

Experimental Water Information Interface Webpage Product Description Document

Updated: August 2023

Part I – Mission Connection

a. Product Description –

Effective on Wednesday, September 20, 2023, the Office of Water Prediction (OWP) National Water Center (NWC) began hosting water information from version 3.0 of the National Water Model (NWM)--which is an hourly, uncoupled hydrologic analysis and forecast system that provides streamflow for over 3 million river reaches and other hydrologic information on 1 km, 250 m and 100 m grids--on its Experimental Water Information Interface Webpage. The webpage can be found at <https://water.noaa.gov/map>.

b. Purpose –

The Experimental Water Information Interface Webpage is a mapping interface which allows users to display a range of water information, such as snow depth; snow water equivalent; and NWM output. NWM output includes streamflow, streamflow anomaly, soil saturation images, and forecast hydrographs for over 3 million river reaches for an analysis cycle along with short-, medium-, and long-forecast ranges. Information is available for the contiguous United States including the Great Lakes and Lake Champlain drainage basins, Hawaii, Puerto Rico, the United States Virgin Islands (USVI) and southern Alaska. NWM v3.0 includes the following new/modified features:

- First time provision of NWM Total Water Level guidance for coastal areas of the Continental United States (CONUS), Hawaii and Puerto Rico / US Virgin Island domains.
- NWM Domain expansion to south-central Alaska (Cook Inlet, Copper River Basin, and Prince William Sound regions), enabling provision of NWM operational hydrologic model forecast guidance to this region.
- Addition of the National Blend of Models (NBM) as a forcing source for NWM CONUS medium-range forecasts and Alaska short-range and medium-range forecasts.
- Use of Multi-Radar Multi-Sensor (MRMS) precipitation as forcing for the NWM Analysis and Assimilation configuration over the Puerto Rico / US Virgin Island domain.
- Ingest of RFC-supplied reservoir outflow forecasts at 77 additional locations, bringing the total of such sites to 392.
- Enhancements to the treatment of reservoirs, land surface parameters and calibration/regionalization approach leading to improvements in model skill.
- Implementation of a new surface runoff scheme (Xinanjiang) within the NWM, improving streamflow simulation performance.

- Various hydrofabric improvements for all domains.



A topographic basemap with NWM flowlines appears when the Experimental Water Information Interface Webpage is first displayed (Figure 1).

Figure 1. Experimental Water Information Interface Webpage

Interactive Forecast Chart

Use the “+” zoom-in button in the upper left-hand portion of the webpage to zoom into your area of interest to more precisely identify a particular river reach. Click on the map to select a river reach. In this case, the Ohio River at Louisville has been selected and is highlighted in yellow (Figure 2).

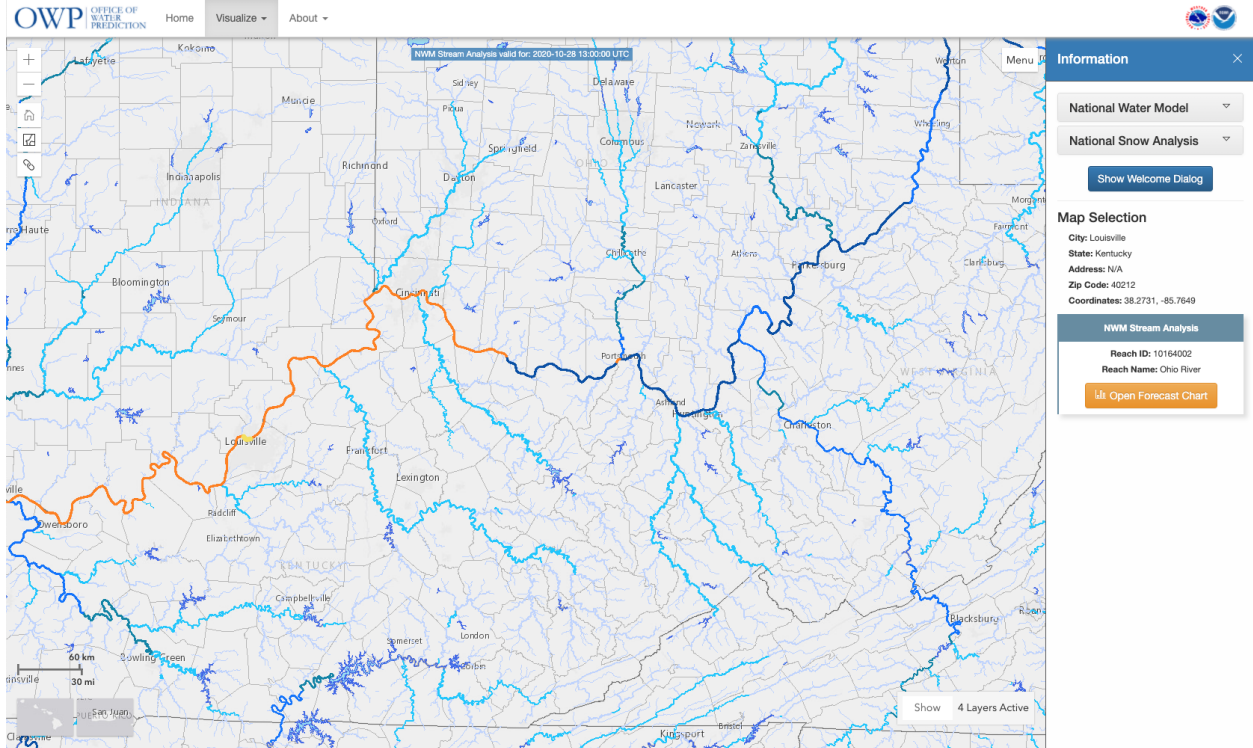


Figure 2. User-selected river reach on the Experimental Water Information Interface Webpage

The Information section to the right of the map shows additional information about your map selection, including city, state, address, zip code, coordinates, reach ID, and reach name. Click on the Open Forecast Chart button to display a forecast hydrograph for your selected river reach (Figure 3). A hydrograph is a graph showing the rate of flow versus time past a specific point in a river.

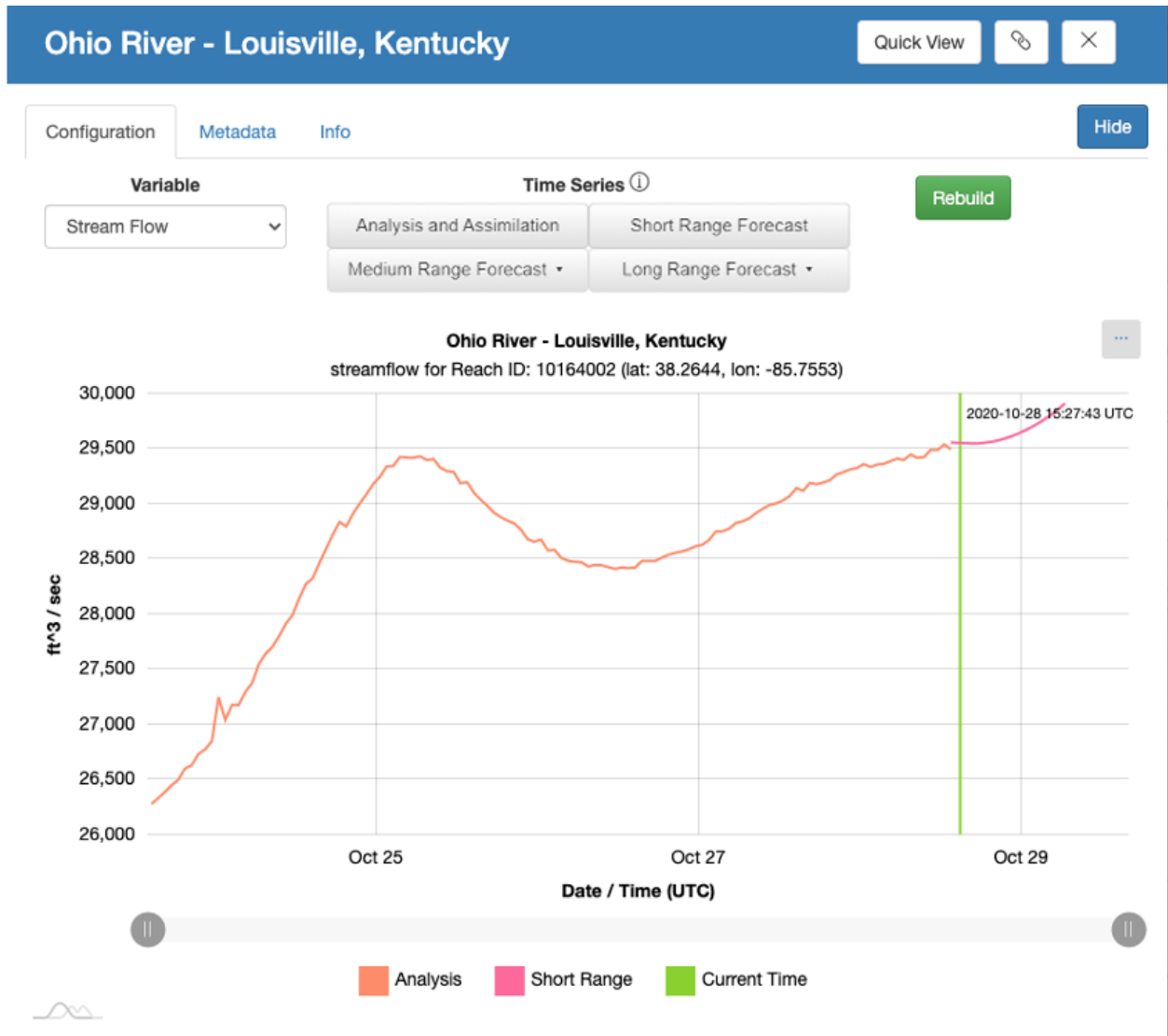


Figure 3. Experimental Interactive Forecast Chart depicting an Analysis and Assimilation and Short-Range Forecast hydrograph for a user-selected river reach.

On the Experimental Interactive Forecast Chart (Configuration tab), users have the option of displaying (**Note:** HI, PR, and AK domains do not have all options listed below):

- 1) The Analysis and Assimilation forced by the HRRR, RAP, and observed precipitation
- 2) The Short-Range Forecast (18-hour) forced by the HRRR and RAP
- 3) The Medium Range Forecast forced by the GFS including the most recent 10-day medium-range, the 8.5-day 6-member ensemble mean, and the 6 individual medium-range ensemble members each extending out to 8.5 days
- 4) The 10-day Medium-Range Blend forced by the National Blend of Models
- 5) The Long Range Forecast including the 30-day long-range ensemble mean and the 4 individual long-range ensemble members each extending out to 30 days.

The Medium Range Time-lagged Ensembles and the Long Range Ensembles are described in the next two sections, respectively.

Medium Range Time-lagged Ensemble Explanation

Medium-Range Ensemble:

The National Water Model (NWM) features a Medium-Range ensemble forecast configuration. Cycling four times per day at 00Z, 06Z, 12Z and 18Z, this ensemble consists of six members. Each of these Medium-Range (MR) ensemble members starts from the same set of initial land surface conditions, but uses forcings (precipitation and temperature) from the current and five previous runs of the [Global Forecast System](#) (GFS). Using the current NWM issuance time as the starting point for all 6 inputs creates a time-lagged ensemble (Figure 4). An ensemble forecast mean is also calculated and provided.

This MR ensemble approach seeks to represent the impact of meteorological forcing-based uncertainty on NWM hydrologic forecasts, and does not take into account uncertainty of land surface states or parameters. Each ensemble member represents one possible outcome and, collectively, the ensemble members aim to portray a range of possible outcomes.

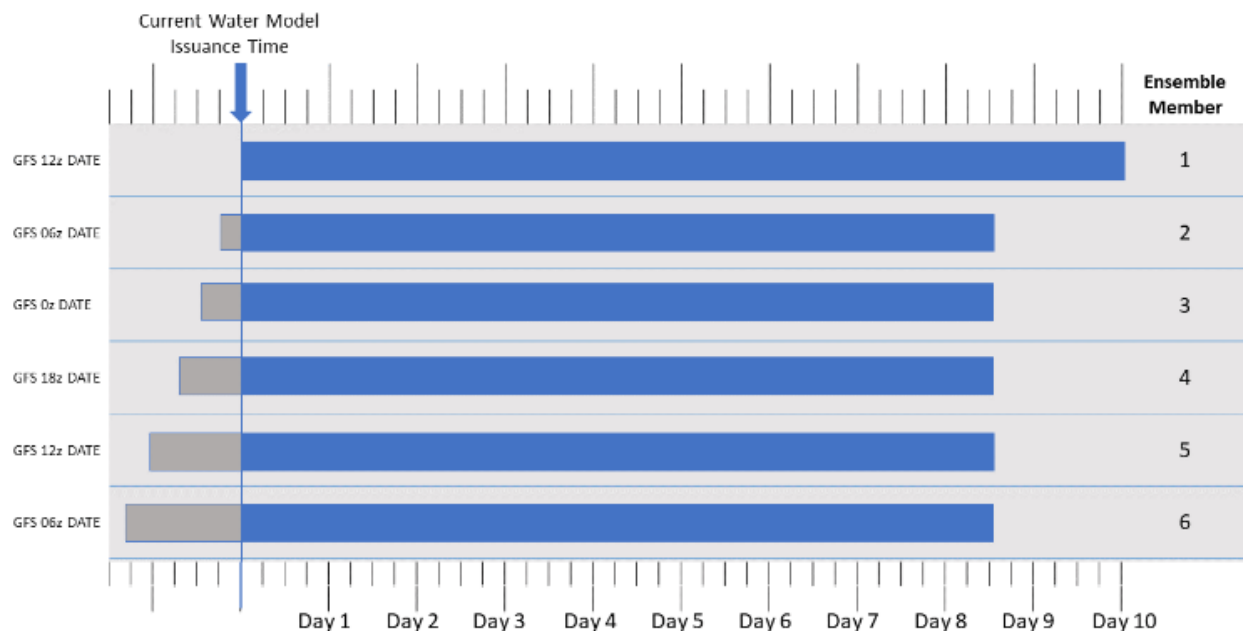


Figure 4. The forcing data is used as input in the development of the 6-member NWM Medium-Range Ensemble. The Member 1 forecast uses the most recent GFS model run and is 10 days in length, while Members 2 through 6 use successively older GFS cycles and extend to 8.5 days in length. The MR Ensemble forecast mean is 8.5 days in length, using the first 8.5 days from Member 1 and the full-length forecasts from Members 2 through 6.

Displays of the Medium-Range Ensemble

The hydrograph page of a location allows the user to choose from several options on the Medium-Range (MR) Forecast button to view the MR output (Figure 5). Options include the most recent 10-day MR run (Member 1), the 6-member ensemble mean, or the 6 individual ensemble members - all together or with only selected members.

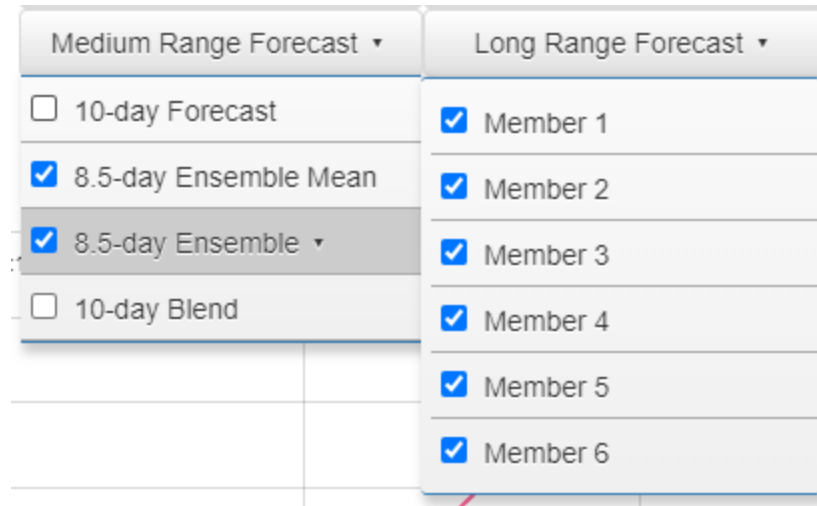


Figure 5. Medium-Range Forecast Dropdown Menu with all options displayed
The 3 options can be chosen individually or in various combinations. 10-day Run and the 8.5-Day Ensemble Mean can be chosen together, as can the 8.5-Day Ensemble Mean and the 8.5-Day Ensemble, and the new 10-day blend displaying the National Blend of Models.

The following figures show the output generated when each main option is selected (Note: Data shown below is not actual observation nor forecast data - it is data used for illustrative purposes)

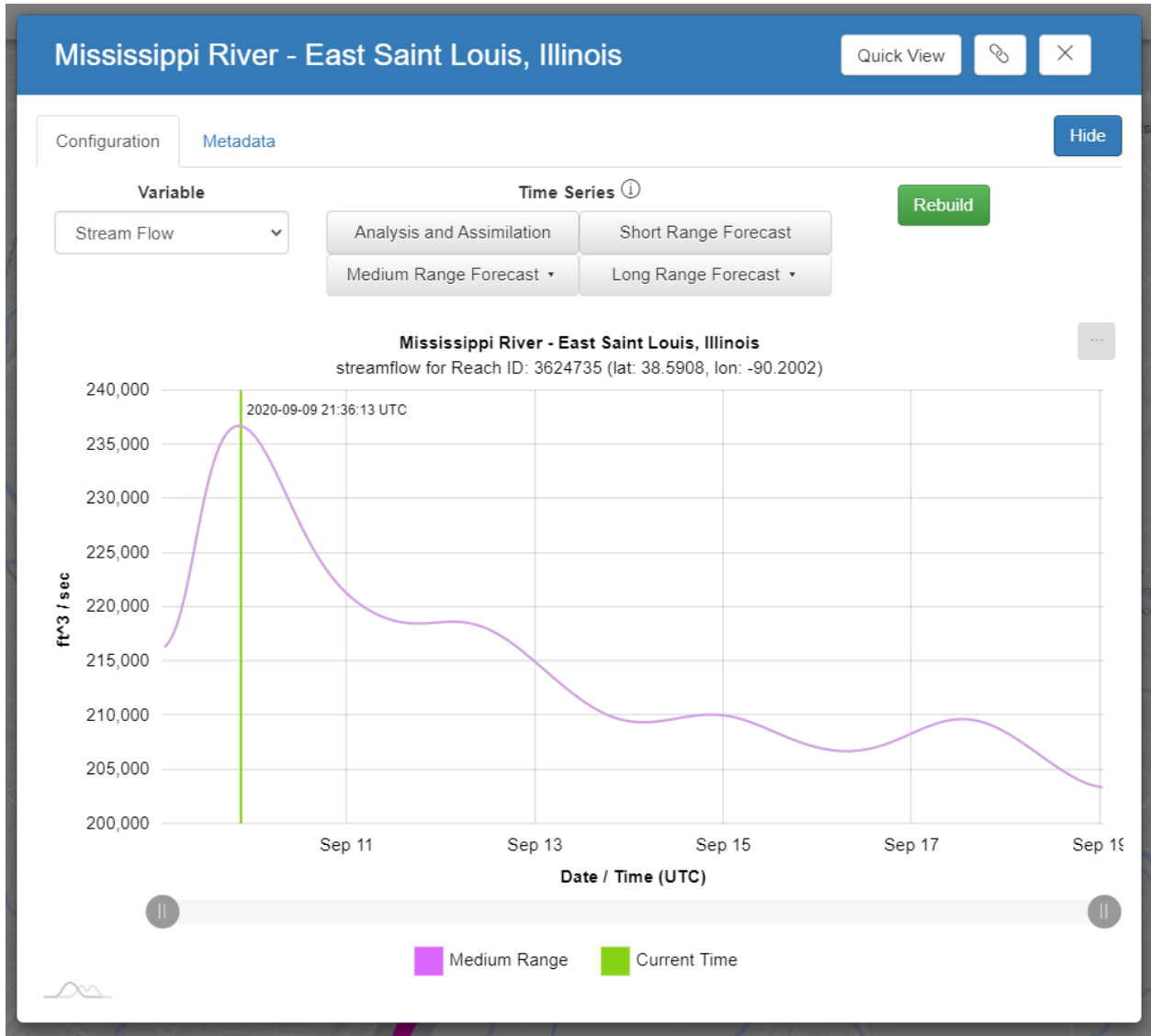


Figure 6: 10-day forecast selected

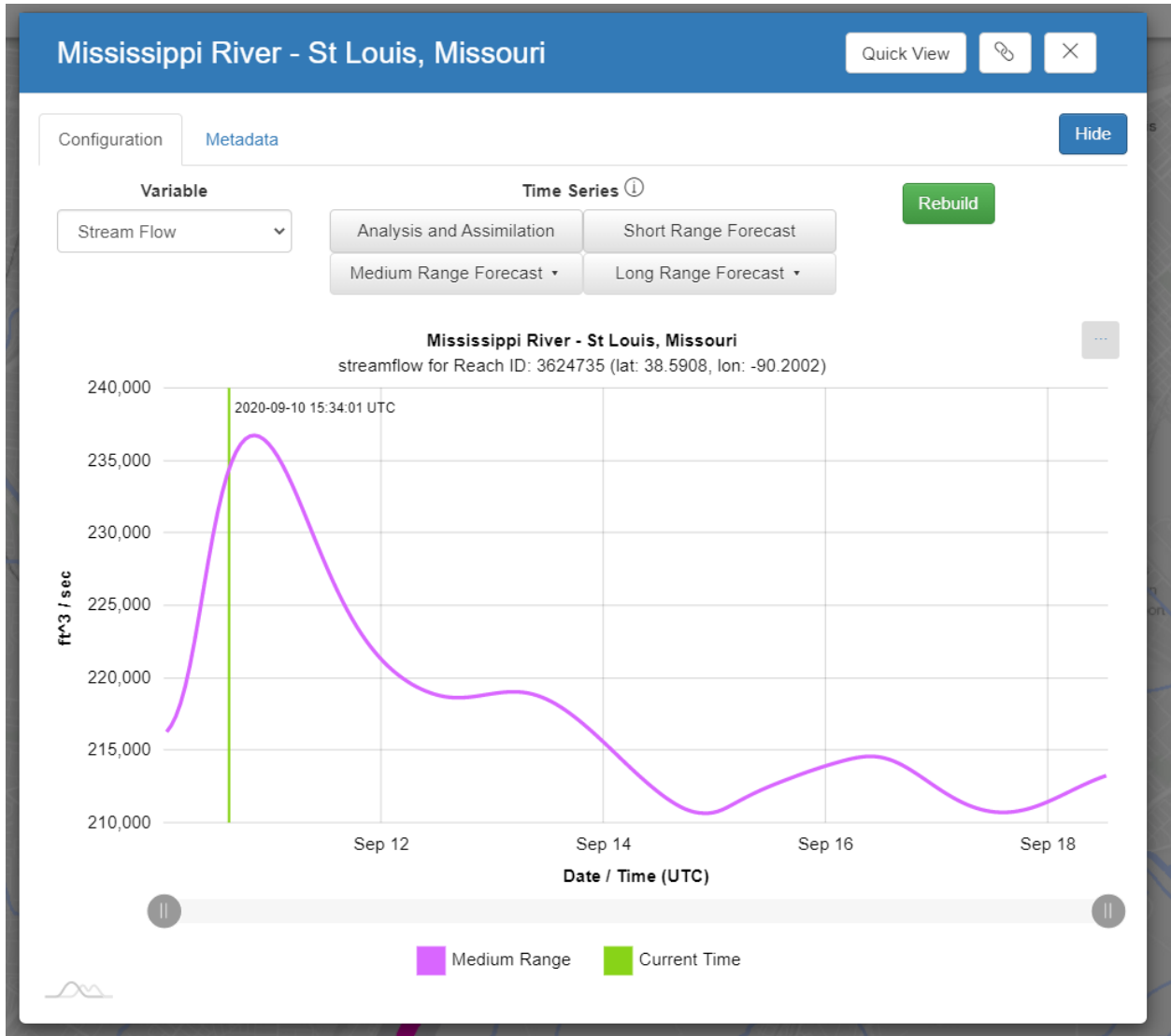


Figure 7: 8.5-day Ensemble Mean selected

Mississippi River - Drummonds, Tennessee

Quick View



Configuration

Metadata

Info

Hide

Variable

Stream Flow

Time Series ⓘ

Analysis and Assimilation

Short Range Forecast

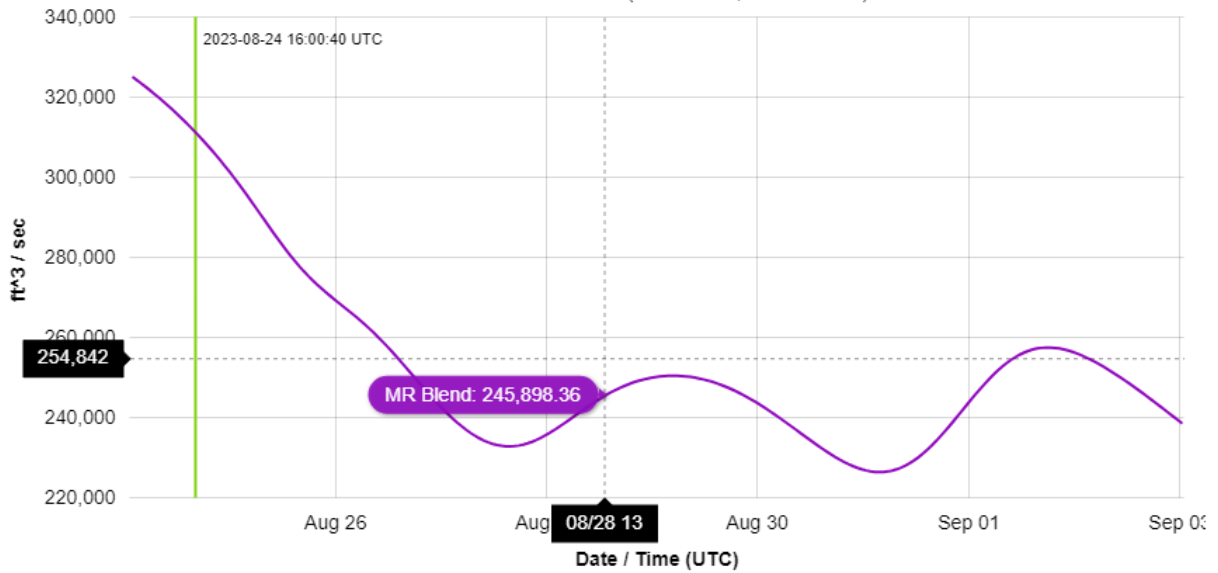
Rebuild

Medium Range Forecast ▾

Long Range Forecast ▾

Mississippi River - Drummonds, Tennessee

streamflow for Reach ID: 7471698 (lat: 40.0479, lon: -97.6010)



Medium Range Blend Current Time

Figure 8: 10-day Blend selected

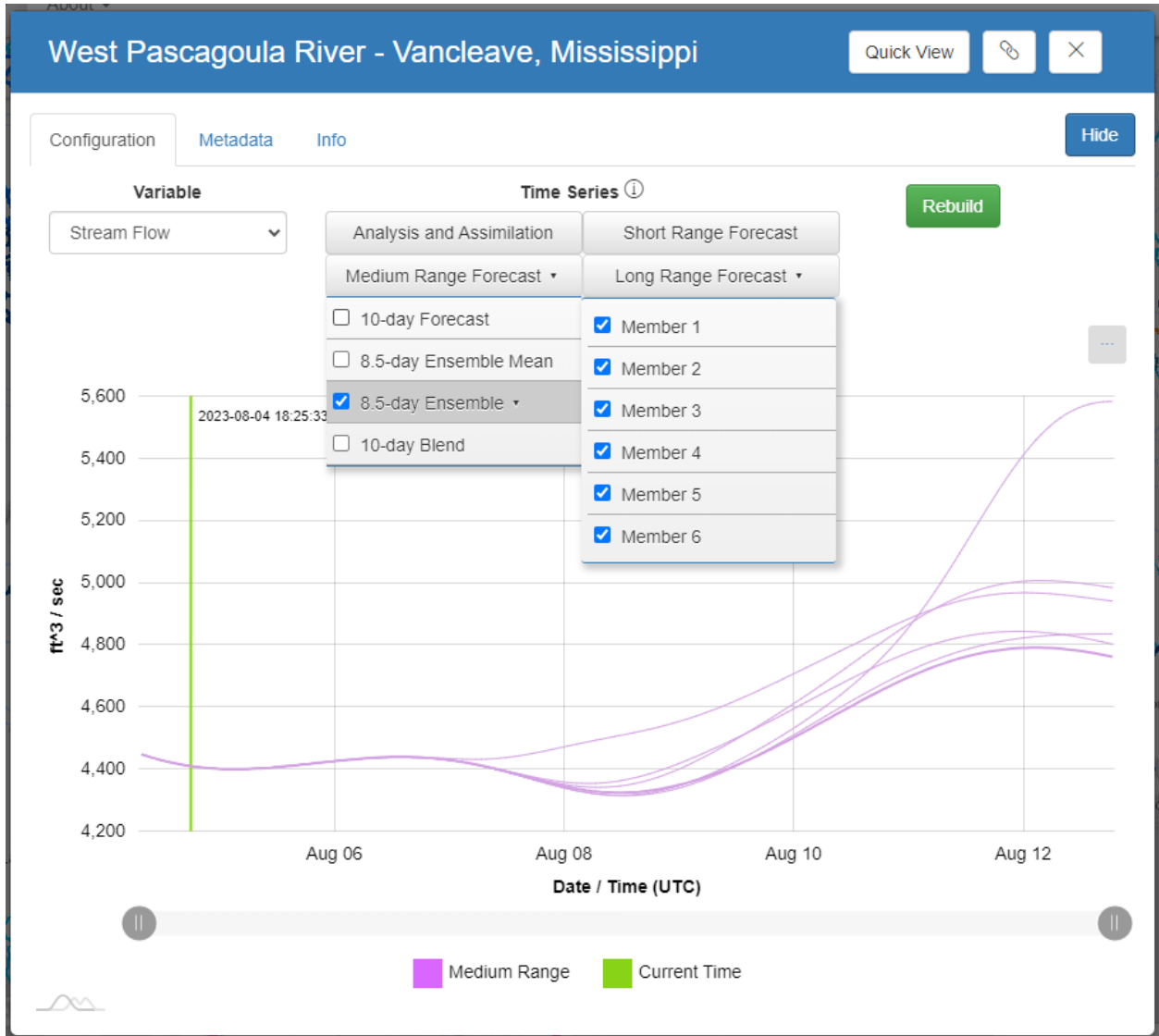


Figure 9: Choosing the 8.5-day Ensemble will show a dropdown with the 6 members listed and selected by default. Individual members can be toggled on/off from that menu. This display shows all 6 members of the ensemble.

Long-Range Ensemble Description

Descriptions:

Long-Range Ensemble:

The National Water Model (NWM) features a Long-Range (30-day) ensemble forecast configuration. The Long-Range (LR) forecast cycles four times per day at 00Z, 06Z, 12Z, and 18Z, and there are 4 ensemble members in each cycle, each forced with a different Climate Forecast System (CFS) forecast member. Each ensemble member uses the CFS forcing with the same member identifier, e.g. LR ensemble member 1 uses CFS ensemble member 1. The LR forecast

produces 6-hourly streamflow, and, as with the other forecast configurations, is initialized with a common restart file from the Analysis and Assimilation configuration. The display options available are the 4 ensemble members and the ensemble forecast mean from the latest LR forecast cycle.

This LR ensemble approach seeks to represent the impact of meteorological forcing-based uncertainty on NWM hydrologic forecasts, and does not take into account uncertainty of NWM land surface states or parameters. Each ensemble member represents one possible outcome and, collectively, all of the ensemble members aim to portray a range of possible outcomes.

Long Range Ensemble:

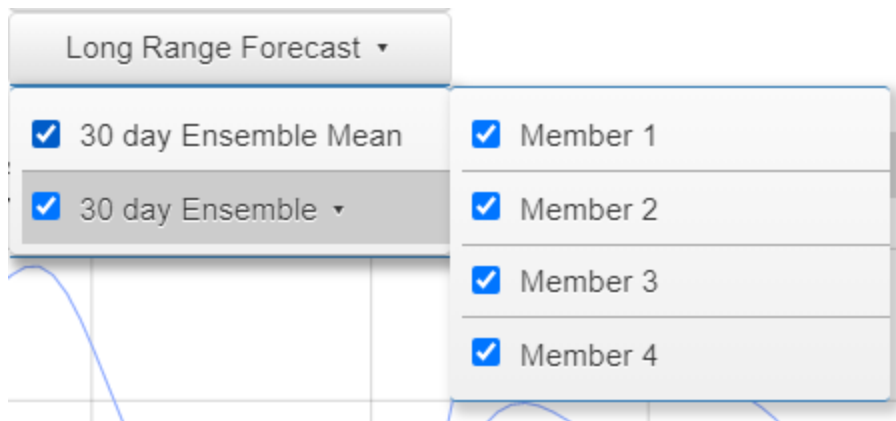


Figure 10. Long-Range Forecast Ensemble menus. The ensemble mean (Figure 11) and the individual ensemble members can be displayed individually (Figure 12) or together (Figure 13).

(Note: Data shown below is not actual observation nor forecast data - it is data used for illustrative purposes)

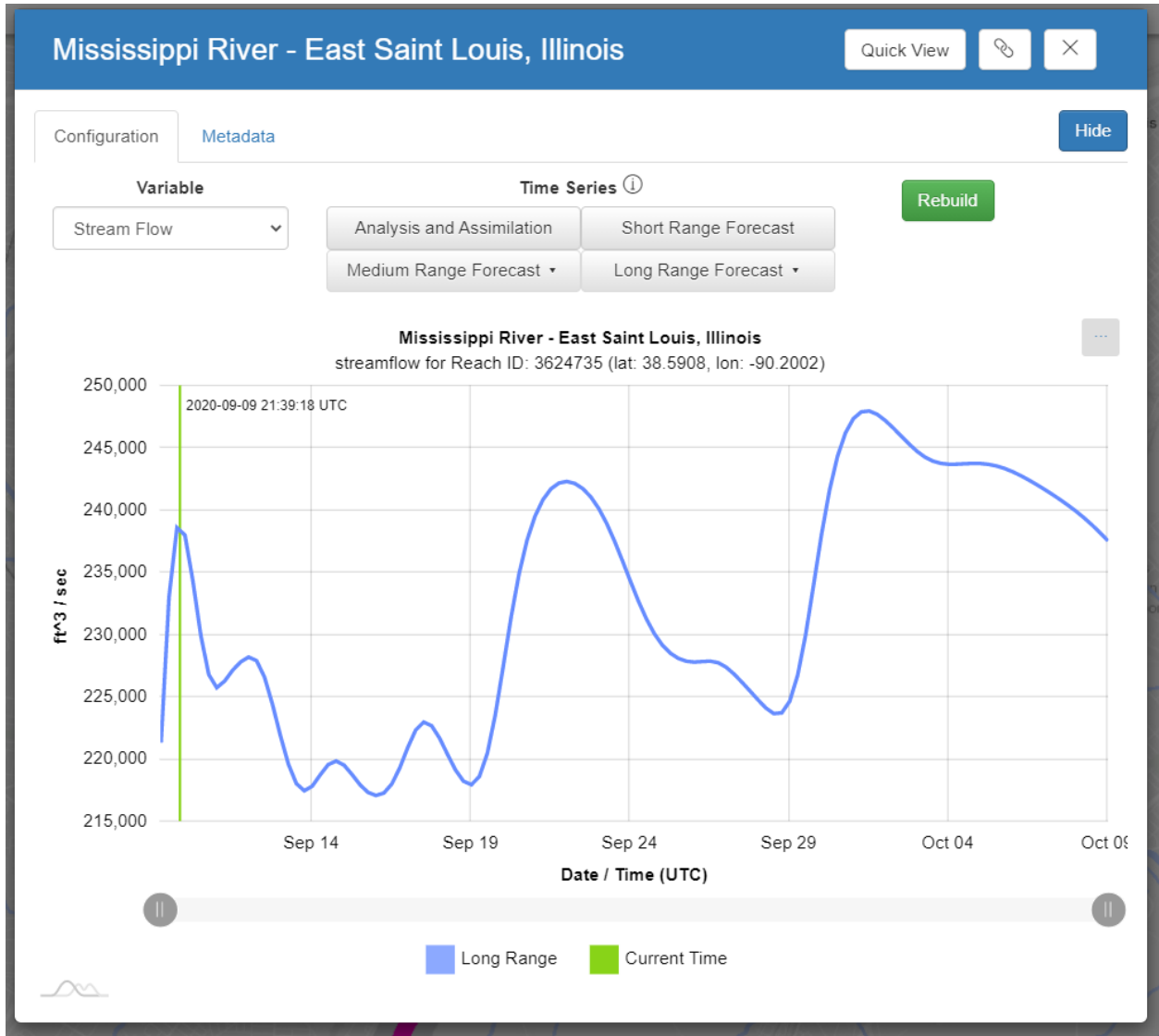


Figure 11. 30-day Ensemble Mean. The ensemble mean depicted is the one from the most recent LR ensemble run.

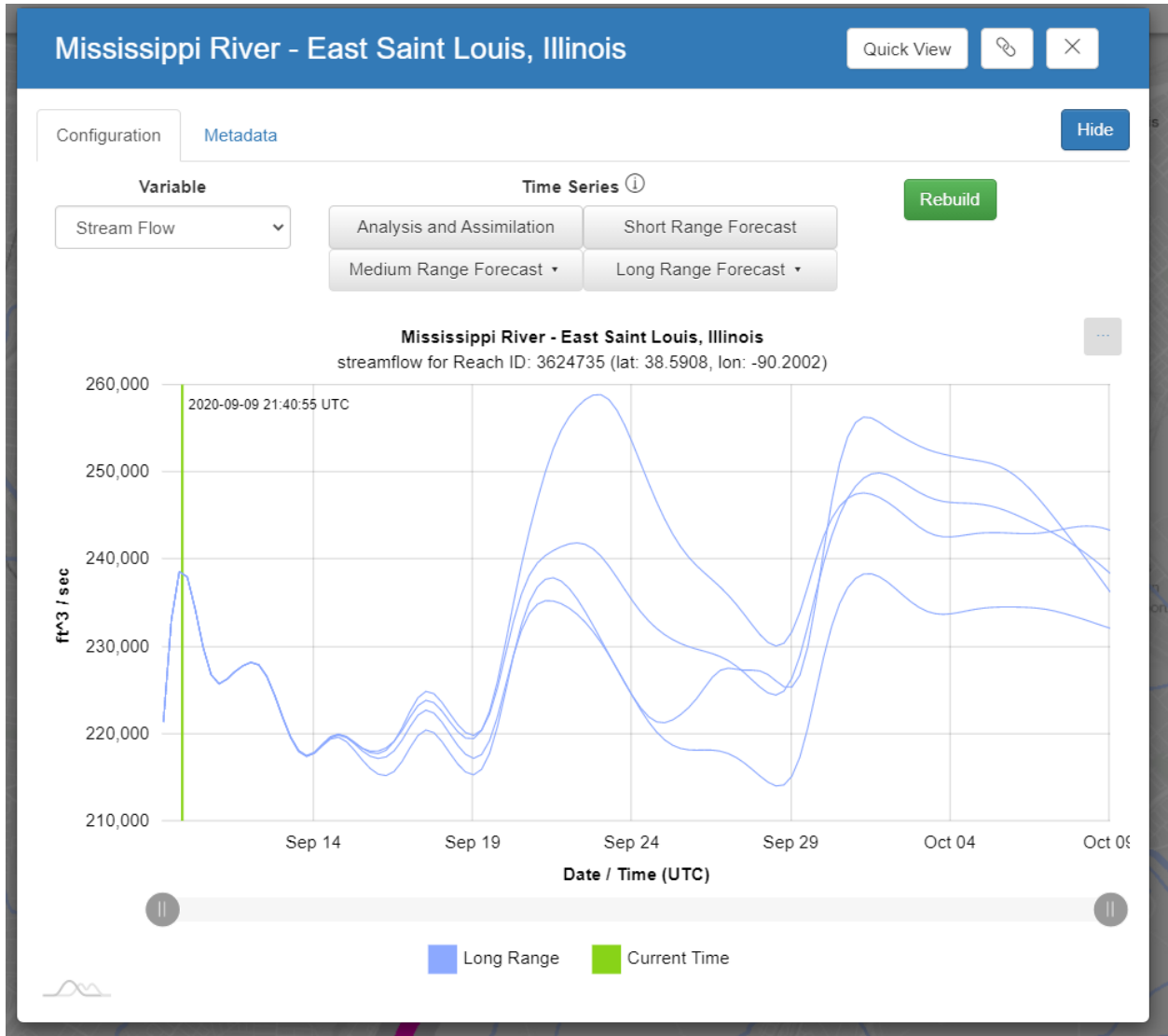


Figure 12. 30-day Forecast Ensemble individual members from the most recent LR ensemble run.

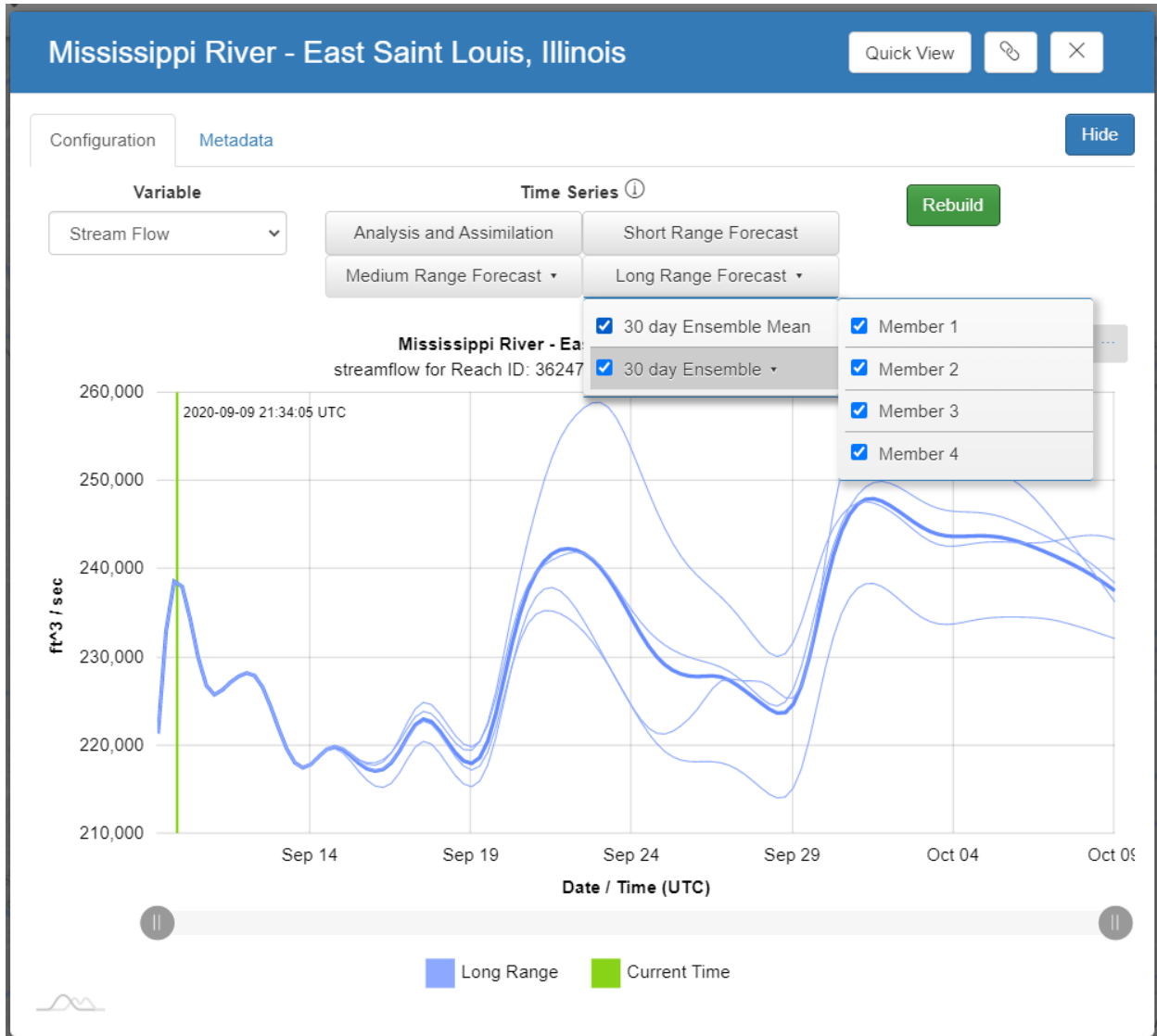


Figure 13. 30-day Ensemble mean and individual members

Users can display fewer forecasts on the hydrograph by adjusting the time control buttons below the time axis. Clicking the ... button to the right of the hydrograph title allows a user to download hydrograph images in PNG, JPG, SVG, and PDF formats and data in JSON, CSV, XLSX, HTML, and PDF formats. Users can choose to print the hydrograph or annotate on the hydrograph. Metadata pertaining to the selected river reach and the streamflow forecast at that location is available via the Metadata tab. The Permalink button copies a permalink to the user's clipboard while the Quickview link at the top right copies a permalink to the hydrograph and opens the Forecast Chart Quick View page. Clicking the Rebuild button restores the hydrograph to its default view. Information about the various NWM configurations is available via the Info tab.

Experimental NWM Image Viewer

Images from the NWM for various time periods are available by clicking on the Visualize drop-down menu at the top of the Experimental Water Information Interface Webpage and selecting the Experimental Image Viewer.

From the Dataset drop-down menu, users can choose to view:

- Streamflow (Figure 14)
- Streamflow Anomaly (Figure 15)
- Soilsat Top (Near-Surface Soil Moisture) (Figure 16)
- Precip (Precipitation) (Figure 17)

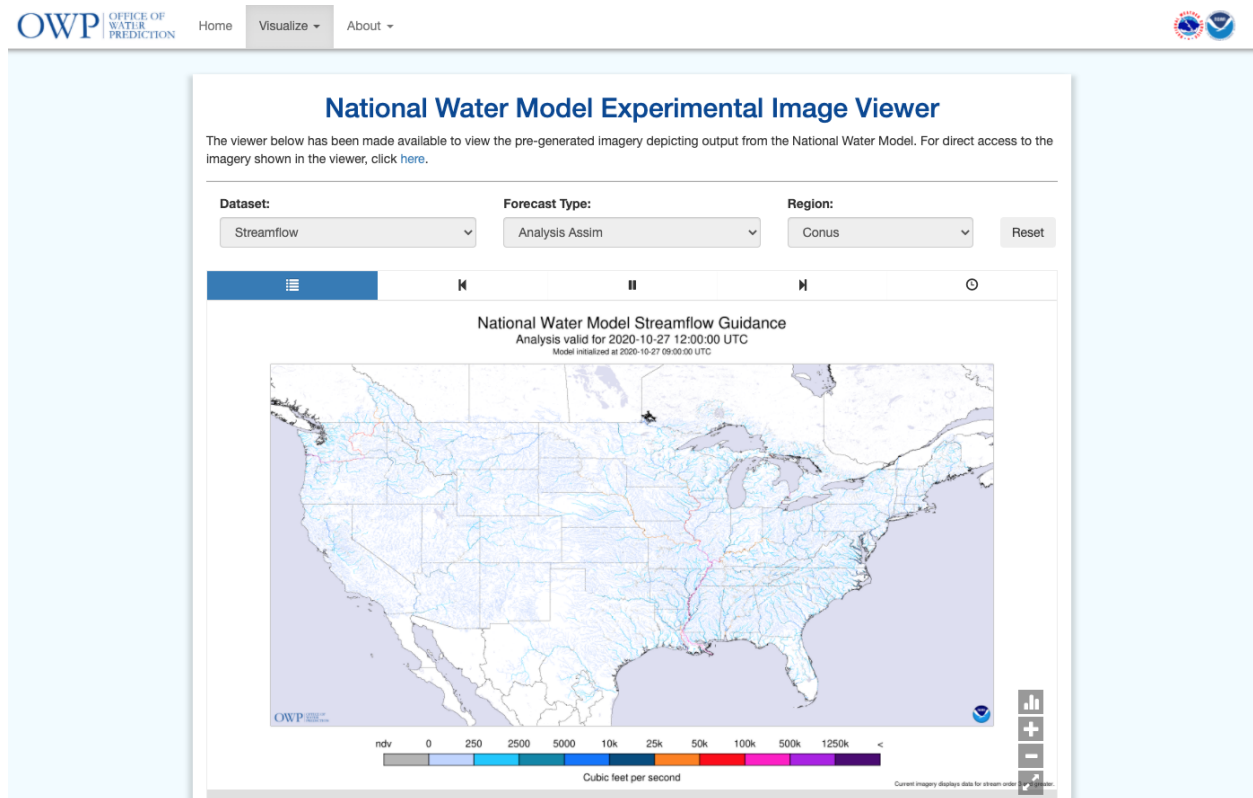


Figure 14. Experimental NWM Image Viewer – Streamflow Analysis Assim Guidance for the contiguous United States

National Water Model Experimental Image Viewer

The viewer below has been made available to view the pre-generated imagery depicting output from the National Water Model. For direct access to the imagery shown in the viewer, click [here](#).

Dataset: Streamflow Anomaly Forecast Type: Short Range Region: Conus Reset

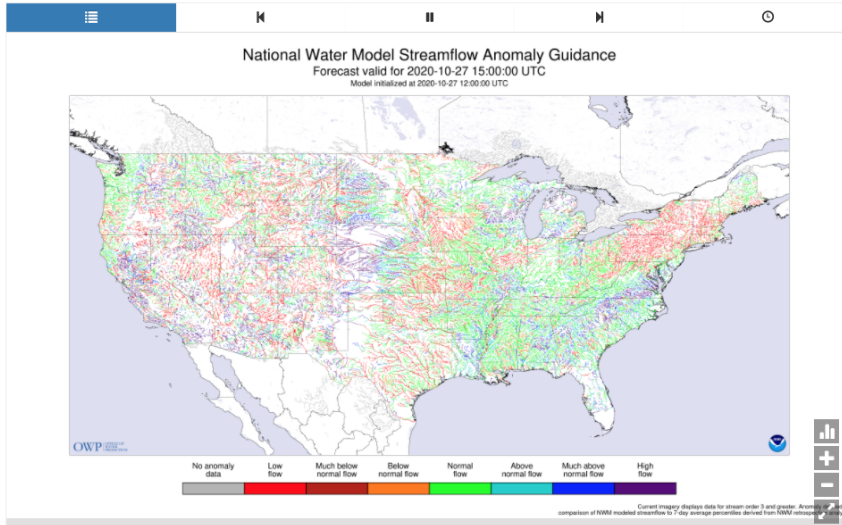


Figure 15. Experimental NWM Image Viewer – Short-Range, Streamflow Anomaly Guidance for the contiguous US

National Water Model Experimental Image Viewer

The viewer below has been made available to view the pre-generated imagery depicting output from the National Water Model. For direct access to the imagery shown in the viewer, click [here](#).

Dataset: Solsat Top Forecast Type: Medium Range Ensemble Mean Region: Conus Reset

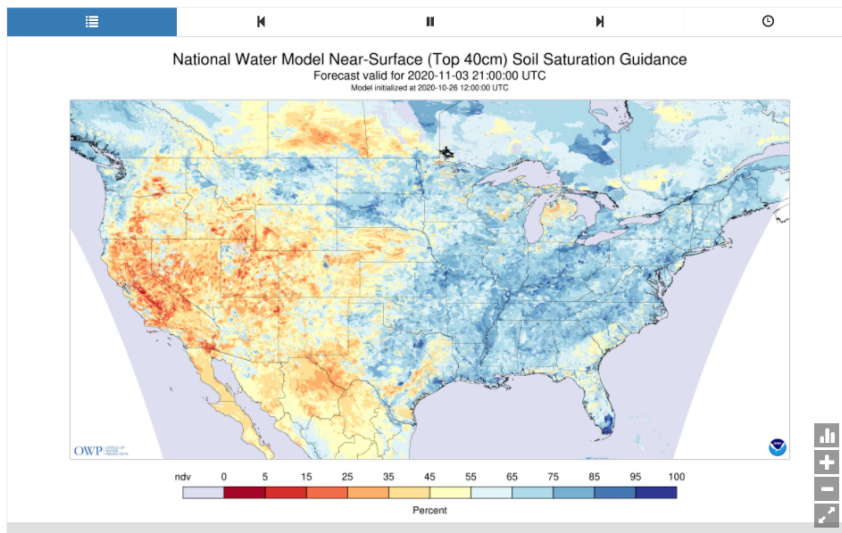


Figure 16. Experimental NWM Image Viewer – Medium-Range Ensemble Mean, Soilsat Top (Near-Surface Soil Moisture) Guidance for the contiguous United States

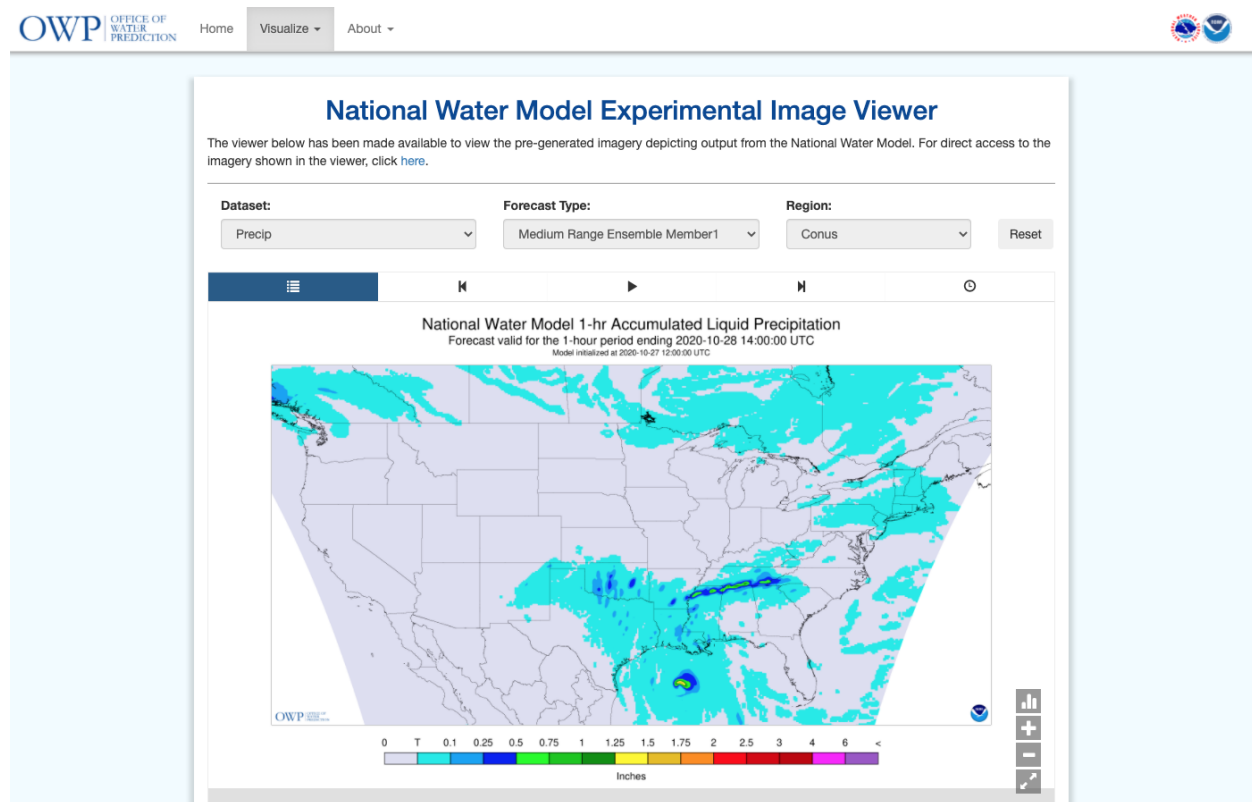


Figure 17. Experimental NWM Image Viewer - Medium Range Ensemble Member 1, Precip (Precipitation) Guidance for the contiguous US

From the Region drop-down menu, users can choose:

- CONUS to display a map of the contiguous United States
- Hawaii to display a map of Hawaii
- Puerto Rico to display a map of Puerto Rico and the U.S. Virgin Islands
- Alaska to display a map of Southern Alaska

From the Forecast Type drop-down menu, dependent upon Region, users can choose:

- Analysis Assim to display a real-time snapshot of the selected dataset
- Short-Range to display 18-hour deterministic (single value) guidance
- Medium-Range Ensemble Member 1 to display 10-day deterministic (single value) guidance
- Medium-Range Ensemble Mean to display 10-day ensemble guidance
- Long-Range Ensemble Mean to display 30-day ensemble guidance

If the Hawaii, Alaska or Puerto Rico regional views are chosen, Streamflow Anomaly is no longer an option under the Dataset dropdown and Forecast Type becomes limited to:

- Analysis Assim to display a real-time snapshot of the selected dataset (Figure 18)
- Short-Range to display 60-hour deterministic (single value) guidance (Figure 19)

National Water Model Experimental Image Viewer

The viewer below has been made available to view the pre-generated imagery depicting output from the National Water Model. For direct access to the imagery shown in the viewer, click [here](#).

Dataset: Streamflow **Forecast Type:** Analysis Assim **Region:** Hawaii **Reset**

Navigation controls: Home, Previous, Play, Next, Full Screen

Analysis valid for 2020-10-27 12:00:00 UTC
Model initialized at 2020-10-27 09:00:00 UTC

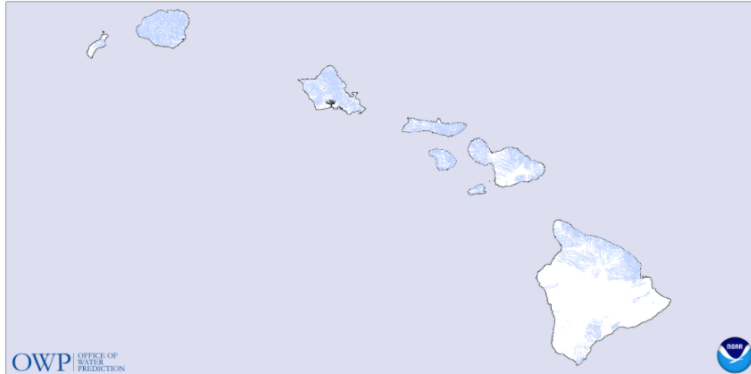


Figure 18. Experimental NWM Image Viewer - Streamflow Analysis Assim Guidance for Hawaii

National Water Model Experimental Image Viewer

The viewer below has been made available to view the pre-generated imagery depicting output from the National Water Model. For direct access to the imagery shown in the viewer, click [here](#).

Dataset: Streamflow Forecast Type: Short Range Region: Puerto Rico Reset

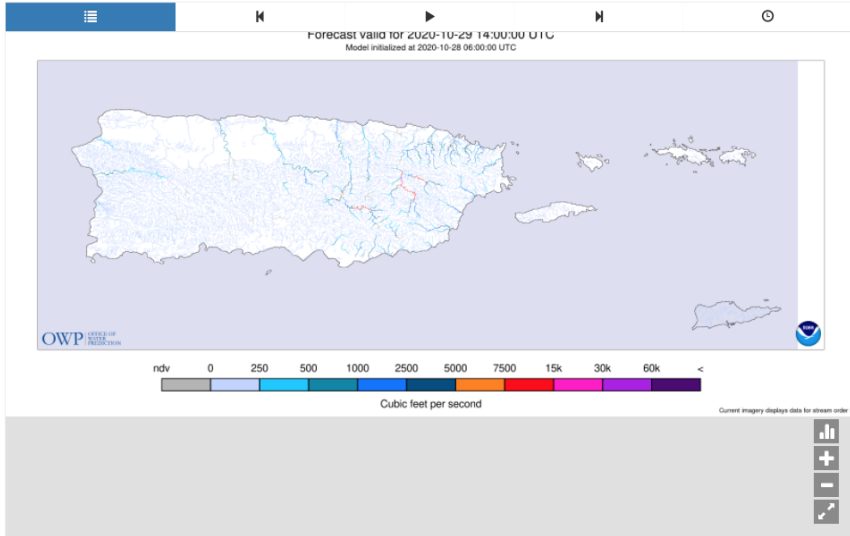


Figure 19. Experimental NWM Image Viewer - Short-Range, Streamflow Guidance for Puerto Rico and the U.S. Virgin Islands

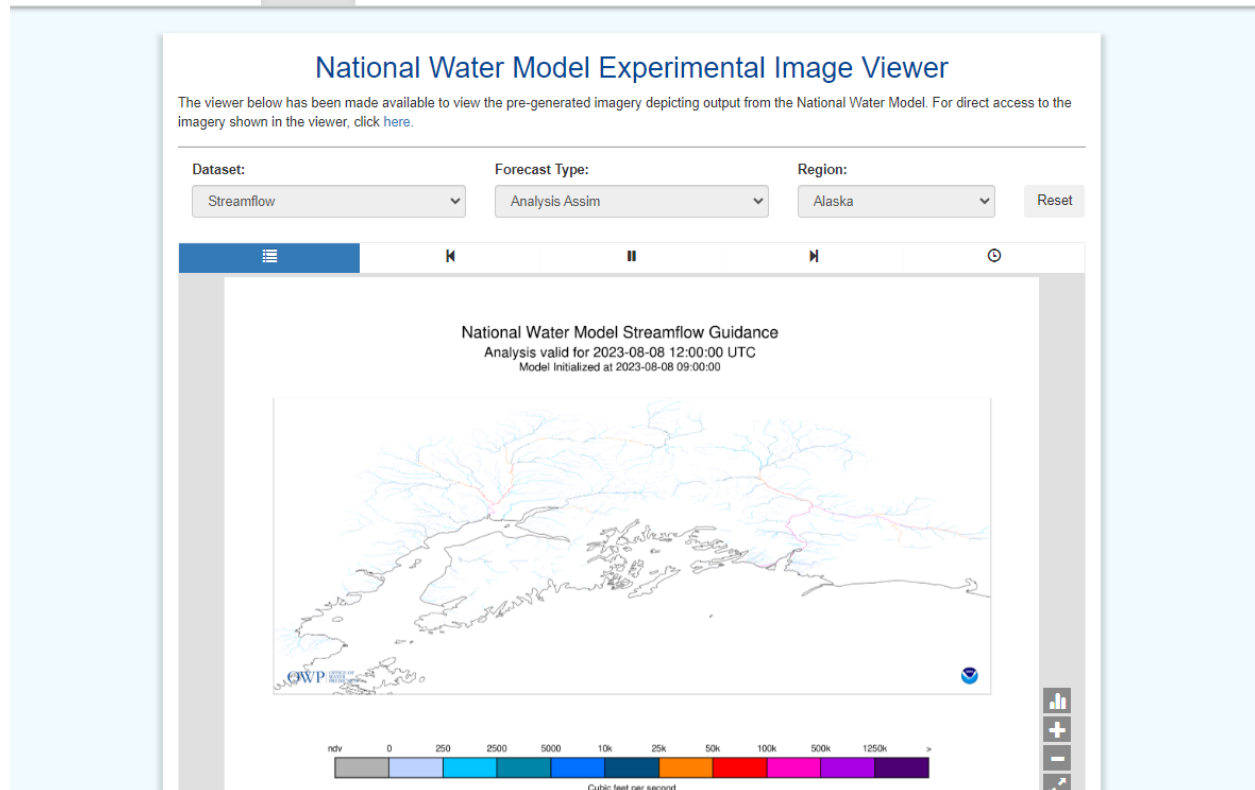


Figure 20. Experimental NWM Image Viewer - Analysis Assim, Streamflow Guidance for Southern Alaska

Use the buttons and slider control above the map to:

- Display an image at a particular time
- Stop/start the looping of images
- Loop images forward/backward in time
- Control the looping speed

Regardless of the view options chosen, at the lower right-hand corner of the map, people can use the zoom control “+” and “-” buttons for changing the zoom level of the map or to display the map in full screen and the legend control button to increase/decrease the size of the map legend or toggle it on and off.

Experimental Water Information Interface Mapping Controls

The upper left-hand portion of the webpage includes zoom, default map view, and inset map controls as well as a button to permalink the current map view. The zoom control consists of “+” and “-” buttons for changing the zoom level of the map. Clicking the default map view button sets the map extent to what was initially shown when the webpage was first displayed. The Permalink map view button copies a permalink of the current map view extent to the user’s clipboard. The Inset Map button removes or attaches the Hawaii and Puerto Rico regional inset maps.

The upper right-hand portion of the webpage displays the Menu button. Under the Menu dropdown menu, Help, Basemaps, Show/Hide Data Time, Downloads, Information, Legends, and Location Search are available. Clicking on Help displays information on the main menu, reach selection, and layer list. Clicking Basemaps allows users to display water information with 7 types of base maps, including Topographic, United States Geological Survey (USGS) topographic, Delorme, Streets, Dark Grey, Light Grey, and Imagery with Labels maps. Clicking the Show/Hide Data Time button toggles on or off the valid time displayed at the top of the map. Clicking the Downloads button allows users to download National Snow Analysis (NSA) regions data in Keyhole Markup language Zipped (KMZ) format. Selecting the Information button displays information on the NWM and allows users to view snow statistics for 18 regions. The map legend is displayed by clicking on the Legends button. Selecting the Location Search button displays the Navigation controls. Users can search for a particular location by address or coordinate or quickly navigate to a specific geographic region.

The lower right-hand portion of the webpage includes Map Layer control. Users can toggle various types of layers, including NWM Lakes and Reservoirs, NWM Stream Analysis, U.S. States and Counties, and USGS Stream Gauges, off and on. Clicking on the Layers Info button provides descriptions of the various types of layers that are available for display. Users can click on the New Layer button to add layers to the map.

c. Audience –

Users include National Weather Service (NWS) River Forecast Centers (RFCs) and Weather Forecast Offices (WFOs), NWS regions, National Centers for Environmental Prediction (NCEP) centers, USGS, Environmental Protection Agency (EPA), Federal Emergency Management Agency (FEMA), U.S. Army Corps of Engineers (USACE), National Aeronautics and Space Administration (NASA), United States Bureau of Reclamation (USBR), state agencies, local and regional emergency responders, the National Ocean Service (NOS), National Integrated Drought Information System (NIDIS), academia and private industry.

d. Presentation Format –

Users will be able to view water information on the Experimental Water Information Interface Webpage at <https://water.noaa.gov/map>.

All NWM output is stored in NetCDF format in one of three file types:

- 1) 1km gridded NetCDF (land surface variables and forcing)
- 2) 250m/100m gridded NetCDF (ponded water depth and depth to soil saturation)
- 3) Point-type NetCDF (stream routing and reservoir variables)

The two gridded file types are used for four separate rectangular domains, 1) the CONUS+ (roughly from 19N to 58N), 2) the Hawaiian Islands, 3) Puerto Rico and U.S. Virgin Islands, and 4) southern Alaska, while the point NetCDF file type is used for the CONUS (including adjacent hydrologically contributing areas), Hawaiian Islands, Puerto Rico and U.S. Virgin Islands and southern Alaska.

The full set of NWM output data and a subset of forcing files is available on the NOAA Operational Model Archive and Distribution System (NOMADS) and the National Centers for Environmental Prediction (NCEP) FTP server at:

<https://nomads.ncep.noaa.gov/pub/data/nccf/com/nwm>

<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/nwm>

Part II – Technical Description

a. Format and Science Basis –

Detailed technical information about the NWM, including NWM operational configuration, model details, general framework, analysis and assimilation, forecast ranges, and output is available at <https://water.noaa.gov/about/nwm>.

b. Product Availability –

End users will be able to view water information via the Experimental Water Information Interface Webpage at <https://water.noaa.gov/map>.

c. Additional Information - None