



NOAA's River Forecast Centers

Who We Are and How We Can Help You





The Take Away



- River Forecast Centers provide a broad array of products and services, including short-term forecasts, peak flow forecasts, and seasonal water supply forecasts
 - Data and coordination is extremely important
 - Every RFC is different, but all provide decision support and welcome stakeholder engagement
 - Western RFCs are particularly adept at seasonal water supply forecasting
- RFCs are a great resource for dam safety information and implementation of emergency action and safety plans





Overview



- Who, What, and Where are River Forecast Centers

- Work with area Weather Forecast Offices
- Notifying the public



- Summary of key operations, products, and services



- Flood operations at a RFC



- Services available during a dam incident or failure

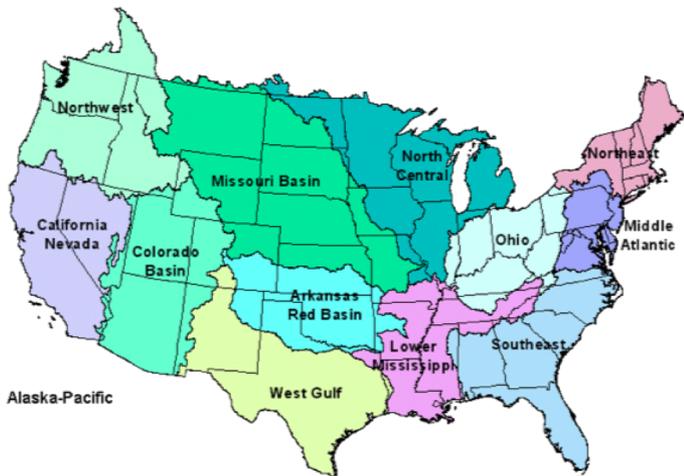


- Coordination with Reclamation





River Forecast Centers



- 13 RFCs nationwide
 - Co-located with a subset of the 122 Weather Forecast Offices (WFOs)
 - Support NOAA's hydrologic services and products
- Focused on decision support
- Western RFCs are particularly adept at water supply services



Working with the WFOs



- Weather Forecast Offices
 - Flood Watches and Warnings
 - Determine flood stages
 - “Eyes on the ground” – document impacts, notify communities
 - Work closely with Emergency Managers
- The CBRFC is the best resource for information regarding streamflow and water supply forecasts



River Forecast Centers

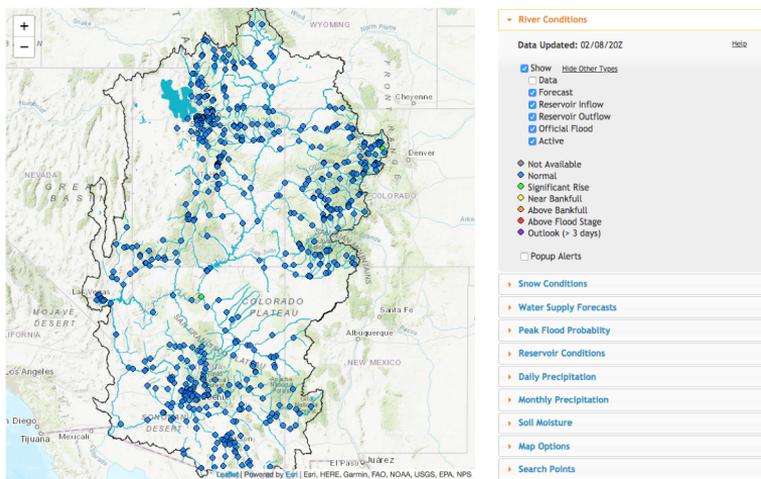
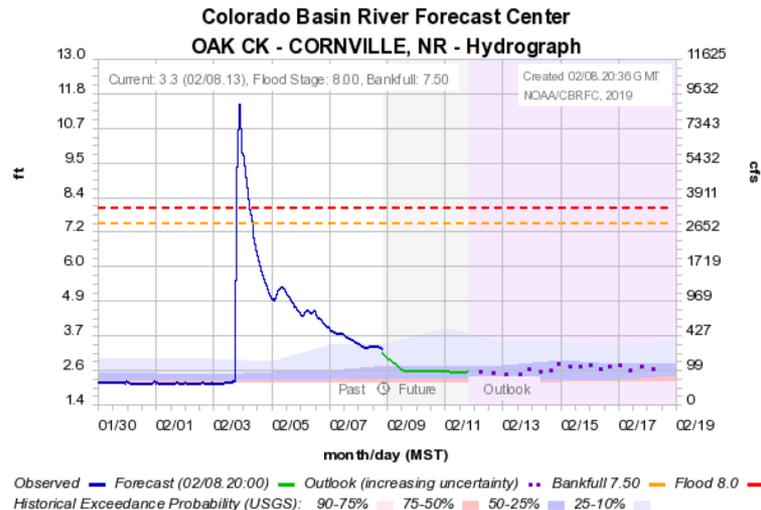


- Work with a broad and diverse set of stakeholders
 - Federal agencies (e.g., Reclamation, Army Corps)
 - Municipal and Agricultural Water Users
 - State, academic, NGOs
- Data consumers - we rely on information provided by many of our stakeholders



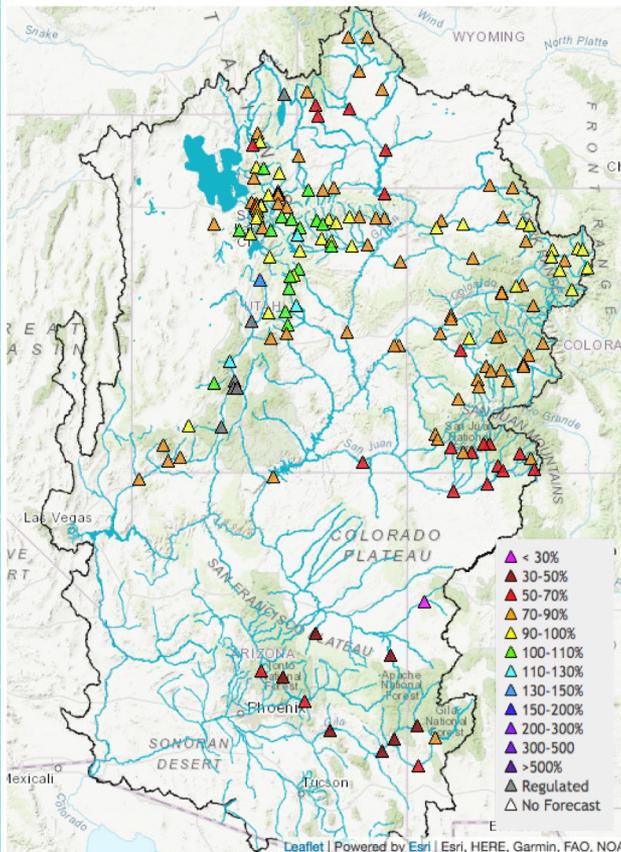
River Forecast Centers

- WFOs are a key stakeholder
 - WFOs issue Flood Watches and Warnings based on RFC guidance
 - Flexible support abilities
 - Provide actionable, risk-based, information
- WFOs coordinate with emergency managers and public in their local areas

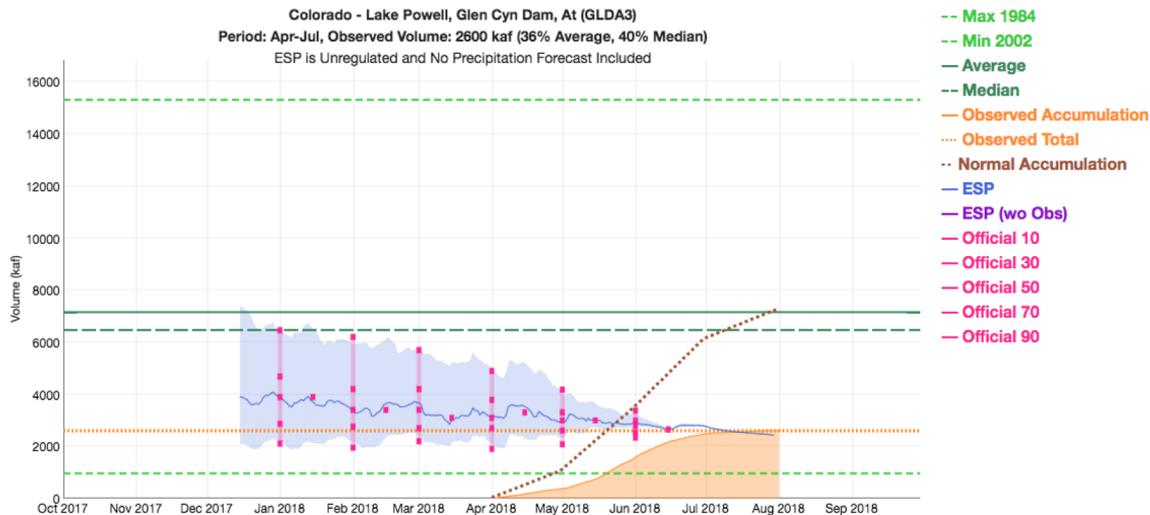




Water Supply Forecasts



Water Supply Forecast

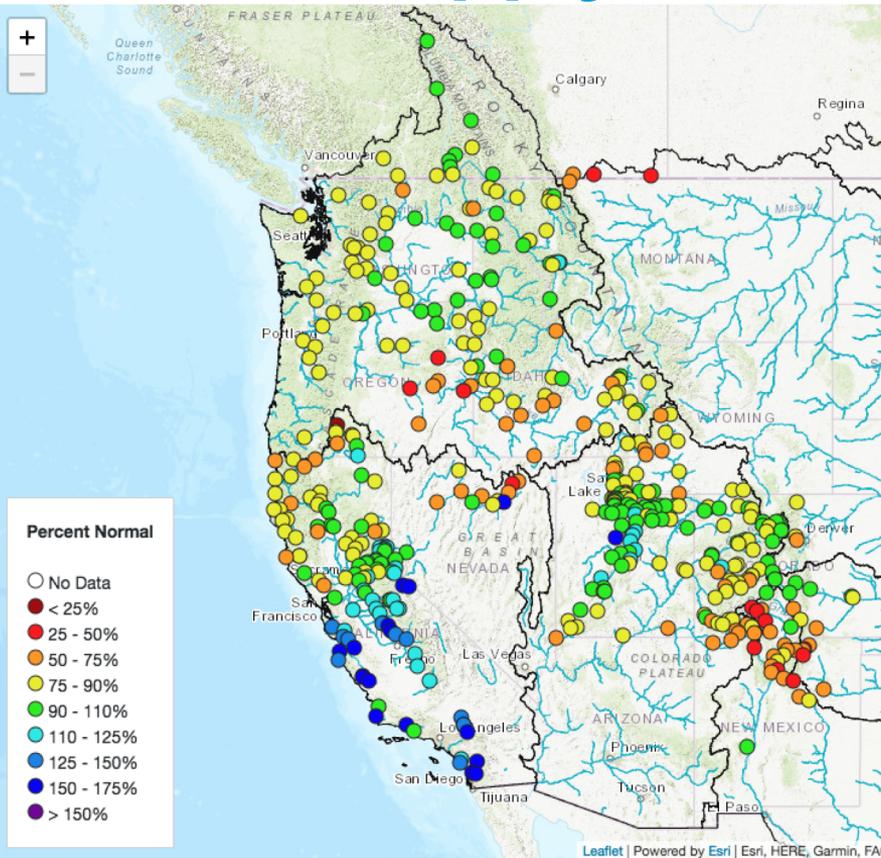


- Probabilistic volumetric forecasts
- Updated daily, with monthly “official” forecasts
- Monthly and seasonal timesteps
- 1 - 5 year forecasts
- Used by Reclamation in reservoir operations models, and other water managers





Water Supply Forecasts



- Western Water Supply Forecast Map
 - Currently bringing water supply forecast information from 6 RFCs in the West together
 - Links to forecasts from western RFCs
 - Goal is for future increased functionality





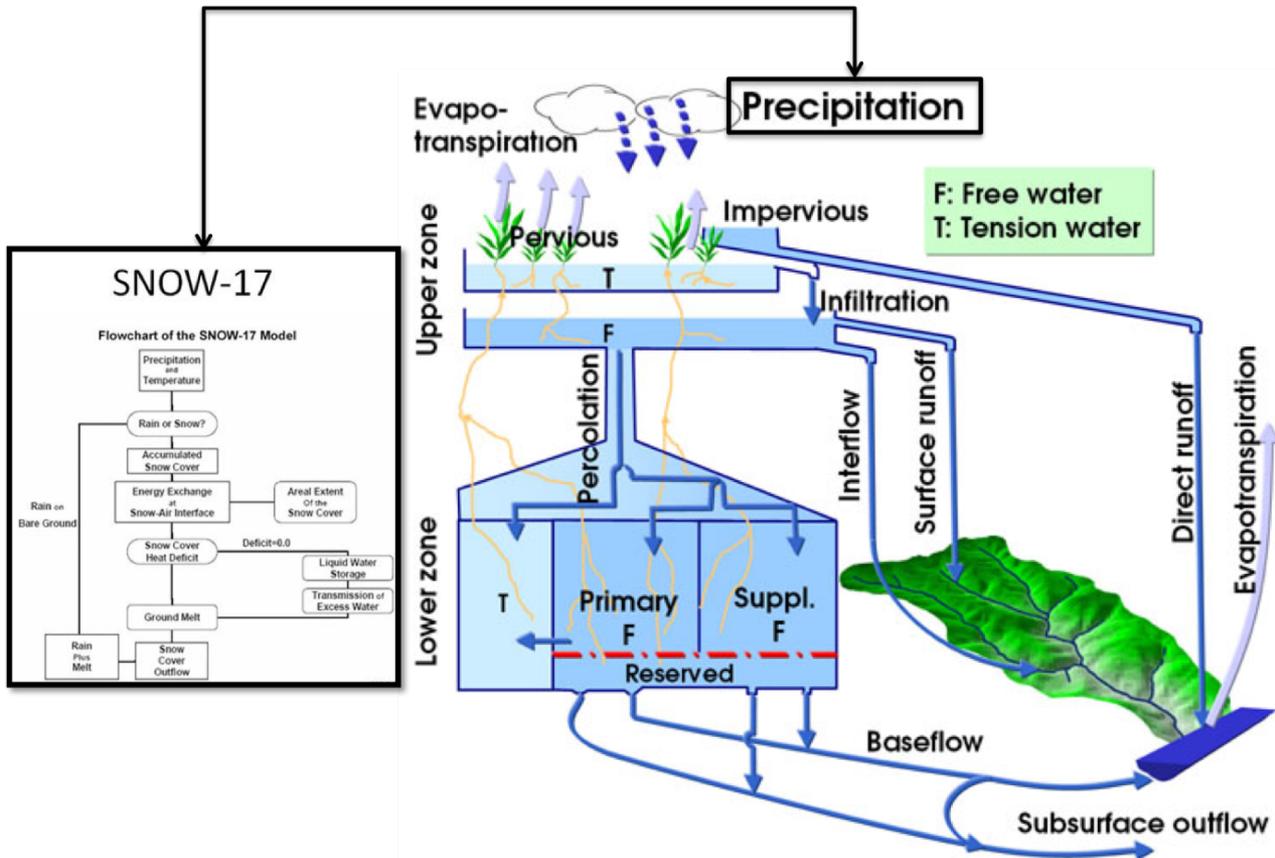
Products and Services



- We use a hydrologic model (Sac-SMA) coupled with a snow accumulation and ablation model (SNOW-17) to develop forecasts
 - Calibration is highly dependent on gage observations
 - Calibrations vary between RFCs, so make sure you contact your RFC of interest for more details!



Our models





Gage Data is Vital

Gage data is really at the heart of what we do. Quality data allows us to make accurate forecasts; without it, our forecasts have significantly more uncertainty

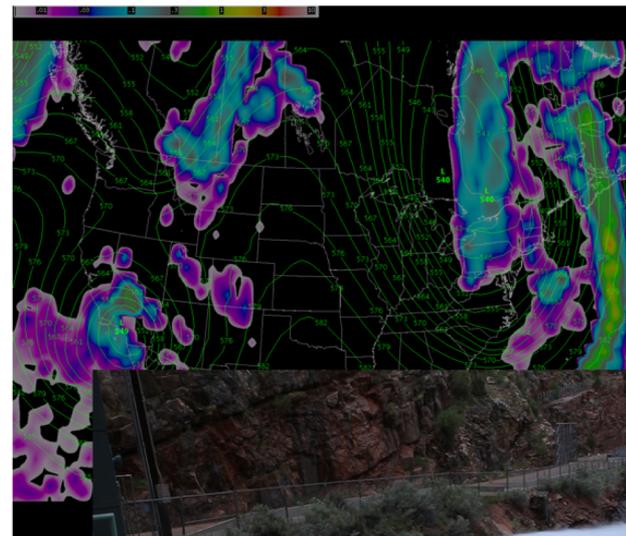
We spend a significant amount of time on data quality control





Forecast Data is Vital

- Short term skill limitations
 - Dependent on skill in weather forecast
 - Knowledge of planned operations (e.g., reservoir operations and use)

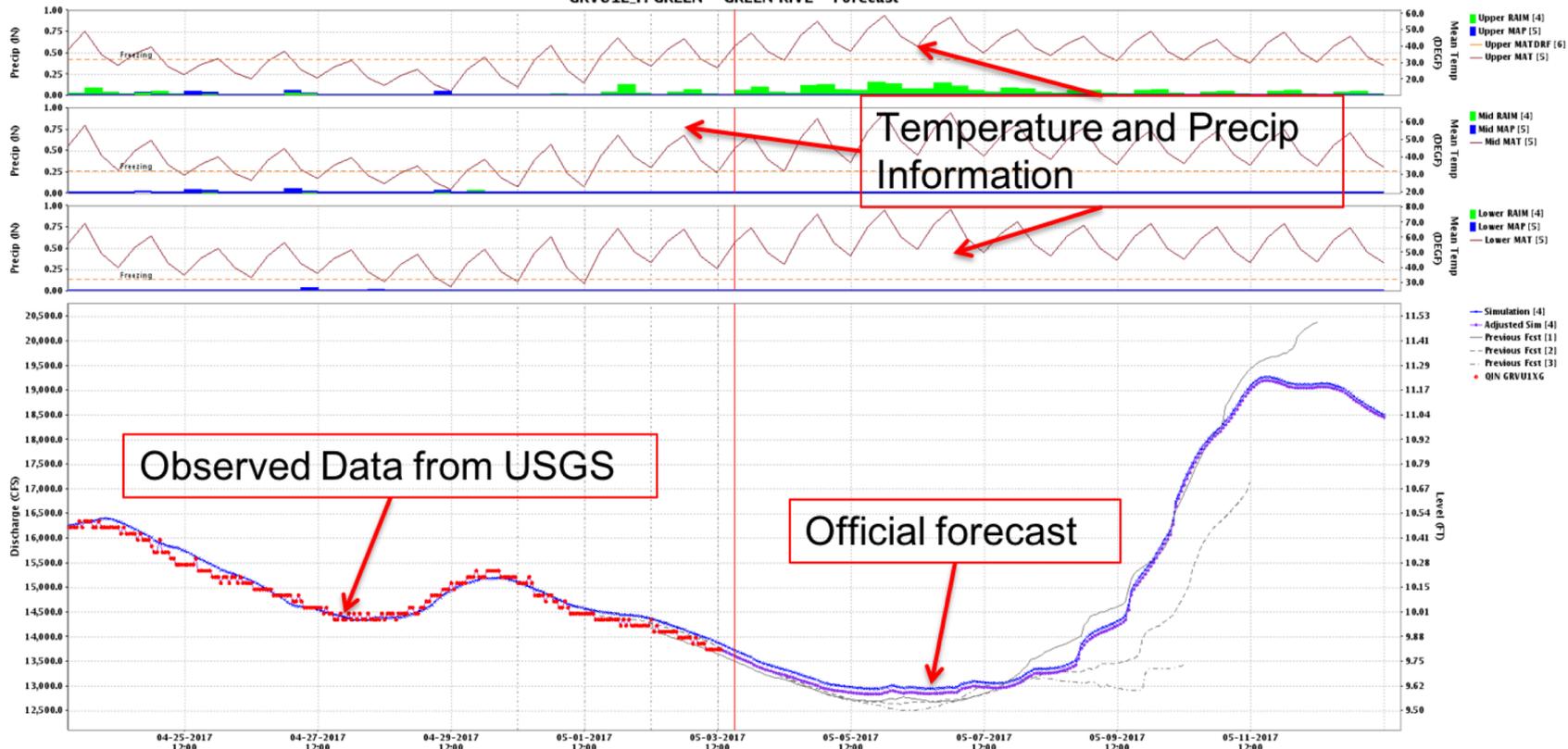




Developing a Forecast



GRVU1L.F: GREEN - GREEN RIVE - Forecast



Externat: [1] 05-02-2017 12:00:00 GMT [2] 05-01-2017 12:00:00 GMT [3] 04-30-2017 12:00:00 GMT GREEN_Approved_Forecast: [4] Green 05-03-2017 12:00:00 GMT Current MergeScalars_Forecast: [5] pl_service_run 05-03-2017 12:00:00 GMT Current
 Commute DRF TAD: [6] 05-03-2017 12:00:00 GMT Current

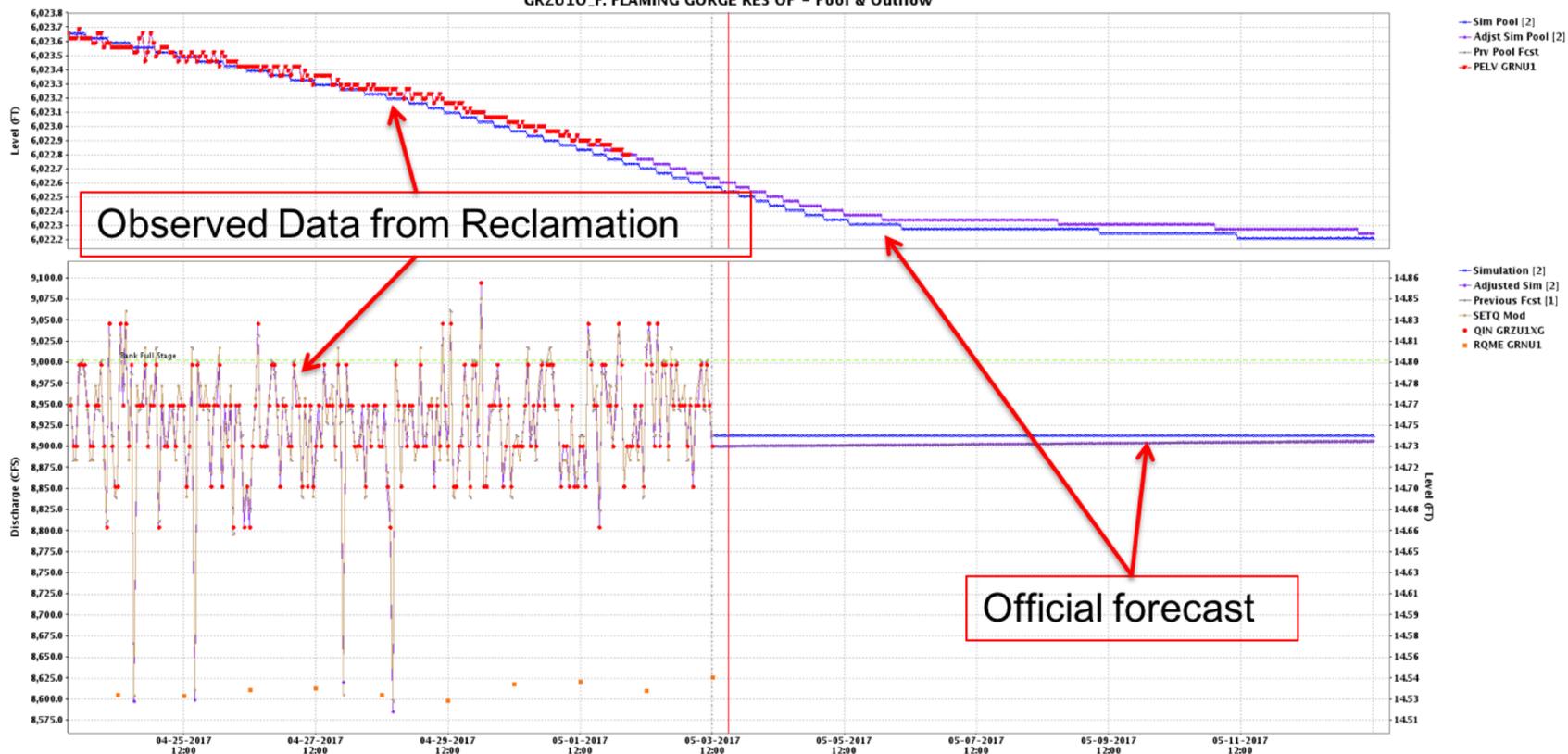




Developing a Forecast



GRZU10_F: FLAMING GORGE RES OP - Pool & Outflow



External: [1] 05-03-2017 12:00:00 GMT GREEN_Approved_Forecast; [2] Green 05-03-2017 12:00:00 GMT Current





Developing a Forecast



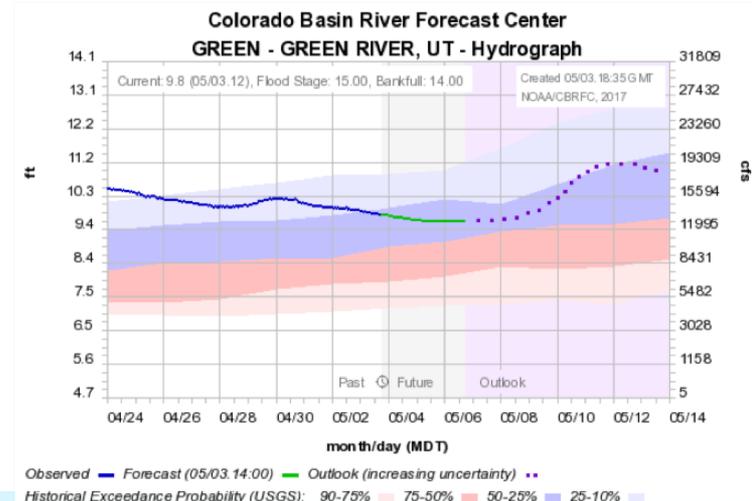
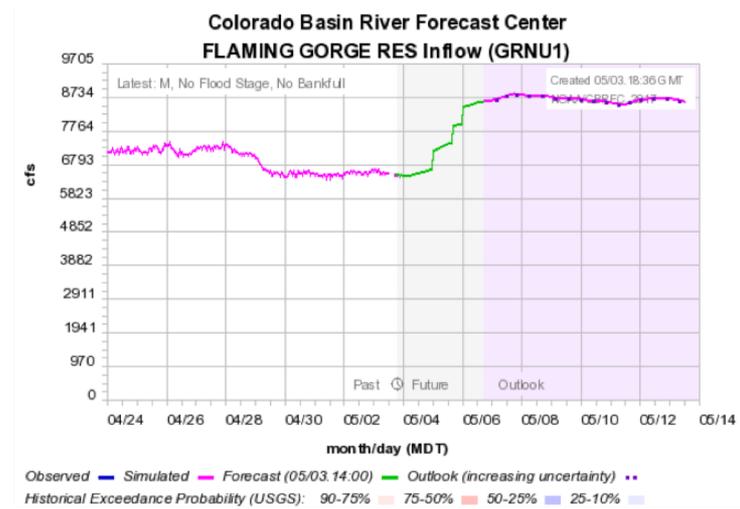
- Forecasters analyze historical and future precipitation and temperature information
- Utilize observations to assess model performance
- Make any adjustments (snow, diversions, etc...). We refer to these as “modifications” or “mods”
- This is done at least once per day



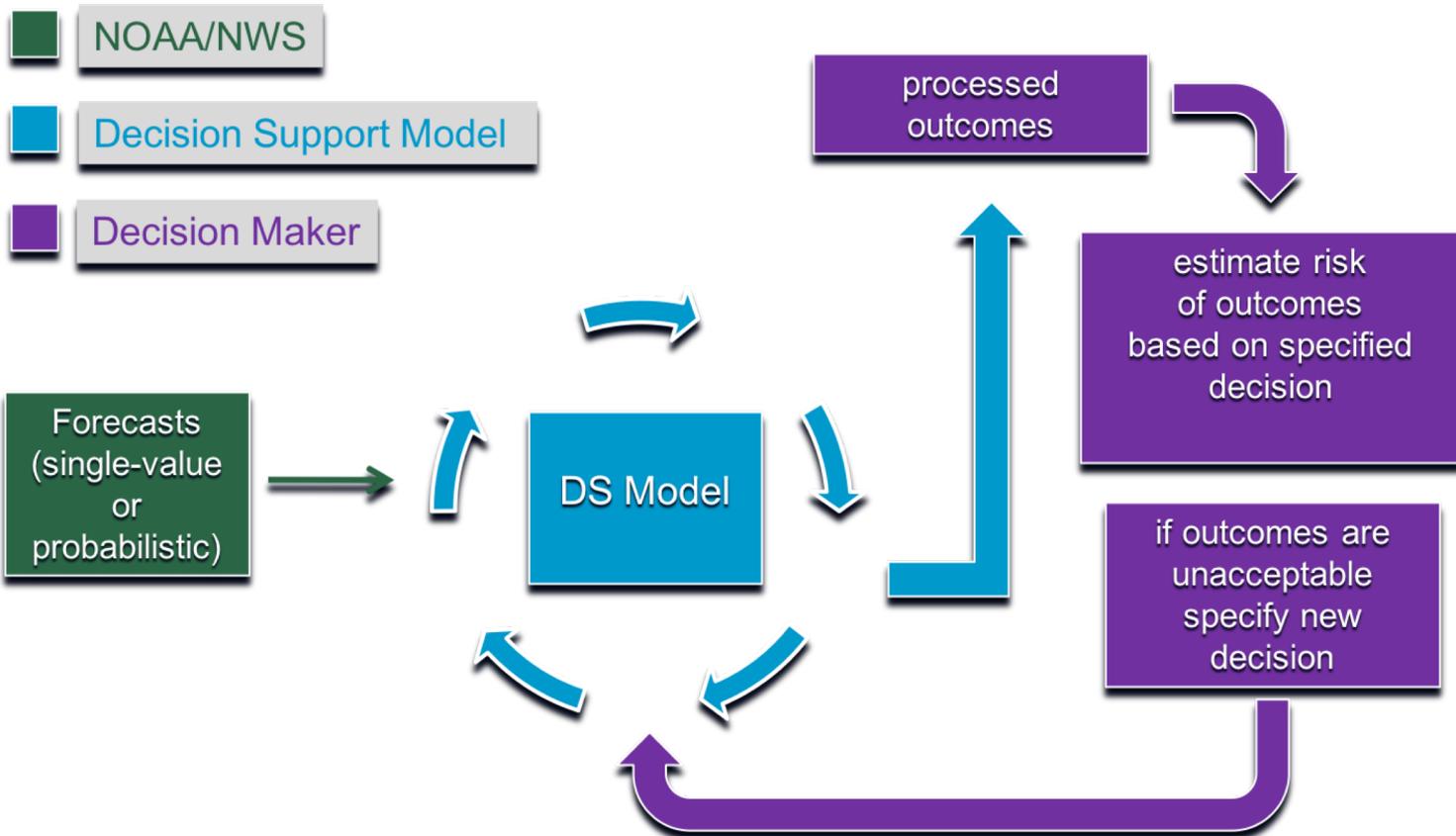


Developing a Forecast

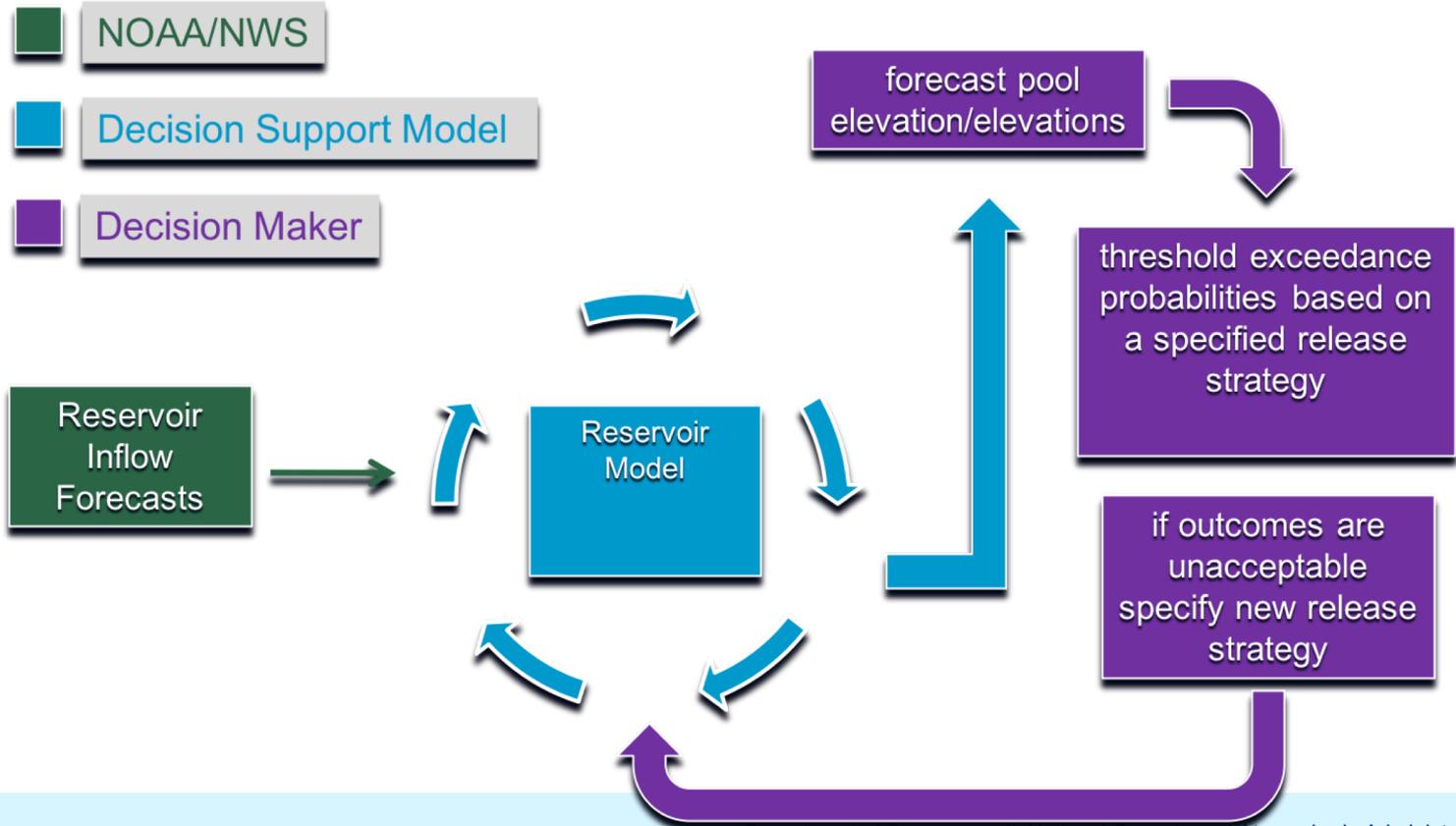
- Products are published to our websites and communicated to stakeholders in a variety of ways
- Information provided by each RFC is presented slightly differently, but generally available!



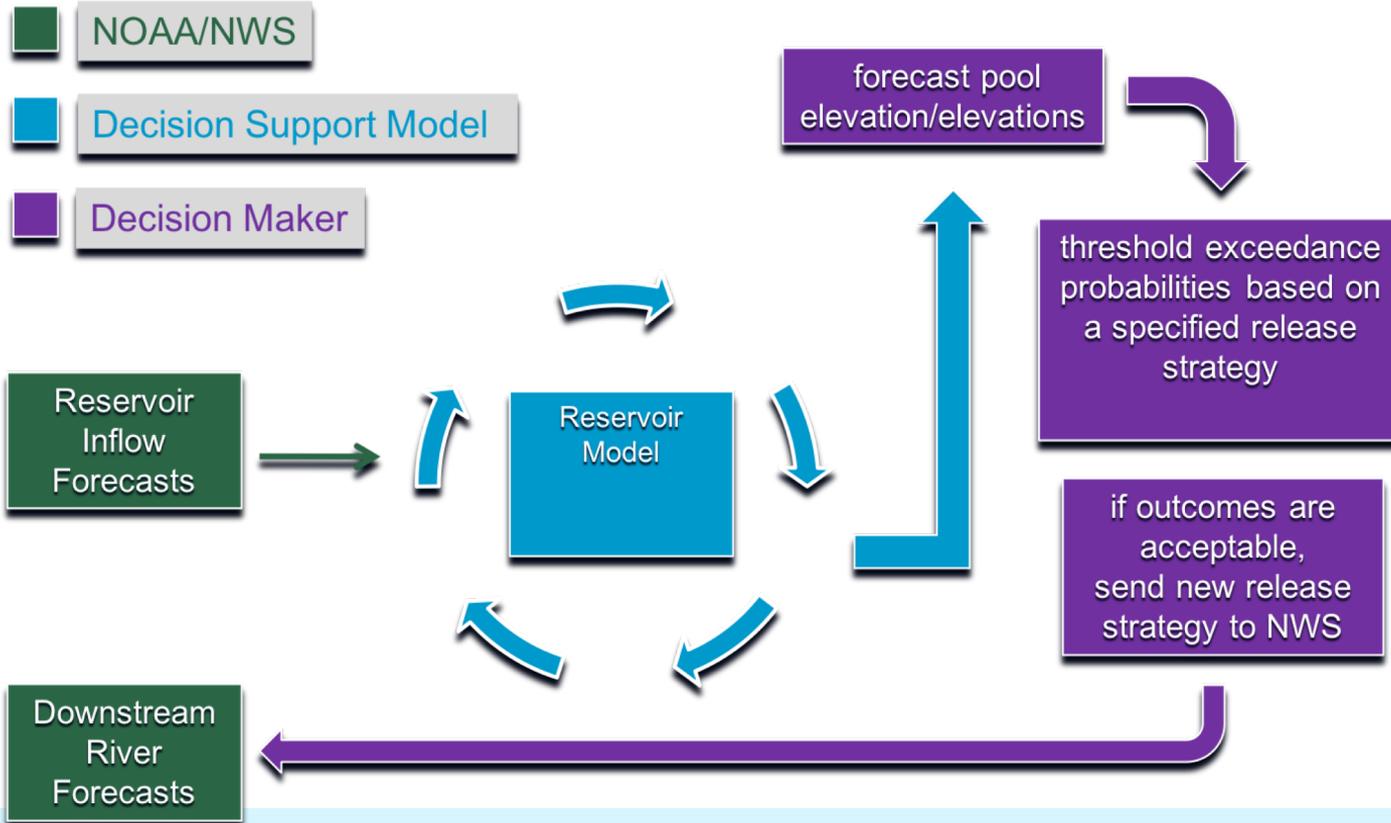
Roles of Forecasts in Decision Support



Role of Forecasts in Decision Support Typical Reservoir Operations



Role of Forecasts in Decision Support for Reservoir Operations





NWS Flood Stages

- Set by Service Hydrologists at local Weather Forecast Offices
 - Coordinated with local stakeholders and EMs
 - Some SHs coordinate over a large area with Hydrologic Focal Points
 - May not necessarily reflect EAP response levels -- but let your local SH know!





NWS Flood Stages

- **Bankfull Stage**
 - Where water begins to overflow the natural bank
 - No damage
- **Action Stage**
 - Stage where NWS or partner takes some sort of mitigating action
 - Be prepared for possible hydrologic activity





NWS Flood Stages



Minor

- Minimal or no property damage, possibly some public threat
- Nuisance flooding
- Water in yards, campgrounds, bike paths
- Not very deep or fast flowing
- Coordinated with local EMs and stakeholders



Moderate

- Inundation of nearby structures and roads, evacuation may be necessary
- Road flooding
- Water deep enough to make life difficult
- Travel restricted
- Some hardships are endured



Major

- Extensive inundation of structures and roads, evacuations are necessary
- Structures destroyed, homes flooded
- Extreme erosion problems
- Loss of transportation, communication
- High degree of danger to people



RFC Operations During Flood Events

Flash Flooding*

- Typically, RFCs offer limited support due to model limitations
- WFOs will take the lead and coordinate with stakeholders and EMs

*Localized flooding caused by short-term, convective, precip events.

Non-Flash Flooding**

- RFCs will coordinate with affected WFOs
- WFOs will coordinate with EMs, stakeholders
- RFCs available to provide continuous support to WFOs, including contingency runs

**Large scale, sometimes long-term flooding driven by synoptic scale events and snowmelt-driven runoff



NWS Role Before Potential Dam Failure

WFOs and RFCs are available to contribute to table-top exercises and other planning events





NWS Role During Potential Dam Failure



- When there is the potential for a Dam Failure
 - Contact your local WFO immediately. If the relationship isn't there now, let's build it.
 - WFO will issue an appropriate watch or warning and coordinate with emergency managers
 - WFO will coordinate with the appropriate RFC to provide support during the incident
 - Disseminate information to the public



Role of RFCs during a Dam Incident and Flash Flooding

We can provide quantitative estimates based on information we have catalogued in our database -- but we need to have the information!

The screenshot displays the 'Dam Tools 1.1' application window. The title bar shows 'SMPDBK - Pg 1 (Reservoir Information)'. The interface is divided into a form on the left and a report on the right.

Form Fields:

- 1. Name of the Dam (optional):** Name of the Dam: []
- 2. Name of the River (optional):** Name of the River: []
- 3. Type of Dam:** Choose the type of dam:
 - Earthen
 - Concrete Gravity
 - Concrete Arch

Report Data (National Inventory of Dams):

Dam Name	LONGVIEW DAM
River	LITTLE BLUE RIVER
State	MO
County	JACKSON
Owner Name	CENWK
Private Dam	N
NID Storage	46900
Max Discharge	22970
Max Storage	46900
Dam Type	Earth
Primary Purpose	Flood Control
All Purposes	Flood Control, Recreation, Fish and Wildlife Pond
Inspection Frequency	5
Year Completed	1965
Surface Area	930

Source: <http://nid.usace.army.mil>

Role of RFCs during a Dam Incident and Flash Flooding



While the NWS has tools for estimating flows and travel times associated with dam breaches, there were no tools for producing such estimates for an emergency spillway structural failure.

Erosion threatened the integrity of the emergency spillway at Lake Oroville following heavy rains in Feb. 2017

NWS issued a Flash Flood Warning for downstream locations on Feb. 12th, 2017



Flash Flood Warning

Until 4:15 PM PST February 13, 2017

Potential Dam Failure for residents in South central Butte County in northern CA

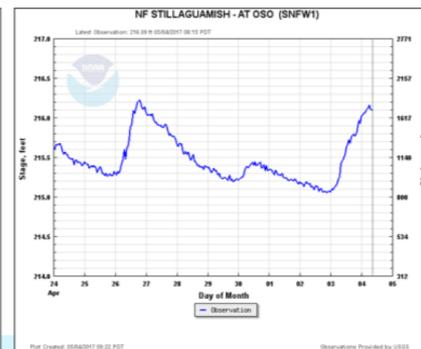
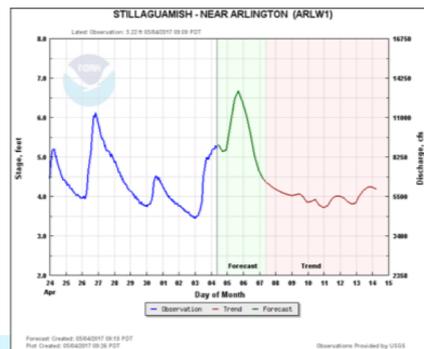


As per CA Department of Water Resources:

- Officials now anticipate a failure of the Auxiliary Spillway at Oroville Dam within the next 60 minutes.
- Residents of Oroville should evacuate in a northward direction such as towards Chico.

Role of RFCs After a Dam Incident and Flash Flooding

- NWS will be heavily involved in post-disaster recovery
 - On site support
 - Localized weather/river forecasts
- RFCs can develop custom products and services to meet stakeholder needs





National Water Center



WPA Weather-Ready Nation
National Oceanic and Atmospheric Administration

National Water Model

Improving NOAA's Water Prediction Services



In August 2016, NOAA took a giant leap forward in its ability to forecast the flow of rivers and streams throughout the entire continental United States with the launch of the

new high resolution National Water Model (NWM).

The NWM will enhance and expand NOAA's water flow forecasts, which to date have been available for approximately 4,000 river locations with stream gages operated by the U.S. Geological Survey. This new model will expand forecasts to 2.7 million stream locations nationwide. Leveraging the full network of nearly 8,000 U.S. Geological Service stream gauges and NOAA's investment in atmospheric modeling, the NWM will provide high-resolution forecasts of soil moisture, surface runoff, snow water equivalent, and other parameters.

We all recognize that water is an essential component of sustainable and resilient communities. But its also a stressed natural resource and potential threat to life, property, and livelihoods during extreme weather events.

Improved Water Information Services

The new NWM improves the National Weather Service's ability to deliver impact-based decision support services nationwide by providing "street level" water information and guidance, as well as serve as the foundation for additional private sector water services. At a minimum, the NWM will immediately provide predictive water information for many locations where none previously existed.

Initially, this new NWM-based information will be particularly useful in headwater areas in support of NOAA's flash flood mission.

How it Works

The NWM simulates the water cycle with mathematical representations of the different processes and how they fit together. This complex representation of physical processes such as snowmelt and infiltration and water movement through the soil layers varies significantly with changing elevations, soils, vegetation types and a host of other variables.

Additionally, extreme variability in precipitation over short distances and times can cause the response on rivers and streams to change very quickly. Overall, the processes are so complex that to simulate it with a mathematical model means that it needs a "supercomputer" in order to run in the time frame needed to support decision makers when flooding is threatening.



National Water Model is a new forecasting tool that will help forecasters predict when and where flooding can be expected.

www.water.noaa.gov





Conclusions



- RFCs can be a great resource and partner for your agency, and can provide information to drive your decision support tools
- Regarding dam safety
 - Can provide quick, quantitative values if information is available
 - Highly dependent on data and current EAPs
 - Engage your WFO and RFC to identify gaps, if any, and work to fill them





Contact Us!



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CNRFC - Pete Fickenscher: peter.fickenscher@noaa.gov

CBRFC - Paul Miller: paul.miller@noaa.gov

If you are interested in another region, contact me and I'll get you in touch with the right person

