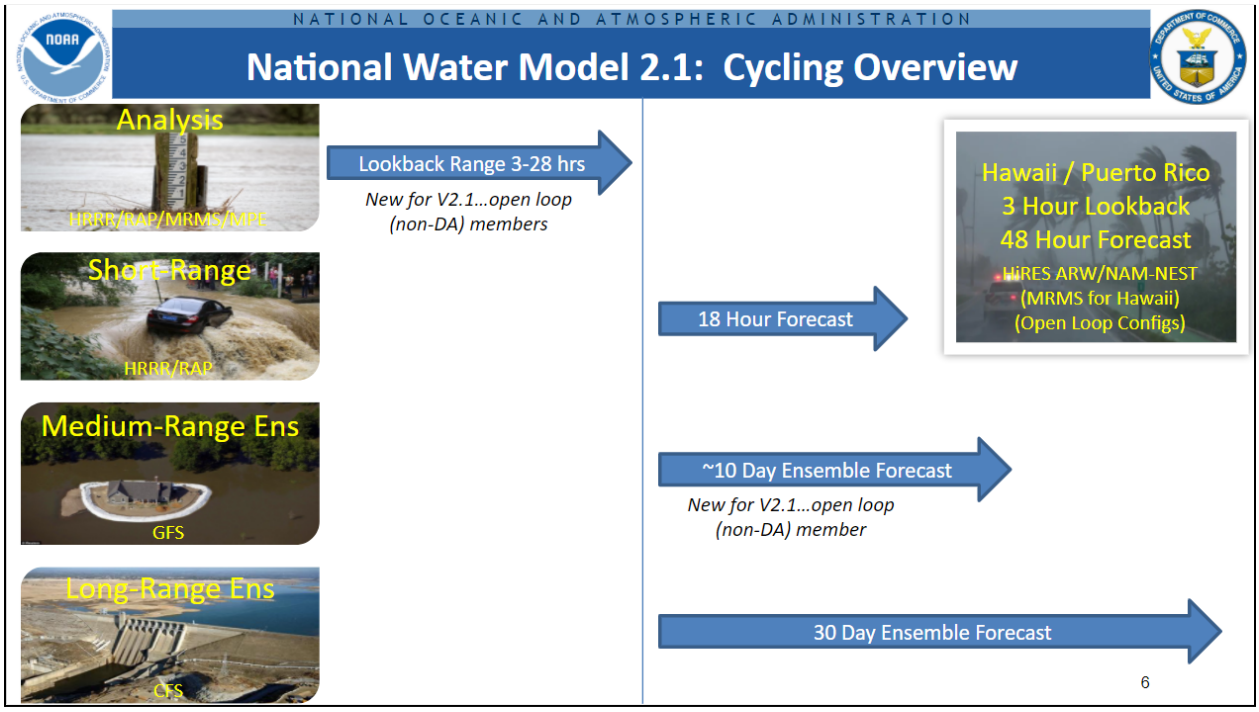
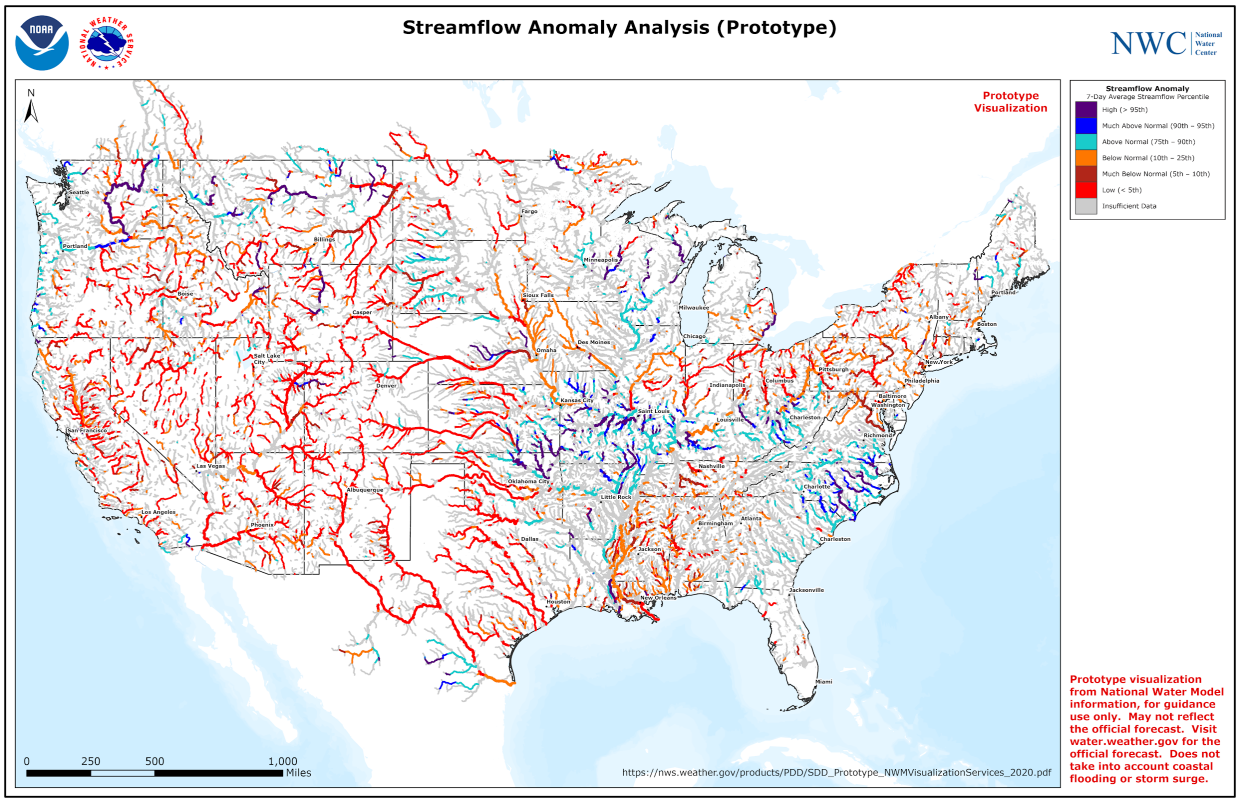


Figure 1: NWM Configurations

Current Conditions (Analysis and Assimilation Forecast)

Service	Brief Description
NWM Streamflow Anomaly Analysis	Depicts current seasonal streamflow anomalies derived from the analysis and assimilation configuration of the NWM over the contiguous U.S.
NWM High Flow Magnitude Analysis	Depicts the magnitude of the NWM streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over the contiguous U.S.
NWM Past 14-Day High Flow Magnitude Analysis	Depicts the magnitude of the peak NWM streamflow forecast over the last 14 days where the NWM signaled high water. This service is derived from the analysis and assimilation configuration of the NWM over the contiguous U.S.
NWM High Flow Magnitude Analysis - Hawaii	Depicts the magnitude of the NWM streamflow forecast in Hawaii where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over Hawaii.
NWM High Flow Magnitude Analysis - Puerto Rico/U.S. Virgin Islands	Depicts the magnitude of the NWM streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over Puerto Rico and the U.S. Virgin Islands.

NWM Streamflow Anomaly Analysis



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/ana_anomaly/MapServer

Description

Depicts seasonal streamflow anomalies derived from the analysis and assimilation configuration of the National Water Model (NWM) over the contiguous U.S. Anomalies are based on 7-day and 14-day moving average streamflow percentiles for each reach and the current calendar day.

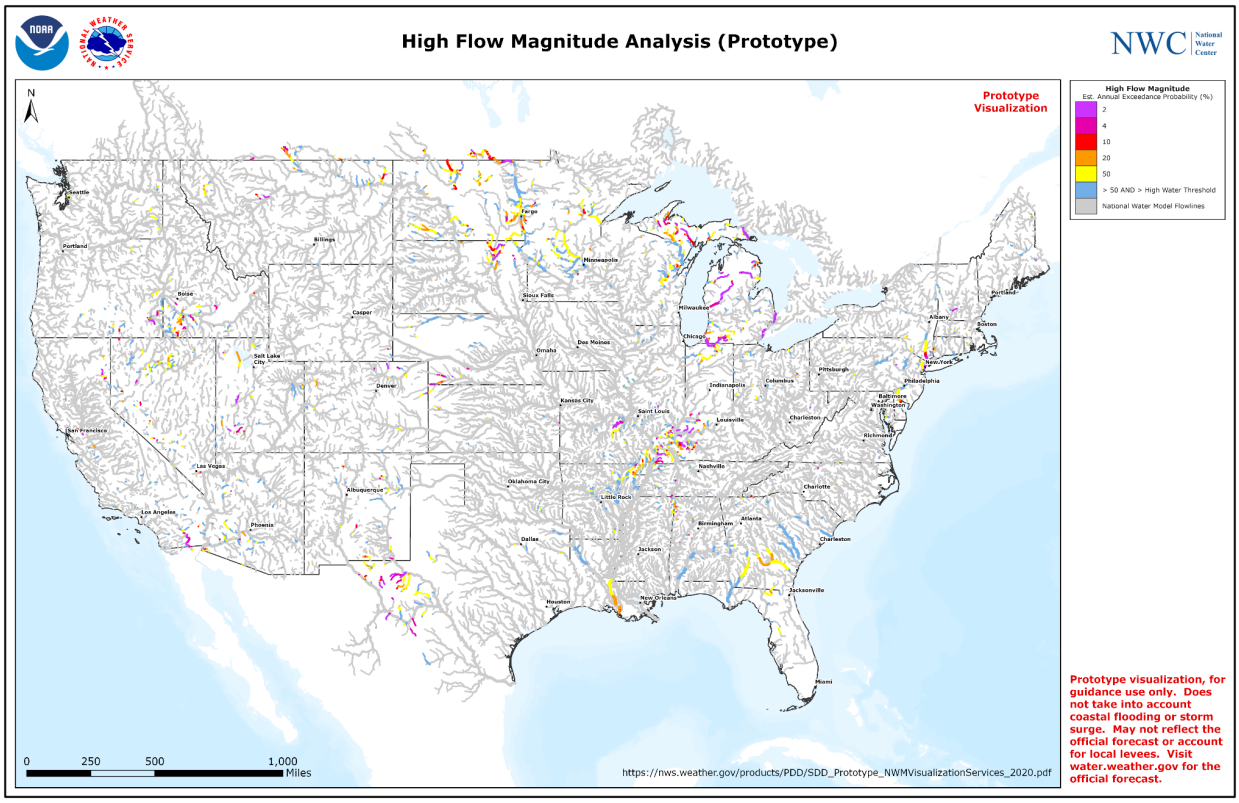
Update Frequency

Daily

Methodology

Streamflow percentiles were derived from 7-day and 14-day moving average streamflows for each reach and each calendar day using the 40-year NWM v2.1 reanalysis simulation. Methods align with the USGS WaterWatch product.

NWM High Flow Magnitude Analysis



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/ana_high_flow_magnitude/MapServer

Description

Depicts the magnitude of the National Water Model (NWM) streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over the contiguous U.S. Shown are reaches with flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their current flow. High water thresholds (regionally varied) and AEPs were derived using the 40-year NWM v2.1 reanalysis simulation.

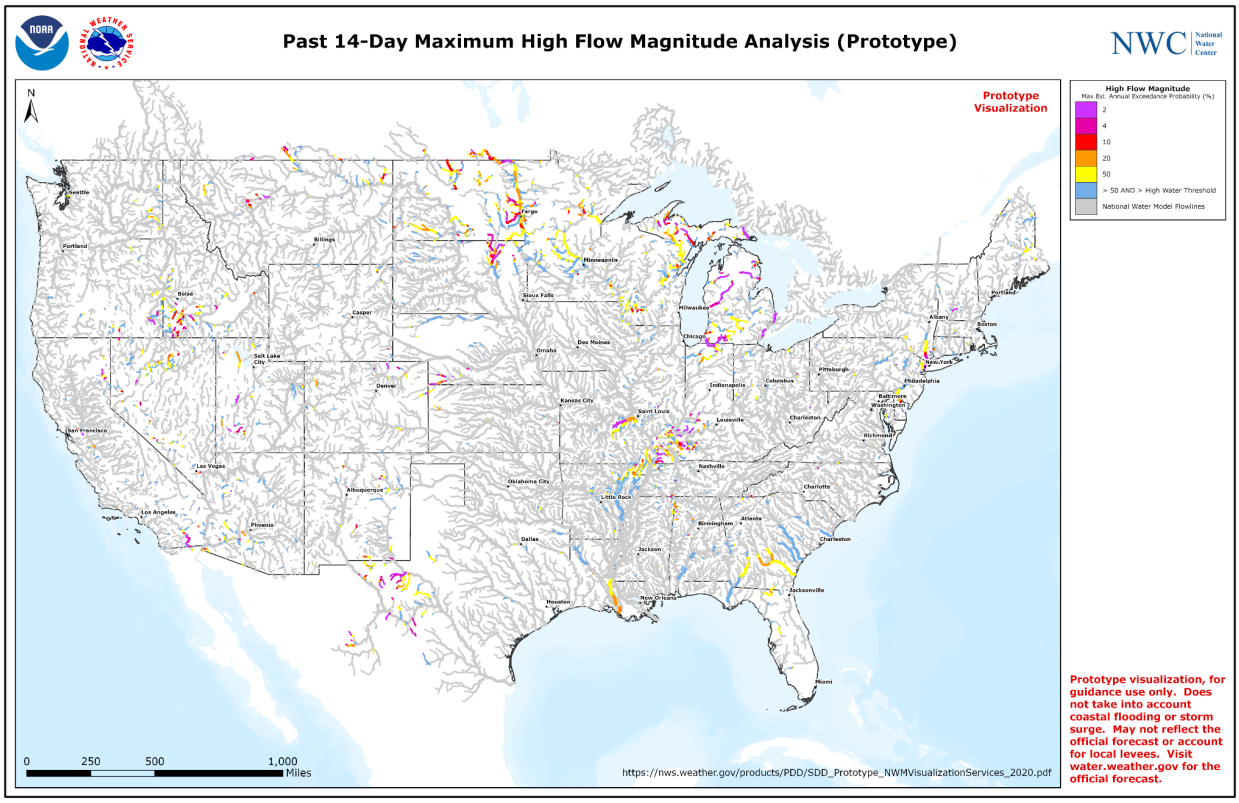
Update Frequency

Hourly

Methodology

AEPs were derived from the 40-year NWM v2.1 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM Past 14-Day High Flow Magnitude Analysis



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/ana_past_14day_max_high_flow_magnitude/MapServer

Description

Depicts the magnitude of the peak NWM streamflow forecast over the past 14 days where the National Water Model (NWM) is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over the contiguous U.S. Shown are reaches with flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their current flow. High water thresholds (regionally varied) and AEPs were derived using the 40-year NWM v2.1 reanalysis simulation.

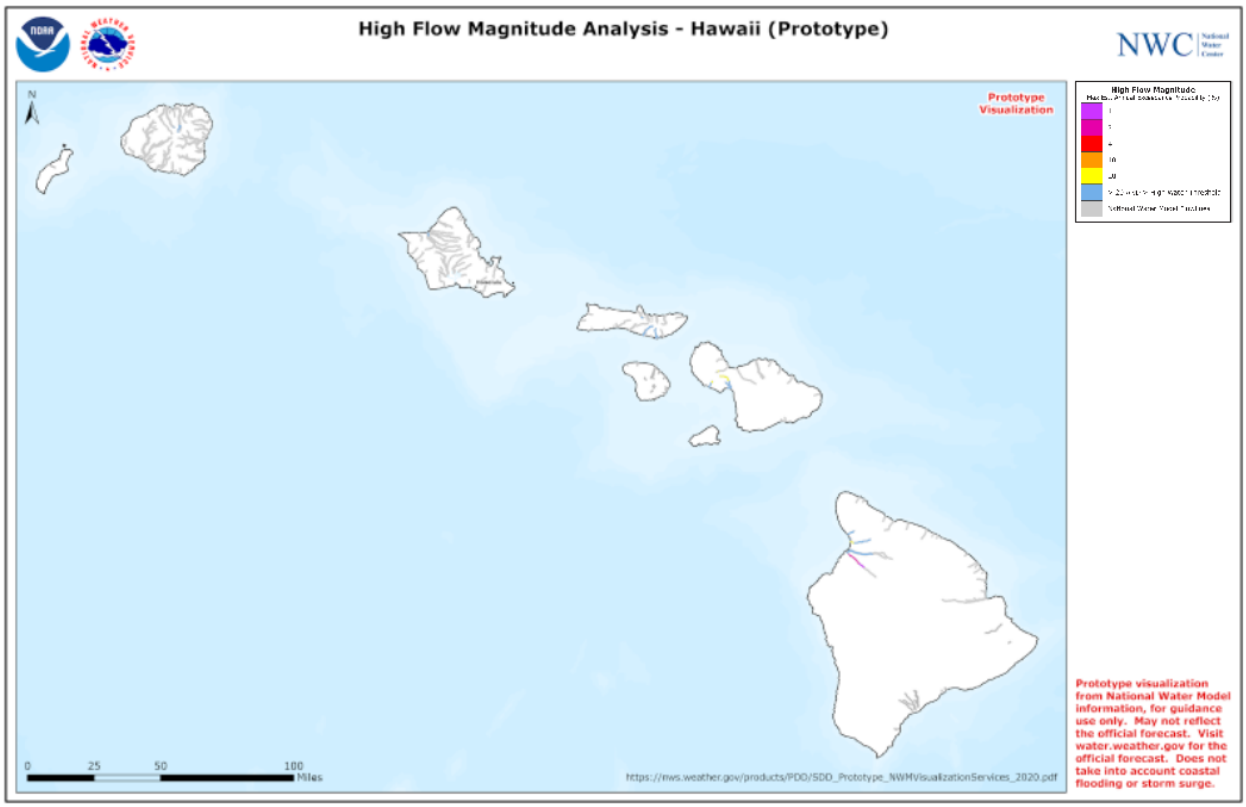
Update Frequency

Daily

Methodology

AEPs were derived from the 40-year NWM v2.1 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM High Flow Magnitude Analysis - Hawaii



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/ana_high_flow_magnitude_hi/MapServer

Description

Depicts the magnitude of the National Water Model (NWM) streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over Hawaii. Shown are reaches with flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their current flow. High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf.

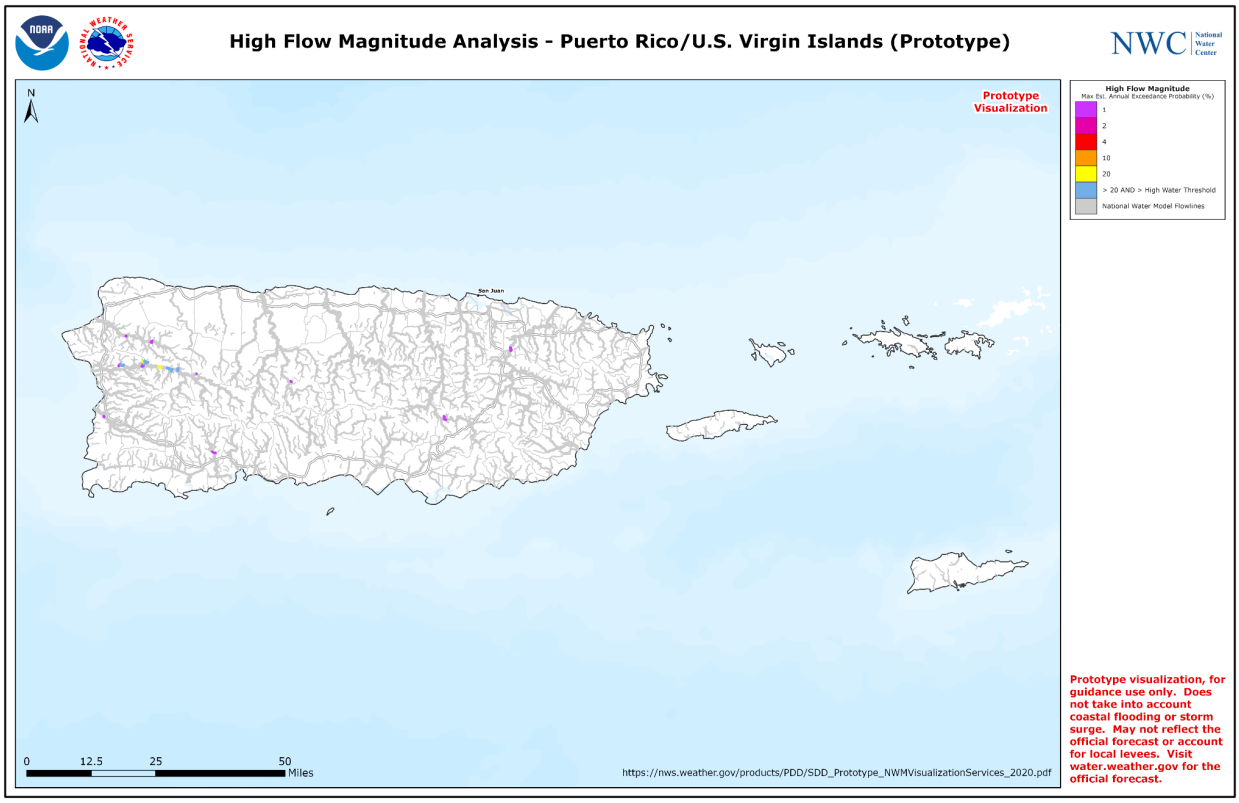
Update Frequency

Hourly

Methodology

High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated by the 50% AEP.

NWM High Flow Magnitude Analysis - Puerto Rico/U.S. Virgin Islands



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/ana_high_flow_magnitude_prvi/MapServer

Description

Depicts the magnitude of the National Water Model (NWM) streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over Puerto Rico and the U.S. Virgin Islands. Shown are reaches with flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their current flow. High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf.

Update Frequency

Hourly

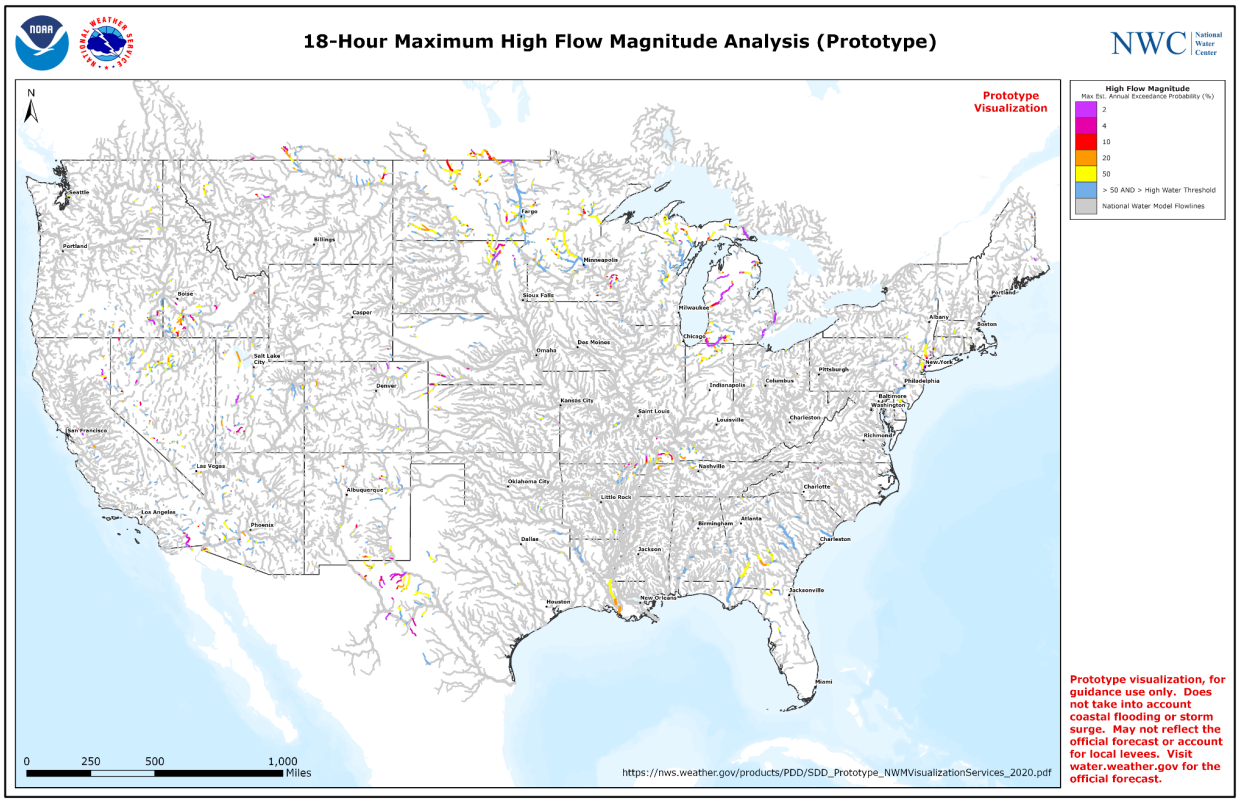
Methodology

High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf. NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated by the 50% AEP.

Short-Range Forecast

Service	Brief Description
NWM 18-Hour Maximum High Flow Magnitude Forecast	Depicts the magnitude of the peak NWM streamflow forecast over the next 18 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over the contiguous U.S.
NWM 48-Hour Maximum High Flow Magnitude Forecast - Hawaii	Depicts the magnitude of the peak NWM streamflow forecast over the next 48 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over Hawaii.
NWM 48-Hour Maximum High Flow Magnitude Forecast - Puerto Rico/U.S. Virgin Islands	Depicts the magnitude of the peak NWM streamflow forecast over the next 48 hours, where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over Puerto Rico and the U.S. Virgin Islands.
NWM 18-Hour High Water Arrival Time Forecast	Depicts the forecast arrival time of high water over the next 18 hours. This service is derived from the short-range configuration of the NWM over the contiguous U.S.
NWM 48-Hour High Water Arrival Time Forecast - Hawaii	Depicts the forecast arrival time of high water over the next 48 hours. This service is derived from the short-range configuration of the NWM over Hawaii.
NWM 48-Hour High Water Arrival Time Forecast - Puerto Rico/U.S. Virgin Islands	Depicts the forecast arrival time of high water over the next 48 hours. This service is derived from the short-range configuration of the NWM over Puerto Rico and the U.S. Virgin Islands.
NWM 12-Hour High Water Probability Forecast	Depicts the probability of forecast high water over the next 12 hours using a time-lagged ensemble from the short-range forecast of the NWM over the contiguous U.S.
NWM 18-Hour Rapid Onset Flooding Forecast	Depicts forecast rapid onset flooding using the short-range configuration of the NWM over the contiguous U.S.
NWM 18-Hour Rapid Onset Flooding Probability Forecast	Depicts the probability of forecast rapid onset flooding over the next 18 hours using a time-lagged ensemble from the short-range configuration of the NWM over the contiguous U.S.

NWM 18-Hour Maximum High Flow Magnitude Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_max_high_flow_magnitude/MapServer

Description

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the next 18 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over the contiguous U.S. Shown are reaches with peak flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their forecast peak flow. High water thresholds (regionally varied) and AEPs were derived using the 40-year NWM v2.1 reanalysis simulation.

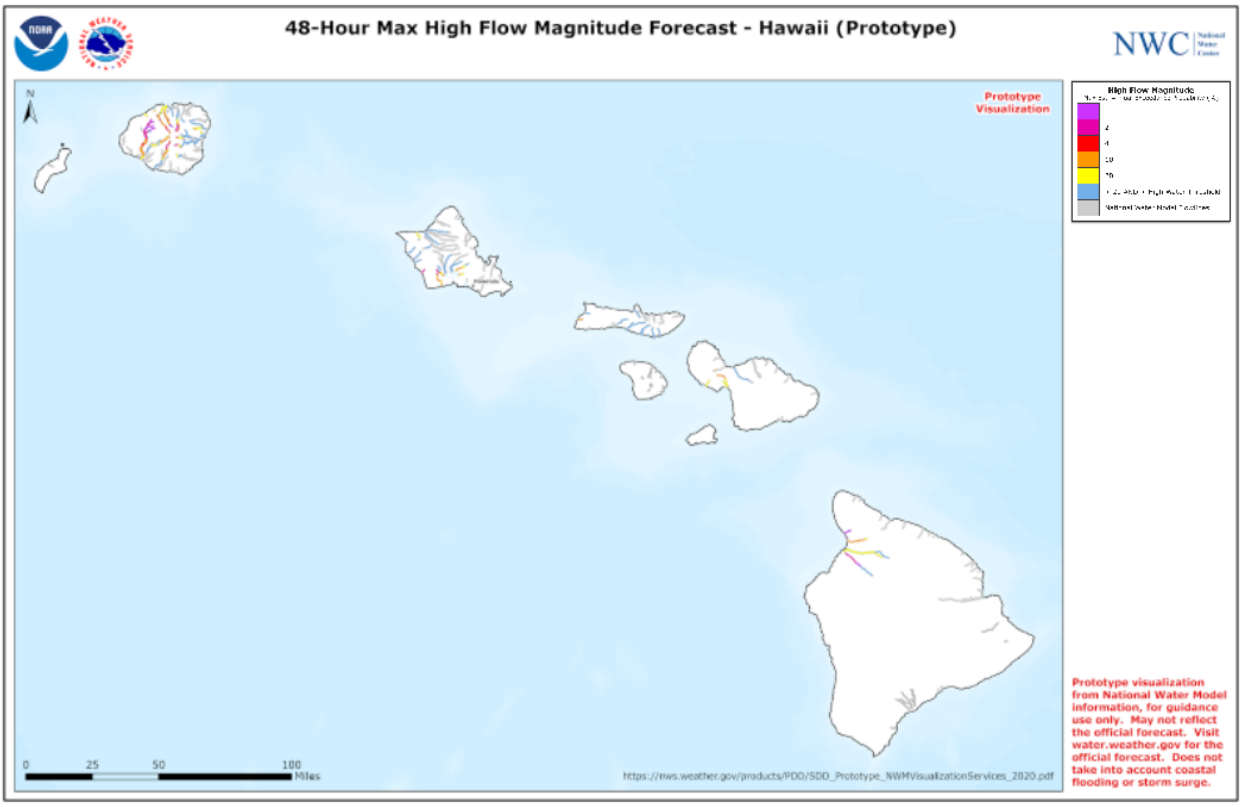
Update Frequency

Hourly

Methodology

AEPs were derived from the 40-year NWM v2.1 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 48-Hour Maximum High Flow Magnitude Forecast - Hawaii



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_max_high_flow_magnitude_hi/MapServer

Description

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the next 48 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over Hawaii. Shown are reaches with peak flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their peak flow. High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf.

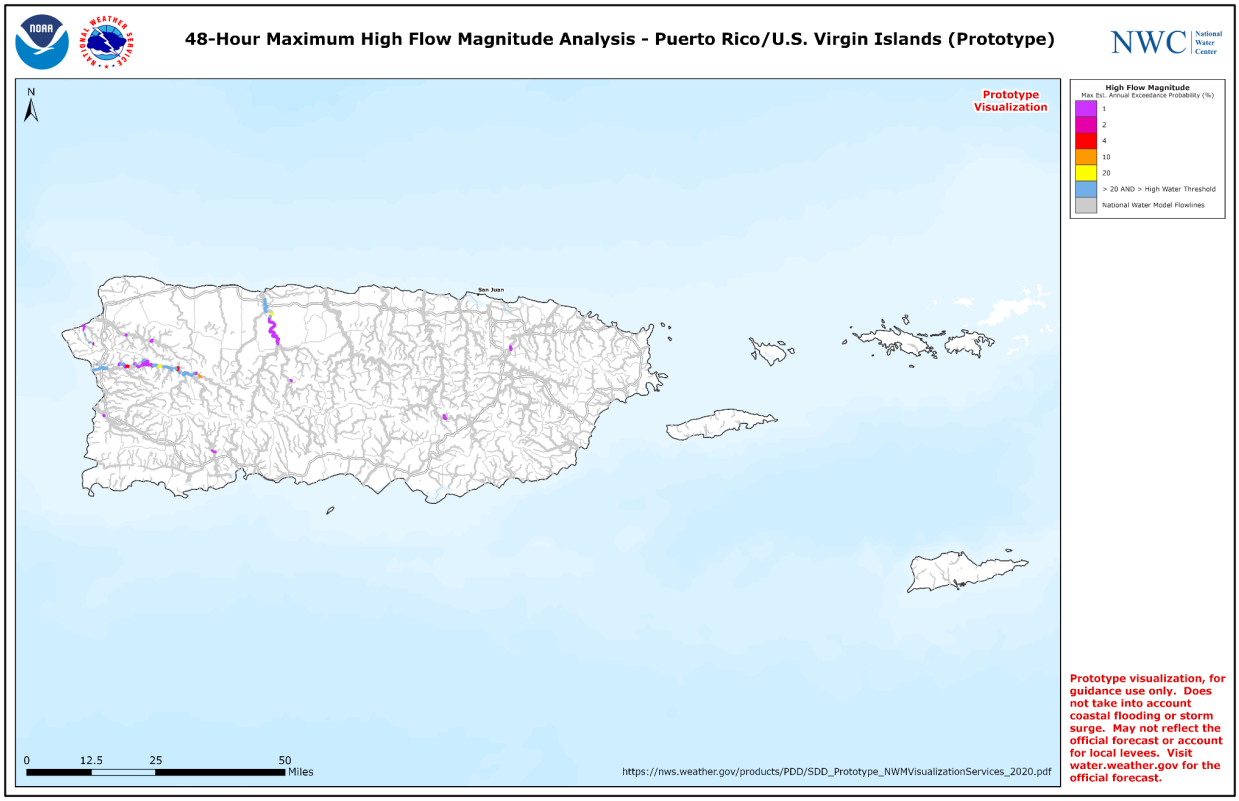
Update Frequency

Every 12 hours

Methodology

High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated by the 50% AEP.

NWM 48-Hour Maximum High Flow Magnitude Forecast - Puerto Rico/U.S. Virgin Islands



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_max_high_flow_magnitude_prvi/MapServer

Description

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the next 48 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM over Puerto Rico and the U.S. Virgin Islands. Shown are reaches with peak flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their peak flow. High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf.

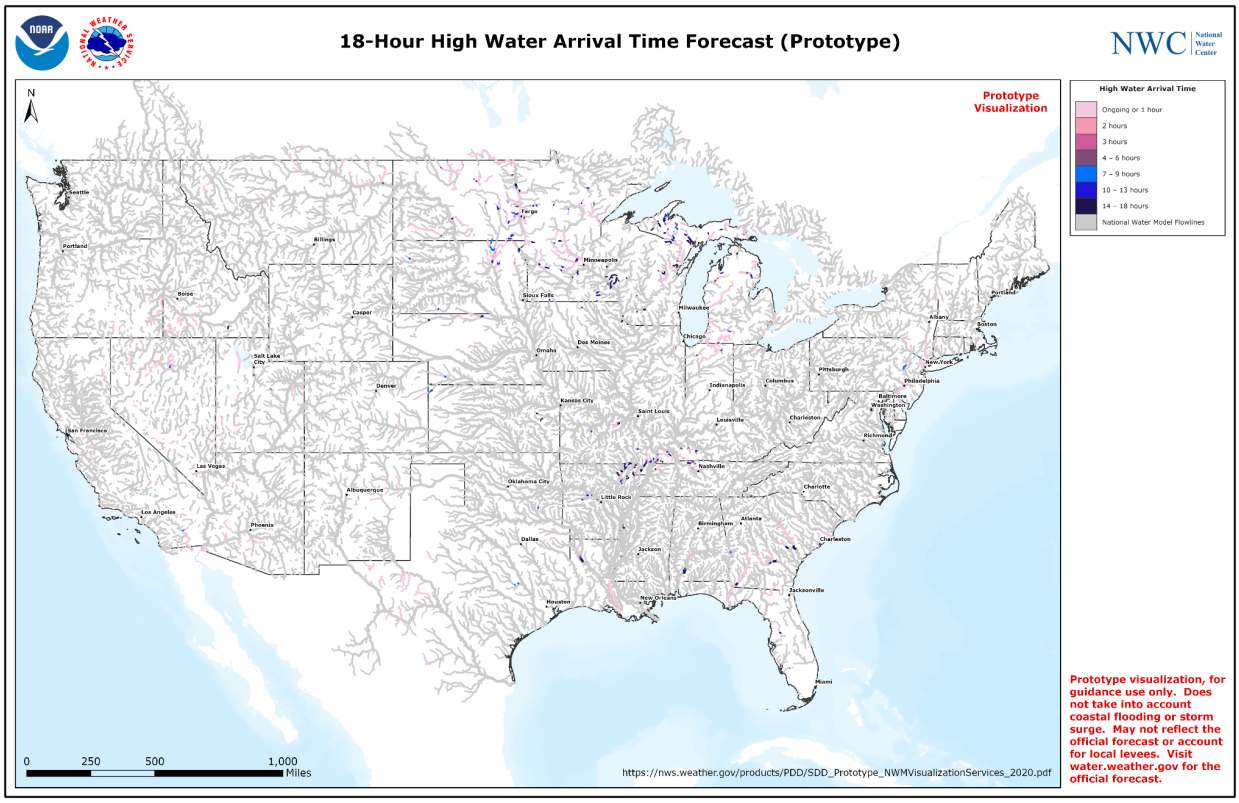
Update Frequency

Every 12 hours

Methodology

High water thresholds and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. NWM streamflow values are compared to these AEPs and classified accordingly. "High water" conditions are approximated by the 50% AEP.

NWM 18-Hour High Water Arrival Time Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_high_water_arrival_time/MapServer

Description

Depicts the forecast arrival time of high water over the next 18 hours. This service is derived from the short-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above the high water threshold over the next 18 hours. Reaches are colored by the time at which they are forecast to reach high water. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

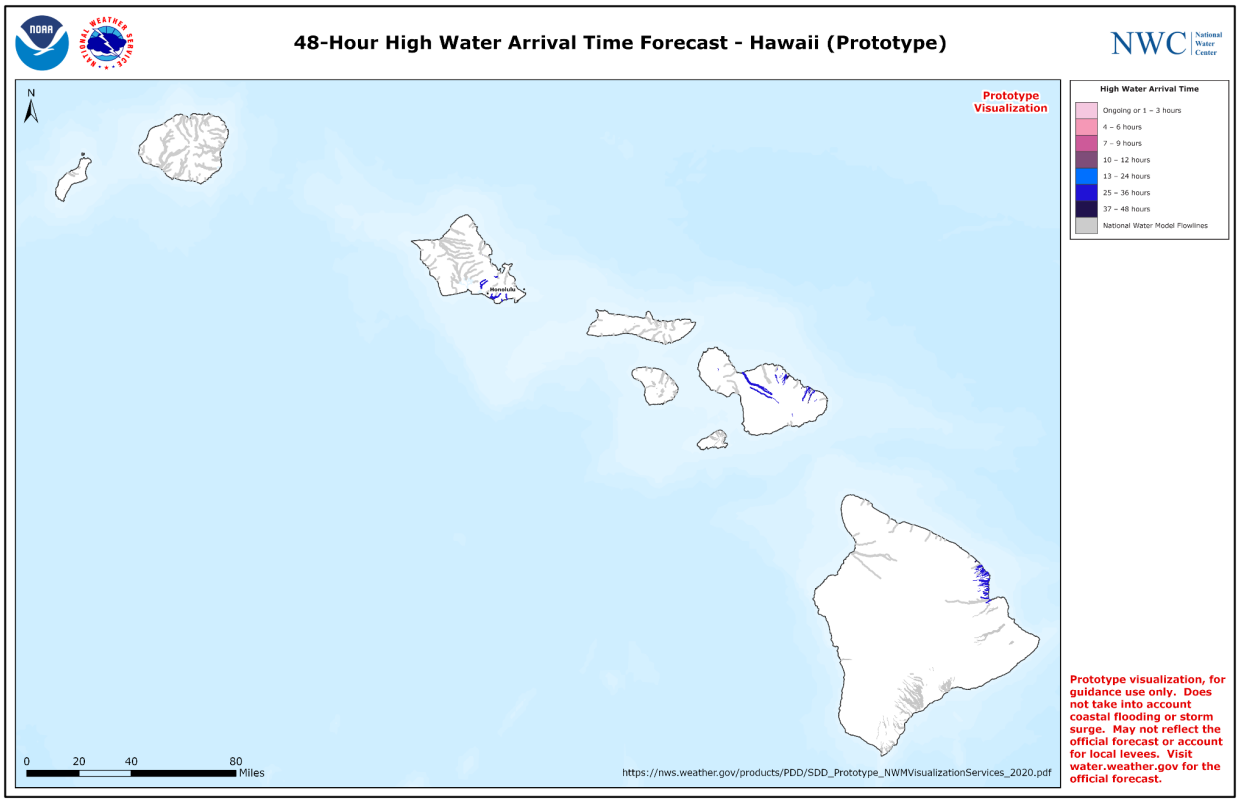
Update Frequency

Hourly

Methodology

The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated "high water" condition. The time at which forecast streamflow first exceeds the "high water" condition is considered the arrival time. "High water" conditions are approximated regionally with an AEP that aligns with the "Action" flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 48-Hour High Water Arrival Time Forecast - Hawaii



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_high_water_arrival_time_hi/MapServer

Description

Depicts the forecast arrival time of high water over the next 48 hours. This service is derived from the short-range configuration of the National Water Model (NWM) over Hawaii. Shown are reaches that are expected to have flow at or above the high water threshold over the next 48 hours. Reaches are colored by the time at which they are forecast to reach high water. High water flows were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf.

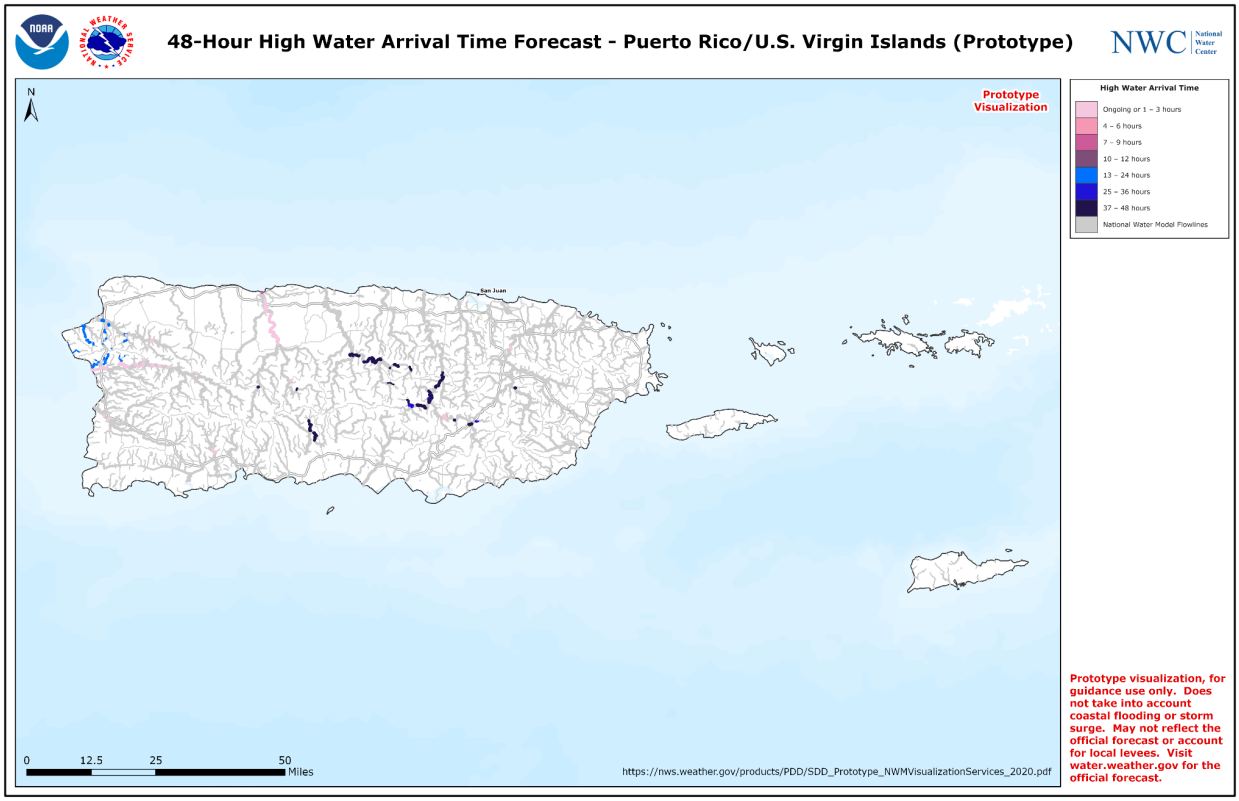
Update Frequency

Every 12 hours

Methodology

The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated "high water" condition. The time at which forecast streamflow first exceeds the "high water" condition is considered the arrival time. High water thresholds were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. "High water" conditions are approximated by the 50% annual exceedance probability.

NWM 48-Hour High Water Arrival Time Forecast - Puerto Rico/U.S. Virgin Islands



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_high_water_arrival_time_prvi/MapServer

Description

Depicts the forecast arrival time of high water over the next 48 hours. This service is derived from the short-range configuration of the National Water Model (NWM) over Puerto Rico and the U.S. Virgin Islands. Shown are reaches that are expected to have flow at or above the high water threshold over the next 48 hours. Reaches are colored by the time at which they are forecast to reach high water. High water flows were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf.

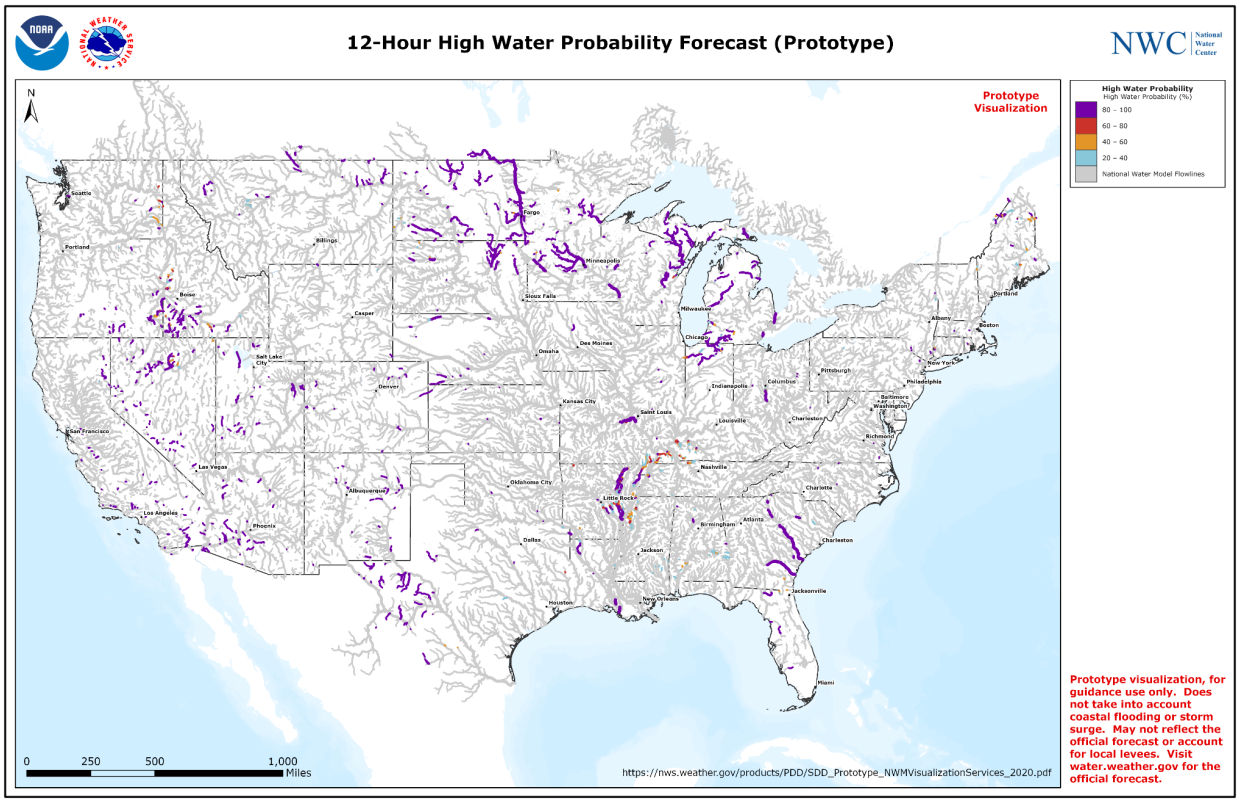
Update Frequency

Every 12 hours

Methodology

The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated "high water" condition. The time at which forecast streamflow first exceeds the "high water" condition is considered the arrival time. High water thresholds were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf. "High water" conditions are approximated by the 50% annual exceedance probability.

NWM 12-Hour High Water Probability Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_high_water_probability/MapServer

Description

Depicts the probability of forecast high water over the next 12 hours using a time-lagged ensemble from the short-range forecast of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are forecast to have flow at or above high water within the next 12 hours of at least one of the last 7 forecasts. Reaches are colored by the probability that they will meet or exceed the high water threshold across the last 7 forecasts. Probabilities are derived by counting the number of forecasts that meet the high water condition within the next 12 hours, equally weighted. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency

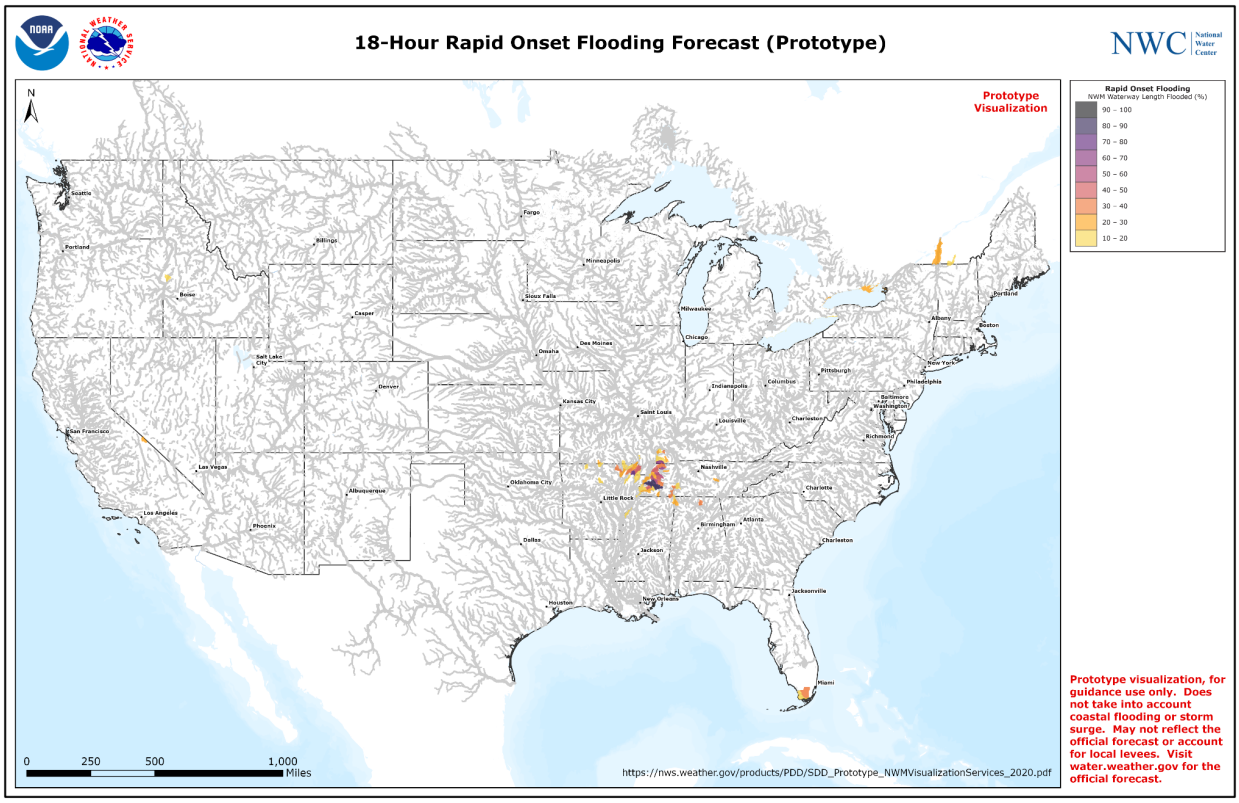
Hourly

Methodology

Shown are reaches that are expected to have forecast streamflow at or above “high water” conditions within the next 12 hours. Probabilities are computed as the % agreement across 7 “ensemble members”, in this case represented by the last 7 short-range forecasts.

“High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 18-Hour Rapid Onset Flooding Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_rapid_onset_flooding/MapServer

Description

Depicts forecast rapid onset flooding using the short-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches (stream order 4 and below) with a forecast flow increase of 100% or greater within an hour, and which are expected to be at or above the high water threshold within 6 hours of that increase. Also shown are USGS HUC10 polygons symbolized by the percentage of NWM waterway length (within each HUC10) that is expected to meet the previously mentioned criteria. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency

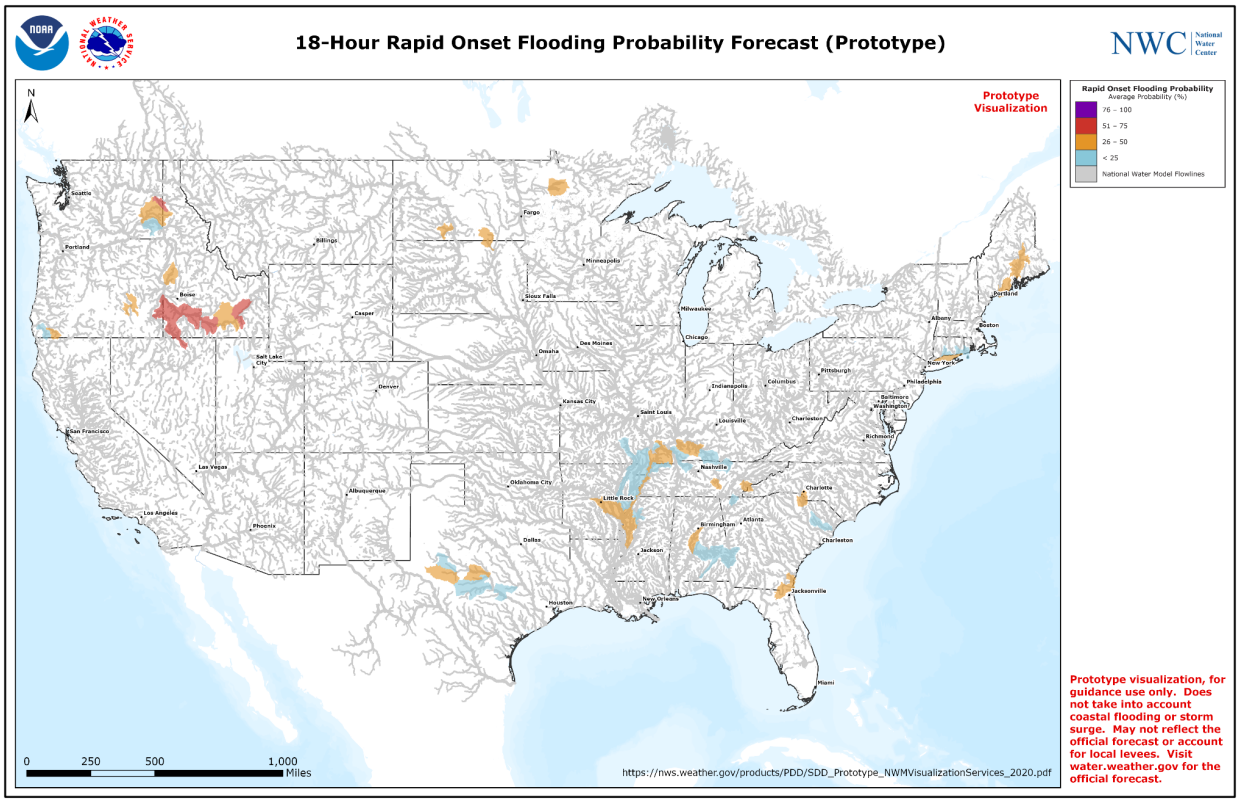
Hourly

Methodology

Shown are reaches that are expected to have a forecast flow increase of 100% or greater within an hour, and which are expected to be at above the high water threshold within 6 hours of that increase. Reaches are colored in two ways. One sublayer colors reaches by the time at which they are expected to reach “high water” conditions. Another sublayer colors reaches by the length of time between when the streamflow increases above the high water threshold and the streamflow decreases below the high water threshold. If the streamflow never decreases below the high water threshold within the forecast period, the length will be “ongoing”. HUC10s are also shown and colored based on the percentage of NWM waterway length within that HUC that meets the rapid onset flooding criteria.

“High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 18-Hour Rapid Onset Flooding Probability Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/srf_rapid_onset_flooding_probability/MapServer

Description

Depicts the probability of forecast rapid onset flooding over the next 18 hours using a time-lagged ensemble from the short-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches (stream order 4 and below) that are expected to meet rapid onset flooding criteria (flow increase of 100% or greater within one hour and high water threshold conditions within 6 hours) using the most recent 7 forecasts. Reaches are colored by the probability that they will meet or exceed rapid onset conditions within hours 1-6, 7-12, and 1-12. Probabilities are computed as the % agreement across the 7 ensemble members that a given reach will meet rapid onset criteria at some point during the time period of interest. Hotspots show the average 1-12 hour rapid onset flooding probability, weighted by reach length, for USGS HUC10 basins with greater than 10% of

NWM feature length meeting rapid onset criteria in the next 12 hours. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency
Hourly

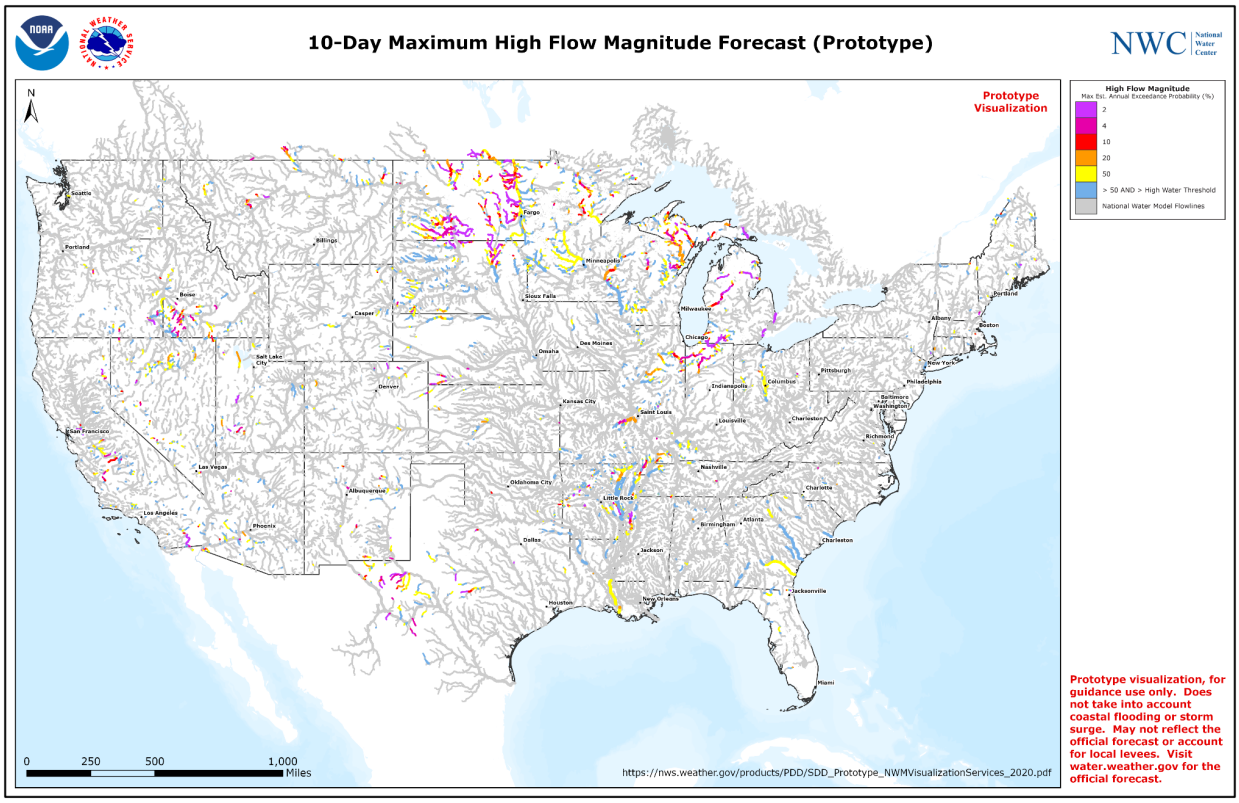
Methodology
Probabilities are computed as the % agreement across 7 “ensemble members”, in this case represented by the last 7 short-range forecasts. Reaches (stream order 4 and below) that are expected to have a forecast flow increase of 100% or greater within an hour, and which are expected to be at above the high water threshold within 6 hours of that increase, are considered agreeable for the probability calculation.

“High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

Medium-Range Forecast

Service	Description
NWM 10-Day Maximum High Flow Magnitude Forecast	Depicts the magnitude of the peak NWM streamflow forecast over the next 3, 5 and 10 days where the NWM is signaling high water. This service is derived from the medium-range configuration of the NWM over the contiguous U.S.
NWM 10-Day High Water Arrival Time Forecast	Depicts the forecast arrival time of high water over the next 10 days. This service is derived from the medium-range configuration of the NWM over the contiguous U.S.
NWM 5-Day High Water Probability Forecast	Depicts the probability of forecast high water over the next 5 days using ensembles from the medium-range configuration of the NWM over the contiguous U.S.
NWM 10-Day Rapid Onset Flooding Forecast	Depicts forecast rapid onset flooding using the medium-range configuration of the NWM over the contiguous U.S.
NWM 10-Day Rapid Onset Flooding Probability Forecast	Depicts the probability of forecast rapid onset flooding over the next 10 days using ensembles from the medium-range configuration of the NWM over the contiguous U.S.

NWM 10-Day Maximum High Flow Magnitude Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/mrf_max_high_flow_magnitude/MapServer

Description

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the next 3, 5 and 10 days where the NWM is signaling high water. This service is derived from the medium-range configuration of the NWM over the contiguous U.S. Shown are reaches with peak flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their forecast peak flow. High water thresholds (regionally varied) and AEPs were derived using the 40-year NWM v2.1 reanalysis simulation.

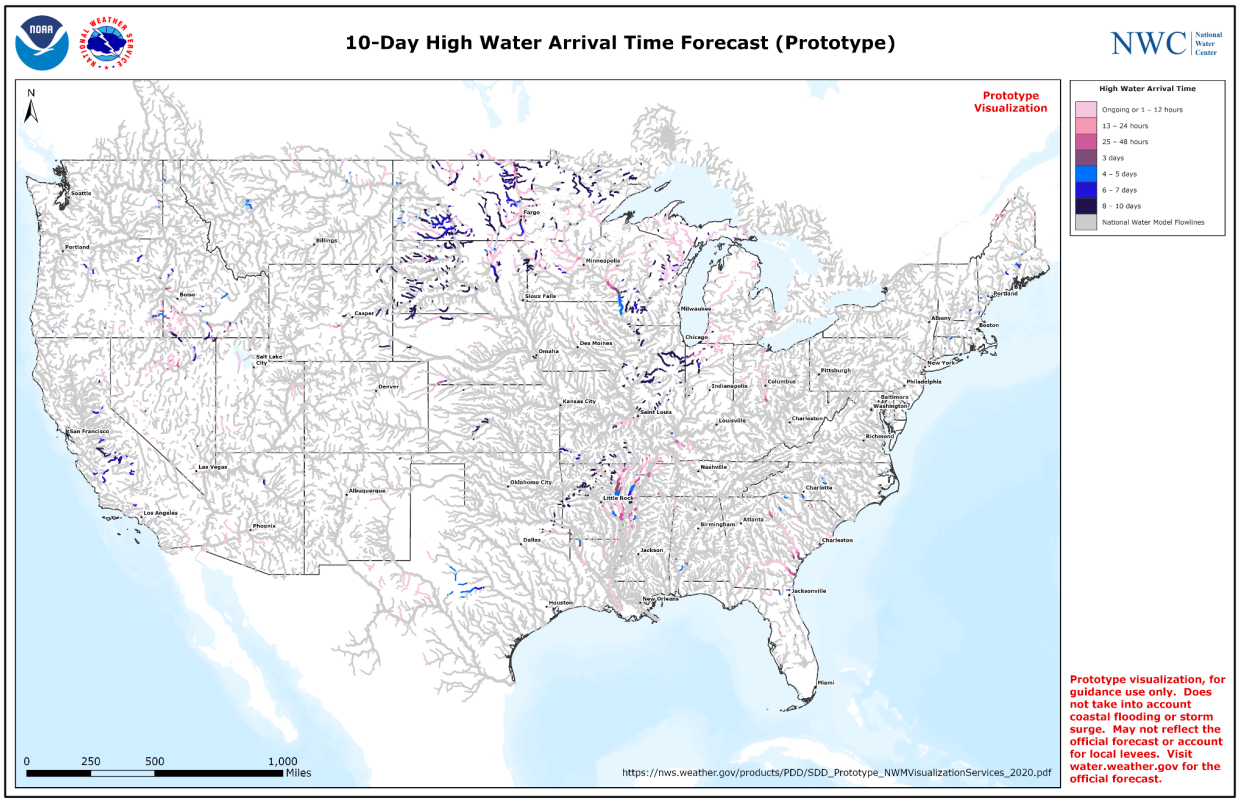
Update Frequency

Every 6 hours

Methodology

AEPs were derived from the 40-year NWM v2.1 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. “High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 10-Day High Water Arrival Time Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/mrf_high_water_arrival_time/MapServer

Description

Depicts the forecast arrival time of high water over the next 10 days. This service is derived from the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above the high water threshold over the next 10 days. Reaches are colored by the time at which they are forecast to reach high water. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

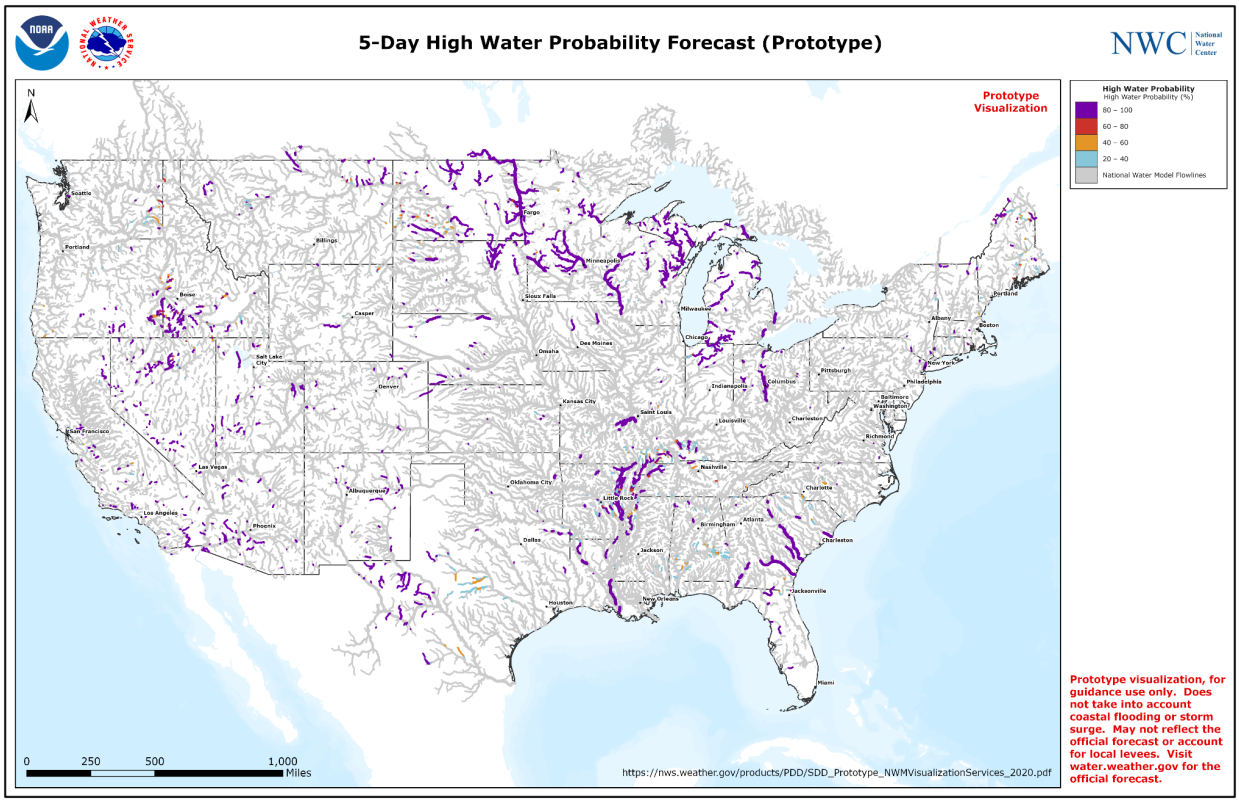
Update Frequency

Every 6 hours

Methodology

The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated “high water” condition. The time at which forecast streamflow first exceeds the “high water” condition is considered the arrival time. AEPs were derived from the NWM (v2.1) retrospective, utilizing a multi-decade flood frequency analysis with guidance from the USGS Bulletin 17C. “High water” conditions are approximated with an AEP determined to represent a region, using areas with similar *variability* in water-year runoff efficiency (McCabe and Wolock, 2016).

NWM 5-Day High Water Probability Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/mrf_high_water_probability/MapServer

Description

Depicts the probability of forecast high water over the next 5 days using ensembles from the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above high water on Day 1, Day 2, Day 3, and Days 4-5, using the 7 ensemble members of the medium-range forecast. Reaches are colored by the probability that they will meet or exceed the high water threshold on Day 1, Day 2, Day 3, and Days 4-5. Probabilities are computed as the % agreement across the 7 ensemble members, equally weighted. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency

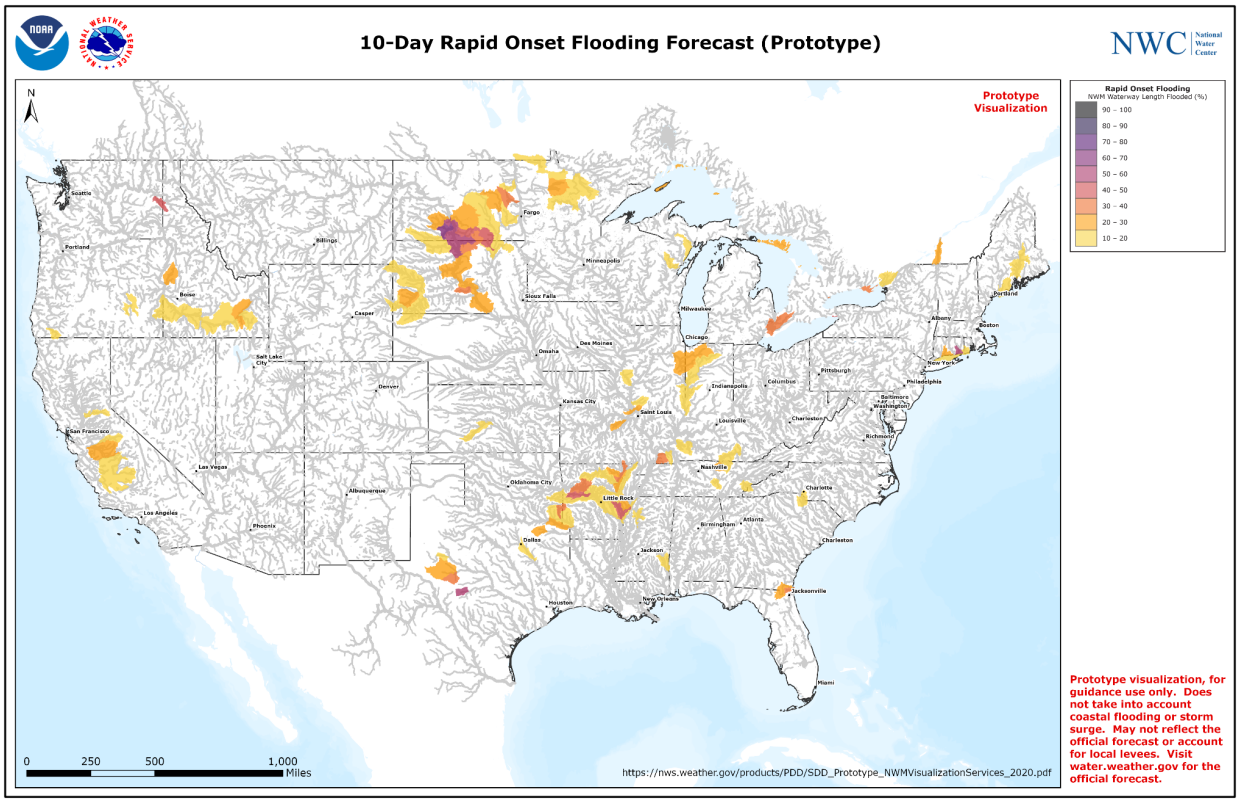
Every 6 hours

Methodology

Shown are reaches that are expected to have forecast streamflow at or above “high water” conditions on Day 1, Day 2, Day 3, and Days 4-5. Probabilities are computed for Day 1, Day 2, Day 3, and Days 4-5 valid time ranges. For a particular reach, all forecast streamflow values from the 7 ensemble members for the valid time ranges of interest are obtained and considered of equal weight. From these values, the number of times a reach was forecast to be at or above “high water” during each of the valid time ranges is used to compute high water threshold probabilities.

“High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 10-Day Rapid Onset Flooding Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/mrf_rapid_onset_flooding/MapServer

Description

Depicts forecast rapid onset flooding using the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches (stream order 4 and below) with a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at or above the high water threshold within 6 hours of that increase. Also shown are USGS HUC08 polygons symbolized by the percentage of NWM waterway length (within each HUC08) that is expected to meet the previously mentioned criteria. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency

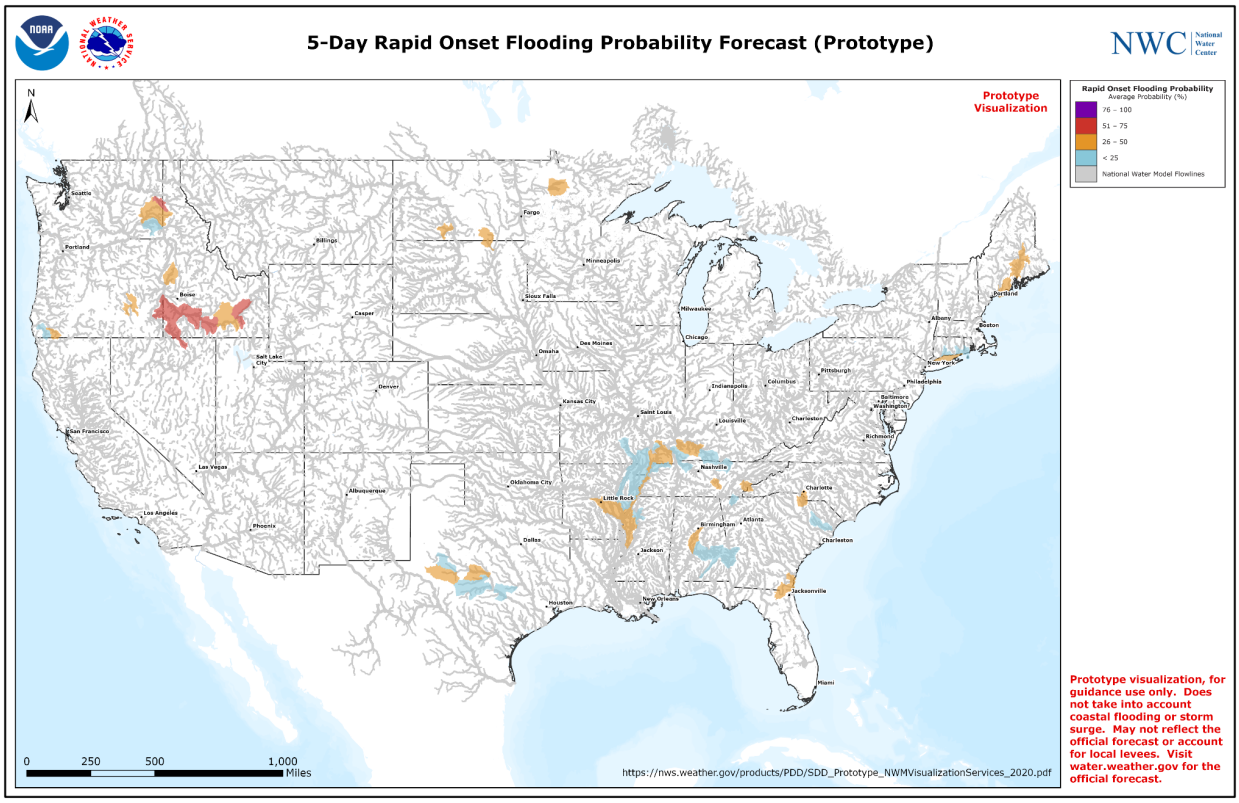
Every 6 hours

Methodology

Shown are reaches that are expected to have a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at above the high water threshold within 6 hours of that increase. Reaches are colored in two ways. One sublayer colors reaches by the time at which they are expected to reach “high water” conditions. Another sublayer colors reaches by the length of time between when the streamflow increases above the high water threshold and the streamflow decreases below high water. If the streamflow never decreases below “high water” within the forecast period, the length will be “ongoing”. HUC08s are also shown and colored based on the percentage of NWM waterway length within that HUC that meets the rapid onset flooding criteria.

“High water” conditions are approximated regionally with an AEP that aligns with the “Action” flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

NWM 10-Day Rapid Onset Flooding Probability Forecast



Service URL

https://maps.water.noaa.gov/server/rest/services/nwm/mrf_rapid_onset_flooding_probability/MapServer

Description

Depicts the probability of forecast rapid onset flooding over the next 10 days using ensembles from the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above high water thresholds on Day 1, Day 2, Day 3, Days 4-5, and Days 1-5 using the 7 ensemble members of the medium-range forecast. Reaches are colored by the probability that they will meet or exceed high water thresholds on Day 1, Day 2, Day 3, Days 4-5, and Days 1-5. Probabilities are computed as the % agreement across the 7 ensemble members, equally weighted. Hotspots show USGS HUC08 basins with greater than 50% of NWM features with flow expected to be at or above high water thresholds over the next 5 days. High water thresholds (regionally varied) were derived using the 40-year NWM v2.1 reanalysis simulation.

Update Frequency
Every 6 hours

Methodology
Probabilities are computed as the % agreement across all medium-range forecast ensemble members. Reaches (stream order 4 and below) that are expected to have a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at above the high water threshold within 6 hours of that increase, are considered agreeable for the probability calculation.

"High water" conditions are approximated regionally with an AEP that aligns with the "Action" flood threshold of the RFC forecast points within each region. Regions are defined by McCabe and Wolock, 2016 based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.