OPERATIONAL HYDROLOGIC MODELING: CURRENT STATUS OF NOAA's NATIONAL WATER MODEL AND PLANS FOR THE FUTURE

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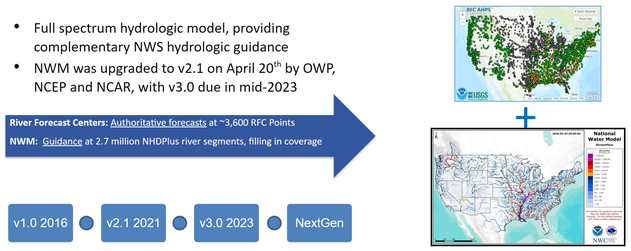
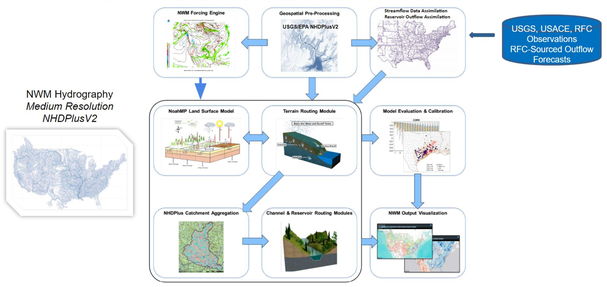
SESSION H55U

NATIONAL WATER MODEL OVERVIEW

- Full spectrum hydrologic model, providing complementary NWS hydrologic guidance
- NWM was upgraded to v2.1 on April 20th by OWP, NCEP and NCAR, with v3.0 due in mid-2023

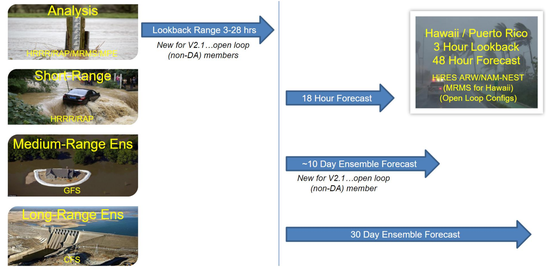


NWM is a fusion of column structure of land surface models, distributed structure of hydrologic models and USGS/EPA NHDPlusV2 stream network. Supported by verification and visualization elements.

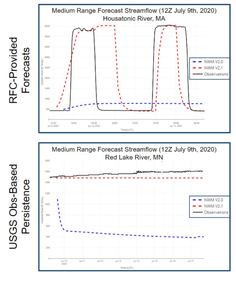


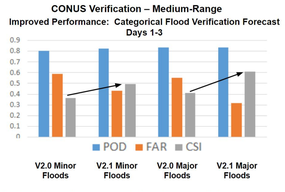
CURRENT OPERATIONS NWM V2.1

National Water Model V2.1: Cycling Overview



Performance Highlights





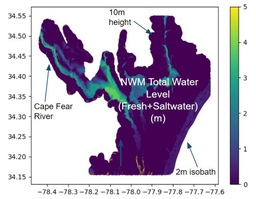
- **Left**: NWM v2.1 ingest of RFC (top), USGS (bottom) and USACE (not shown) data greatly improves streamflow forecast downstream of reservoirs
- **Right**: Categorical flood forecast skill is greatly improved in v2.1. Similar results for days 4-10. Ensembles exhibit higher scores.

NWM IS REVOLUTIONIZING THE PROVISION OF NATIONWIDE HYDROLOGIC GUIDANCE

NWM v3.0 Will Feature Several First Time Capabilities and Major Enhancements

NWM Coupled Total Water Forecasting

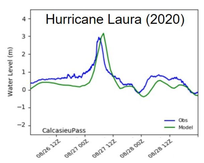
Over 100 million people live near the coast who don't get national total water guidance today

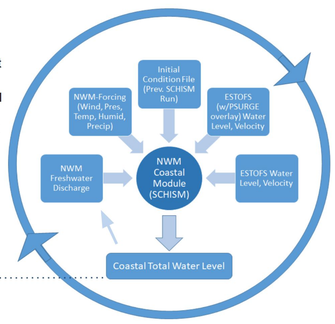


Key Goal: Fill this capability gap by enabling NWM to simulate compound flooding driven by freshwater/surge/tides

Filling the capability gap

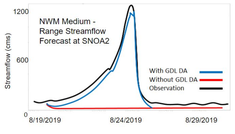
- National total water level forecasts will complement existing regional forecasts with first ever CONUS-wide, Hawaii, PR/VI guidance
- This new freshwater-estuary-ocean coupling will leverage the NWM, a new inland hydraulic routing module, SCHISM, ESTOFS & PSURGE

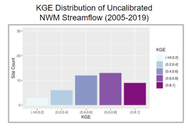


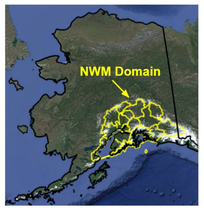


NWM Alaska Domain Expansion

- Close configuration/forcing coordination with APRFC
- Ingest of APRFC glacial dam lake (GDL) outflow forecasts
- Customized model and forcing configurations (APRFC MPE (Stage IV), MRMS, HRRR-AK, GFS, NBM)

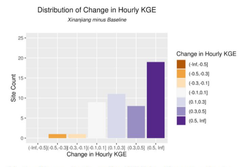






Additional Enhancements

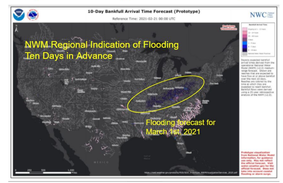
- **Land surface**
  - Updated land cover dataset (NLCD 2016)
  - Added capability for dynamic parameter updates (wildfires and beyond)
  - Improved representation of impervious conditions via NLCD data-based adjustment of precipitation available for infiltration
  - Use of a new runoff module (Xinanjiang)
- **Improved Calibration**
  - Revised regionalization approach
  - Updated calibration objective function (KGE)
- **Improved forcing**
  - Use of National Blend of Models precip to force medium-range ensemble member
  - Use of MRMS QPE over Puerto Rico / US Virgin Islands

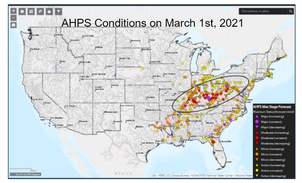


Above: Change in streamflow KGE for all gauges due to application of Xinanjiang scheme (uncalibrated); purple indicates improved performance, orange indicates degraded performance

COMPLEMENTARY FORECAST GUIDANCE

- NWM provides coverage for areas where no traditional NWS river forecasts are available
- Regional NWM signals can be leveraged several days in advance

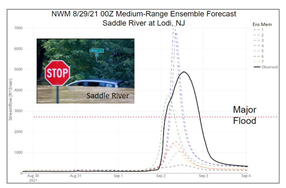




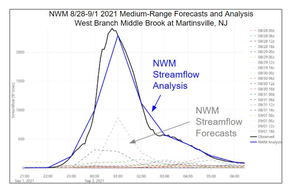
- Moderate to heavy rainfall associated with a front fell from east Texas through the Ohio Valley, creating widespread bankfull to isolated major flooding.
- NWM medium-range forecast showed indication of flooding with a 10-day lead time

Accuracy of Input Forcing Data Greatly Impacts Accuracy of This Guidance

Actionable, timely guidance from NWM … but only with an accurate precipitation forecast



- Three ensemble members depict major flood conditions with 4.5 day lead time



- Observed Precip → Accurate Streamflow
- Forecast Precip → Low-Biased Streamflow

FUTURE DIRECTIONS AND SUMMARY

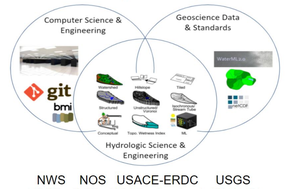
Moving to a NextGen Framework-Based NWM

- The NWM software architecture is being rewritten from the ground up
- This will support spatially heterogeneous modeling approaches and will also feature enhanced modularity to underpin accelerated community development.

NextGen Guiding Characteristics

- Multi-language/platform support with Basic Model Interface (BMI)
- Will have a strong open source link to hydrologic community and advance operations and research

Enabling Technologies



NWS NOS USACE-ERDC USGS
USBR DOE NCAR Academia/CUAHSI

Summary

- The NWM revolutionizes how hydrologic guidance is developed and delivered, providing both complementary and first-time spatial coverage and product type
- What exists now is a foundation that will continue to be built upon
  - v2.1 implemented in April 2021: Hawaii domain expansion, reservoir upgrades
  - v3.0 is anticipated in 2023: Coastal coupling, hydraulic routing, AK domain
  - Initial work on NextGen-based NWM now underway
- Steady upgrades to model skill and value-added visualization products, partnerships with end users and community development will continue to advance the system

CONTACT

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For more information about the National Water Model please visit: https://water.noaa.gov/about/nwm

Access the NextGen NWM GitHub Code Repository

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