An overview of the NWC's experimental products

2023 FFaIR seminar series B. Peggy Lee NWS/OWP/WPOD Techniques and Development Hydrologist June 1, 2023



Who is the NWC?

Nice to Meet You (Again)!





Vision

A "water-ready" nation, capable of addressing the nation's challenges relating to water extremes, water scarcity, and water quality through improved water prediction and related decision support services.

Nice to Meet You (Again)!









Water Prediction Operations Division

- Current operations:
 - 50% staffed
 - 2 shifts every day (5am 8:30pm)
 - Winter Desk (every day Nov May)
 - Surge up to 24 hrs/day for events
- GIS and Software Engineering teams
- Full Operating Capability
 - 41 total employees
 - 24 / 7 operations









Experimental Products

National Water Model in Two Slides!

- NWM is a hydrologic model that simulates observed and forecast **streamflow**
- Compliments official NWS river forecasts provided at approximately 3,600 locations across the CONUS with a very fine spatial and temporal scale and a large spatial coverage (2.7 million river reaches/3.4 million river miles)





National Water Model, Cont.

- Visit: https://water.noaa.gov/about/nwm
 - NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION National Water Model 2.1: Cycling Overview -44% Ana Lookback Range 3-28 hrs Hawaii / Puerto Rico New for V2.1...open loop **3 Hour Lookback** (non-DA) members **48 Hour Forecast HIRES ARW/NAM-NEST** (MRMS for Hawaii) **18 Hour Forecast** (Open Loop Configs) Medium-Range Ens ~10 Day Ensemble Forecast New for V2.1...open loop (non-DA) member lange Ens **30 Day Ensemble Forecast**

ver2.2



1TB/Day



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

How do we extract actionable intelligence from that much of data?
70+ services



NWM AnA Visualization Services



- Depicts the magnitude of the National Water Model (NWM) streamflow analysis and assimilation (AnA) simulations where the NWM is signaling at or above high water thresholds over the contiguous U.S.
- Reaches are colored by the estimated 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.

NWM AnA Visualization Services (Cont.)



- Depicts the magnitude of the peak NWM streamflow analysis over the past 7/14 days where the NWM signaled high water.
- This service is derived from the NWM AnA 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 maximum flow over the past 7/14 days.

12-Hour NWM Probability Visualization Services



- Depicts the probability of forecast high water over the next 12 hours, using a time-lagged ensemble from the National Water Model (NWM) short-range forecast over the contiguous U.S.
- These reaches are colored by the probability that they will meet or exceed the high water threshold within the next 12 hours across the last 7 forecasts.

12-Hour NWM Probability Visualization Services (Cont.)



- Depicts the probability of forecast rapid onset flooding over the next 12 hours using a time-lagged ensemble from the NWM short-range configuration 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 the next 12 hours.



Experimental Services (Publically available)

NWS National Map Viewer



- You can also access from the <u>WaterView</u> Web App
- How do we communicate the NWM output to forecasters and decision-makers?







Experimental Products (Publicly available)







https://www.weather.gov/owp/operations



AHD

- **Episodic**
- **2-6 hrs**

Rapid-onset Flooding

- Flash
- Urban
- **Small Stream**
- **WPC** Coordination
- Inform WFO Warning Workflow
- **PIL: AHDNWC**
- **Archive**





Experimental Area Hydrologic Discussion #417 Valid Times: Sat. 31 Dec 2022 12:12 UTC - Sat. 31 Dec 2022 20:00 UTC Issuance Date/Time: Sat. 31 Dec 2022 12:17:28 UTC

WHAT: Urban, and small stream flooding WHERE: Central California WHEN: Through early Saturday afternoon

FORECAST RAINFALL AND ANTECEDENT CONDITIONS: OPF: 1 - 2"+ (HRRR/WPC) Rainfall Rates: 0.25"+/hr (WPC) Soil Moisture: 75 - 95% (NASA SPoRT)

DISCUSSION.

Persistent rainfall continues to impact portions of central CA with rainfall expected to continue through the early afternoon hours. Antecedent conditions have dramatically increased over the last 7 days with NASA SPoRT showing a 20 - 30% increase in Relative Soil Moisture in deeper soils (10 40 cm) and near surface soils (0 - 10 cm) currently near 100% saturation (NASA SPORT) indicating that any additional rainfall will quickly become runoff into streams and rivers. Additionally many of the streams have already seen a 1 - 2 ft increase in stage over the past hour with most streams in the Coastal Ranges and Sierra Nevada Foothills already with observed streamflows greater than the 95th percentile for historic flows indicating already elevated flows with very little channel capacity if any for any new runoff.

The NWM SRF continues to signal rapid-onset flooding (ROF) with high ROF probabilities generally ranging from 50 - 100 % particularly across the western foothills of the Sierra Nevada with slightly lower probabilities (25 - 100%) across the Bay area and Coastal Ranges, NWM SRF High Flow Magnitude (HFM) service is showing widespread streamflow AEPs of less than 10% also across the western foothills of the Sierra Nevada, likely indicating the highest potential for locally significant flooding impacts across that area. Across the Sacramento Valley and Bay Area, SRF HFM signals are more scattered but isolated AEPs less than 10% are still present suggesting a more localized threat; however, given the denser urban area, urban flooding impacts, ponding of water, and flooding due to poor drainage is likely. Additionally, isolated minor to moderate river flooding is forecast across the area through the weekend. Rises on larger streams and rivers will likely continue through the day.

//Smith ATTN ... WFO ... STO ... MTR ... HNX ATTN...RFC...RSA...WPC



https://www.weather.gov/owp/operations-ahd

National Hydrologic Discussion (NHD)

- What: Discussion for observed, modeled, and expected hydrologic conditions for the United States days 1-10
 - NOT just a National Water Model (NWM) diagnostic discussion
 - Uses all available resources and forecaster knowledge to produce
- Audience: Internal & external surface water information users
- Issuance:
 - **1530Z**
 - PIL: HMDNWC
 - https://www.weather.gov/owp/operations-nhd

AGUS74 KWCO 021525 HMDNWC

National Hydrologic Discussion - EXPERIMENTAL NWS National Water Center - Tuscaloosa AL 915 AM CST MON JAN 2 2023

.Synopsis...

Ongoing river flooding with additional flooding impacts today for East Texas and the Lower Mississippi and Lower Ohio Valleys... Periods of rainfall resume Wednesday with flooding impacts expected in California... Possible flooding impacts Tuesday in portions of the Southeast... Rises on streams and rivers this week in the Northeast... Localized flooding impacts possible later this week in Puerto Rico...

.Discussion...

East Texas and the Lower Mississippi and Lower Ohio Valleys... Moderate to locally heavy rainfall is expected to affect these regions today, bringing a threat for isolated flash, urban, small stream, and riverine flooding impacts. The latest WPC QPF indicates widespread 1 - 3" of rainfall from extreme East TX through northern LA and AR and into southeast MO, southern IL, and western TN/KY, with the highest amounts expected in eastern AR and western TN. Antecedent conditions are wettest in east TX, northern LA, and eastern AR, where riverine flooding is ongoing and forecast from recent rainfall, and soils are primed for flooding impacts from additional rainfall. Top and mid-laver soils are in the 40 -50% relative soil moisture (RSM) range in southeast MO into the Lower OH Valley, but are dry below those layers (NASA SPoRT). The NWM Short Range Forecast (SRF) indicates rapid-onset flooding (ROF) probabilities of less than 50% from southwest AR into northeast AR; expect these signals to gradually increase in coverage as the day progresses. The NWM MRF also continues to indicate ROF probabilities of generally less than 50% in northern LA, AR, western TN/KY, and southeast MO and southern IL. Overall, with the highest rainfall amounts not overlapping with the most vulnerable areas in the region based on antecedent conditions, widespread flooding impacts are not anticipated; however, isolated lower AEPs on smaller streams in northeast AR and southern IL, depicted in the NWM SRF High Flow Magnitude Forecast, suggest some potential for locally significant flooding impacts in these areas. In addition, new and renewed minor riverine flooding is forecast in East TX. LA. and eastern AR. along with forecasts of in-bank rises in these same areas

.California..

Periods of moderate to heavy rainfall and mountain snow will again impact much of the state through day 7 (Sun), providing a threat for additional urban, small stream, and riverine flooding impacts. Light to moderate rainfall through day 2 (Tue) is not expected to produce flooding impacts, and it will not likely allow the entire wet soil column to make room ahead of multiple rounds of heavier rainfall beginning on day 3 (Wed), when the threat for more significant flooding impacts increases. SNODAS and the National Water Model (NWM) continue to indicate that there is very little, if any, snow water equivalent (SWE) left to melt in the lower elevations of northern and central CA; as a result, snowmelt should not be a significant



FHO

- High Level
- **Heads-up**
- 7-Day Outlook
- Comprehensive
- 3 Categories
- 3 Timing Bins
- 1xday* @2100Z
- **Static Map**
- **Map Service**





Experimental 7-Day Flood Hazard Outlook Includes Flash, River, and Tidal Flood Hazards

NWC National Water

Flood Hazard Messages

Hurricane Ian

 For information regarding Hurricane Ian and potential catastrophic flooding impacts across Florida and considerable flood impacts in the Southeast, please see the Tropical Flood Hazard Outlook.

Puerto Rico

www.weather.gov)

 Heavy rainfall may create rises on rivers, flash flooding, and potential landslides through Friday.



https://www.weather.gov/owp/operations-fho

Tropical FHO

- More focused
 text
- 2x day
 - o **@2100Z**
 - **@1130Z**
- Static Map
- Service



Experimental 7-Day Flood Hazard Outlook: Hurricane Ian

Includes Flash, River, and Tidal Flood Hazards

Issued: 2022-09-28 04:00 PM CDT (21:00 UTC) | Valid Through: 2022-10-05 04:00 PM CDT (21:00 UTC) | Next Issuance: 2022-09-29 04:00 PM CDT (21:00 UTC)

Flood Hazard Messages

Storm Surge

- The National Hurricane Center (NHC) is forecasting life-threatening inundation from storm surge along the southwest FL coast, Englewood to Bonita Beach.
- For a depiction of areas at risk, please see the Storm Surge Watch/Warning graphic available at hurricanes.gov.

Central and West Florida

- Hurricane Ian will continue to cause catastrophic, life-threatening flash and urban flooding impacts across west and central FL.
- Widespread river rises to moderate and major flood stage, with some points forecast to exceed record, will persist through the weekend and be slow to recede thereafter across central and northern FL.

Northern Florida, Sothern Georgia, and coastal South Carolina

 Considerable flash, urban, and river flooding is likely across northern FL, southeast GA, and coastal SC beginning on Thursday and through the end of the week.

Southern Florida

 Limited flash and urban flooding impacts are expected to continue across the FL Keys and South FL through Thursday.

Southeast into Mid-Atlantic

 Limited flash, urban, and small stream flooding impacts, with potentially locally considerable impacts in the southern Appalachians, are expected into the weekend as Hurricane Ian tracks along the eastern seaboard.

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





NWC National Water Conter



Thank you!

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