Northwest River Forecast Center
Updates and Forecast Techniques 101

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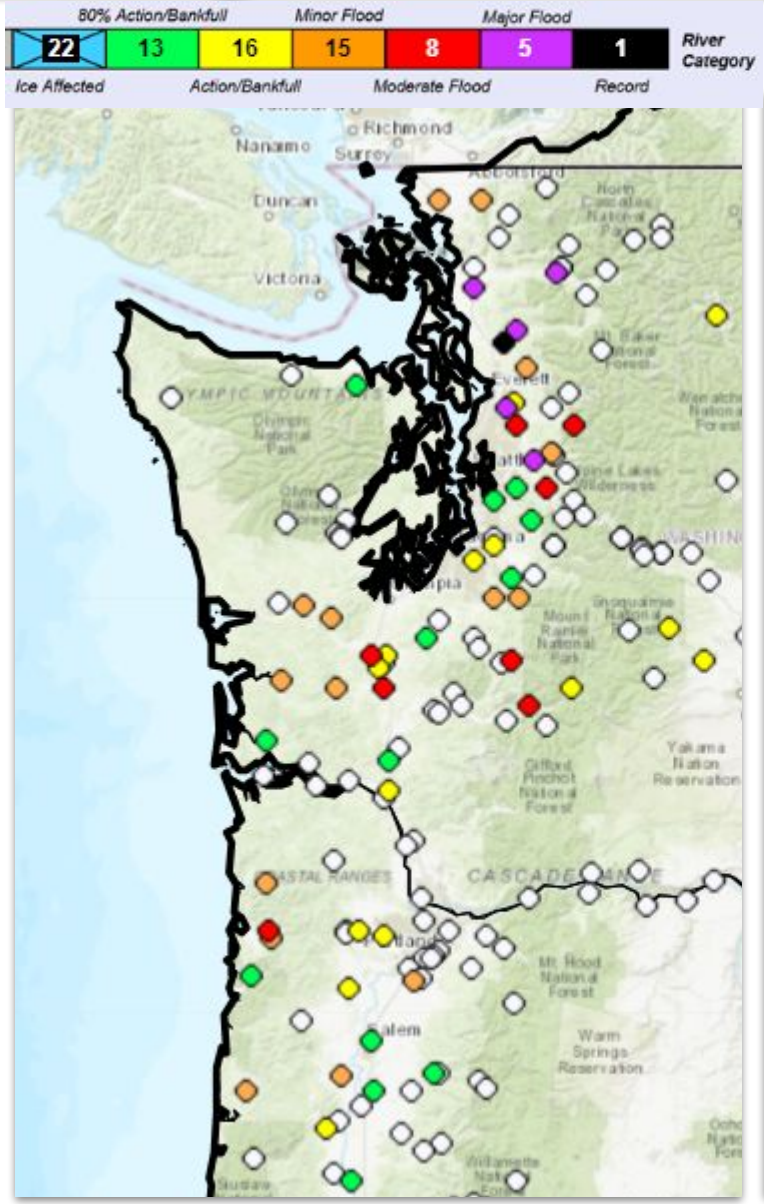
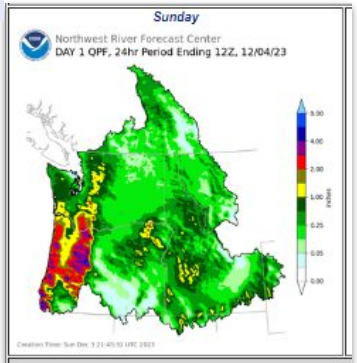
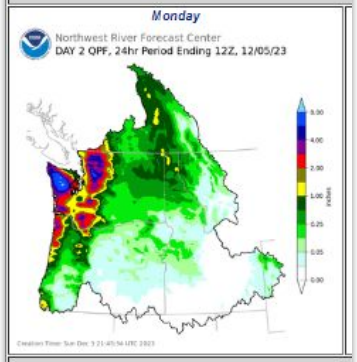
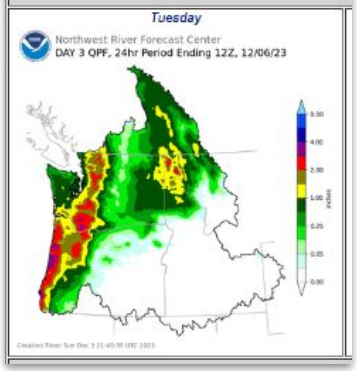
Portland, OR

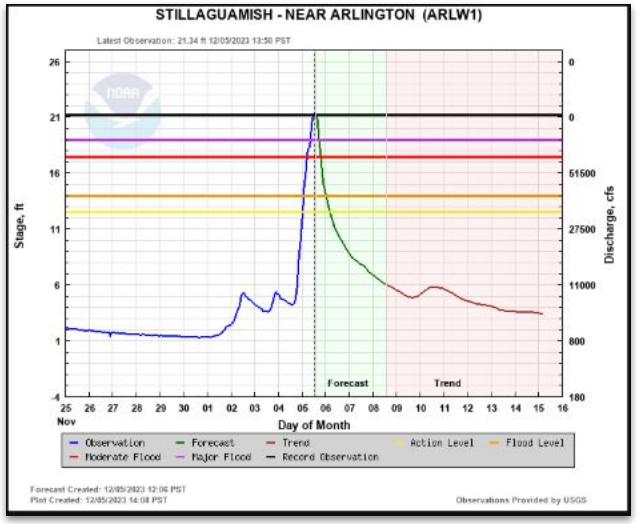
Current Events

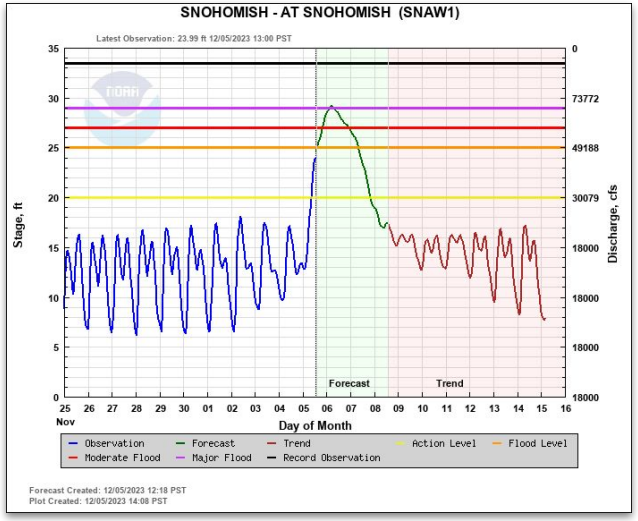


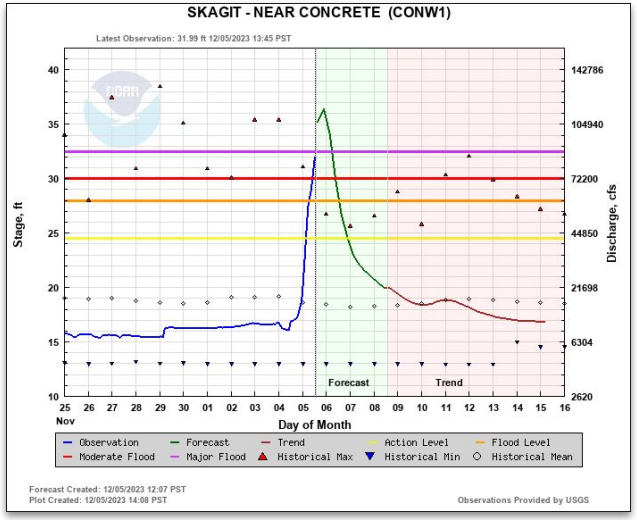


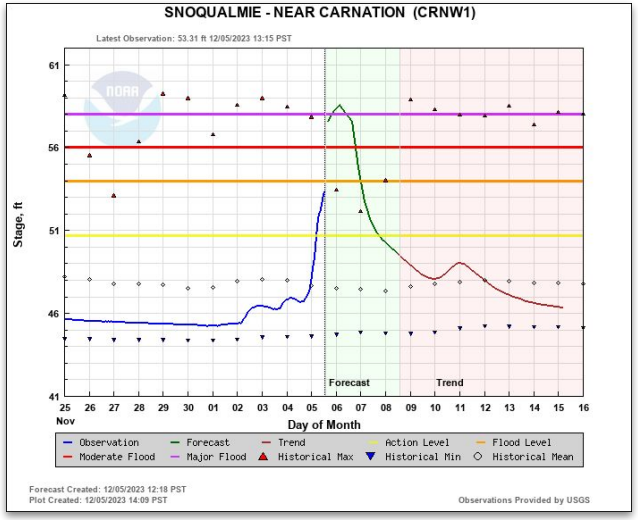








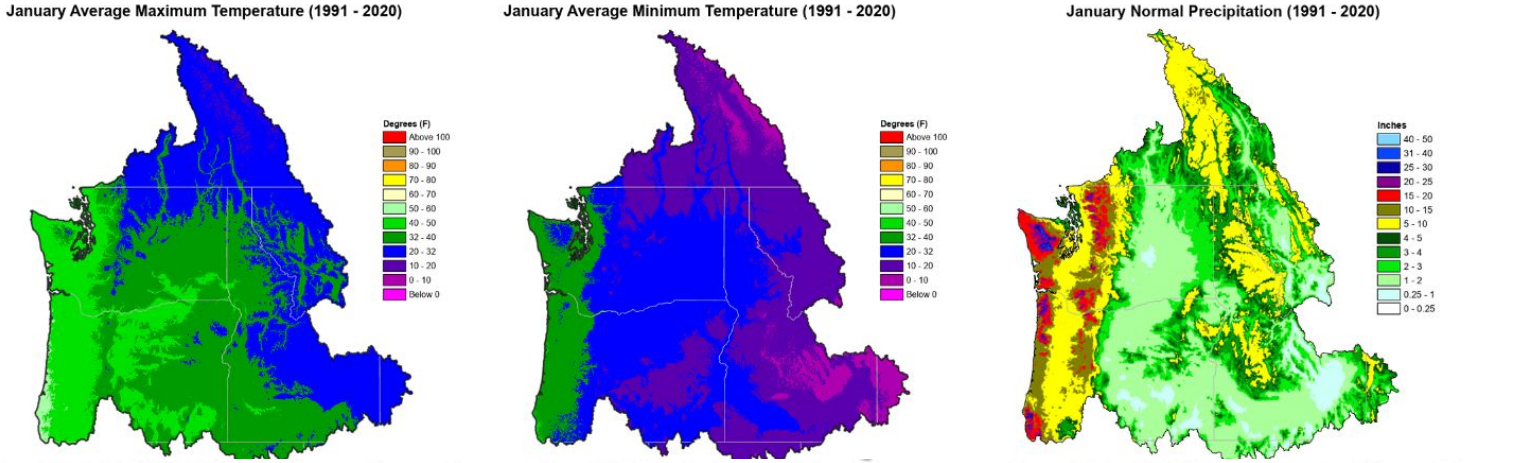




Water Year 2024 Updates for NWRFC

1991-2010 Update for PRISM gridded normals for NWRFC domain

- Monthly Precipitation, Min/Max Temperature
- Precipitation divisions normals and graphics on NWRFC webpage

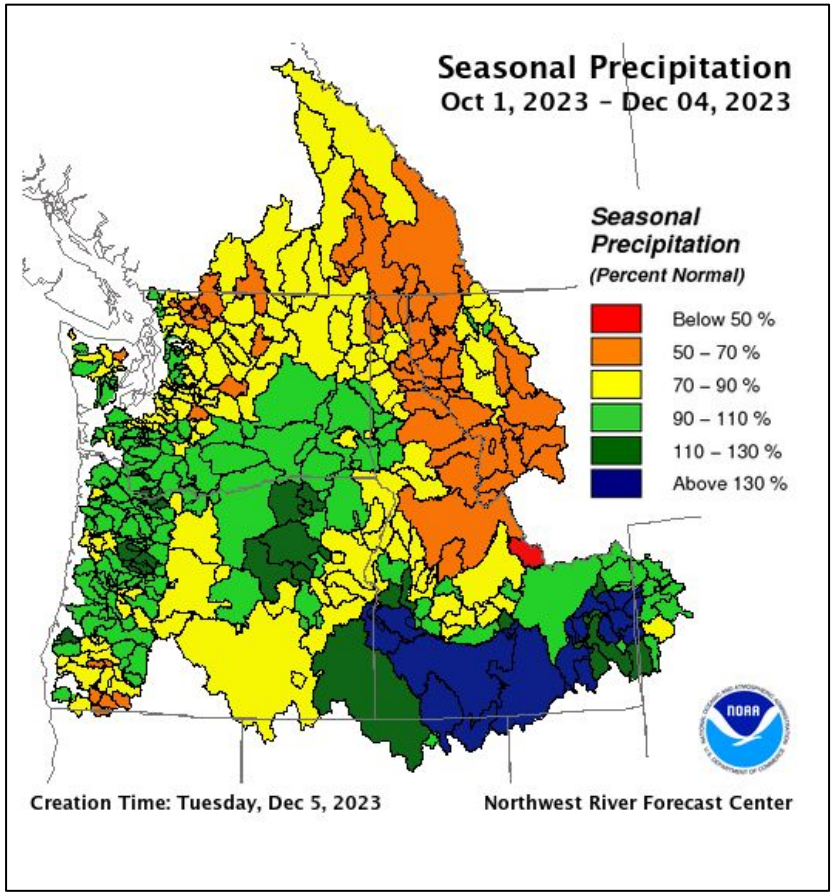


Copyright © 2023, PRISM Climate Group, Oregon State University, https://prism.oregonstate.edu and Pacific Climate Impacts Consortium, University of Victoria https://www.pacificclimate.org/. Data downloaded 8/2023. Map created by Northwest River Forecast Center, 11/17/2023.

1991-2020 Division Averages (Inches)

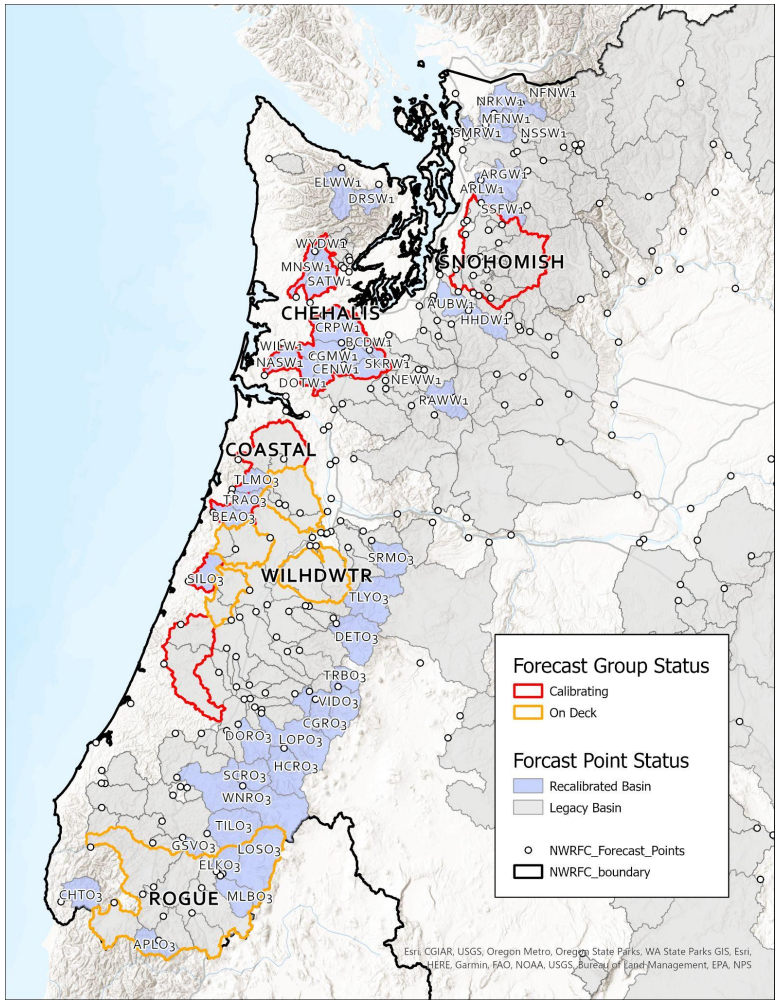
Columbia River Main Stem

DIVISION NAME	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Columbia River Basin abv Grand Coulee	4.29	3.08	3.51	2.72	2.86	3.27	1.73	1.47	2.05	3.45	4.60	4.33
Columbia River Basin abv The Dalles	3.33	2.47	2.71	2.23	2.32	2.13	1.00	0.89	1.29	2.34	3.26	3.53

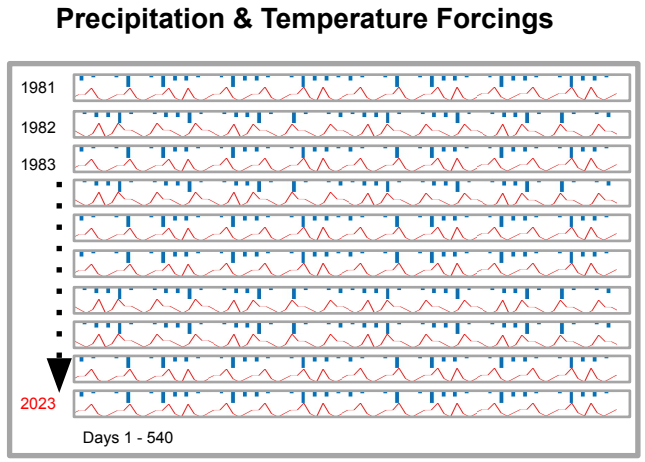


Water Year 2024 Updates for NWRFC

Recalibration of NWRFC models (westside in progress)

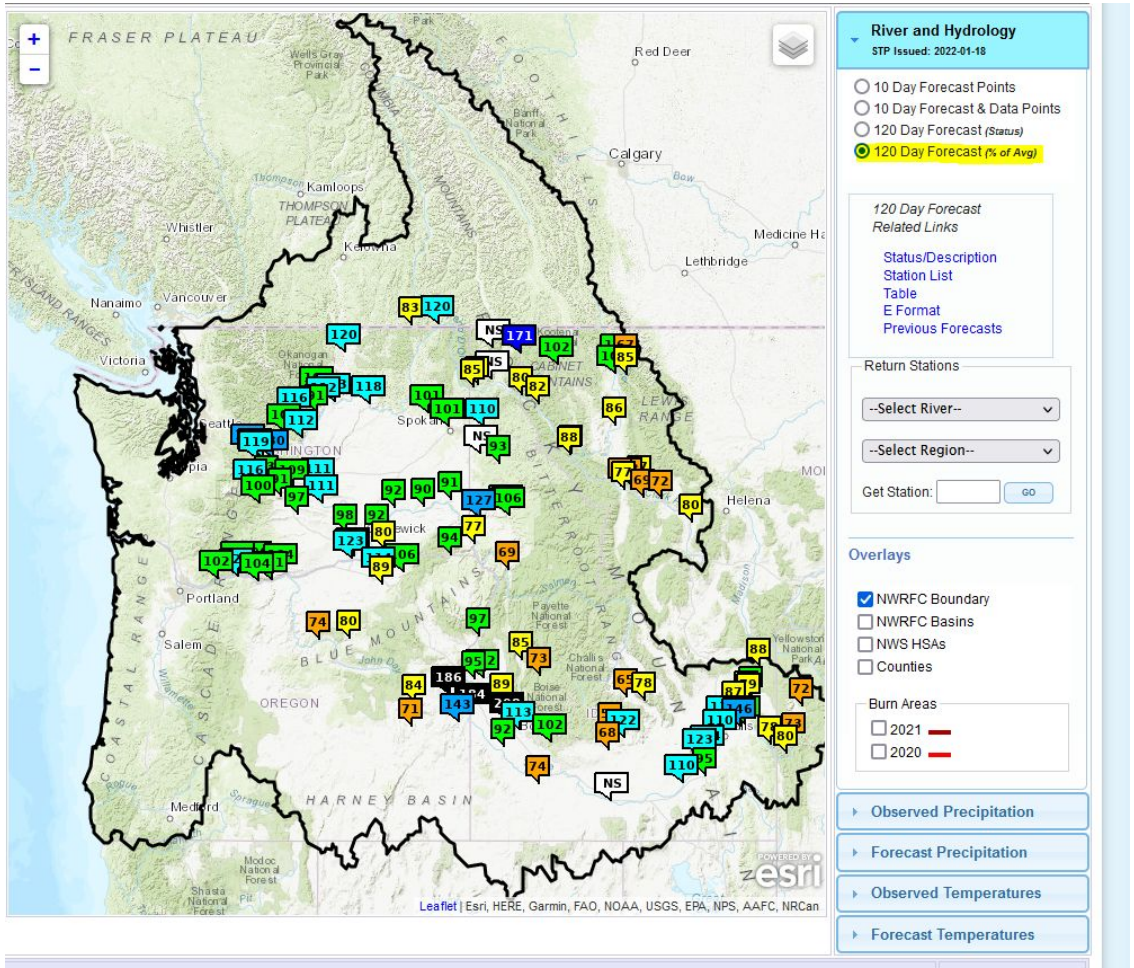


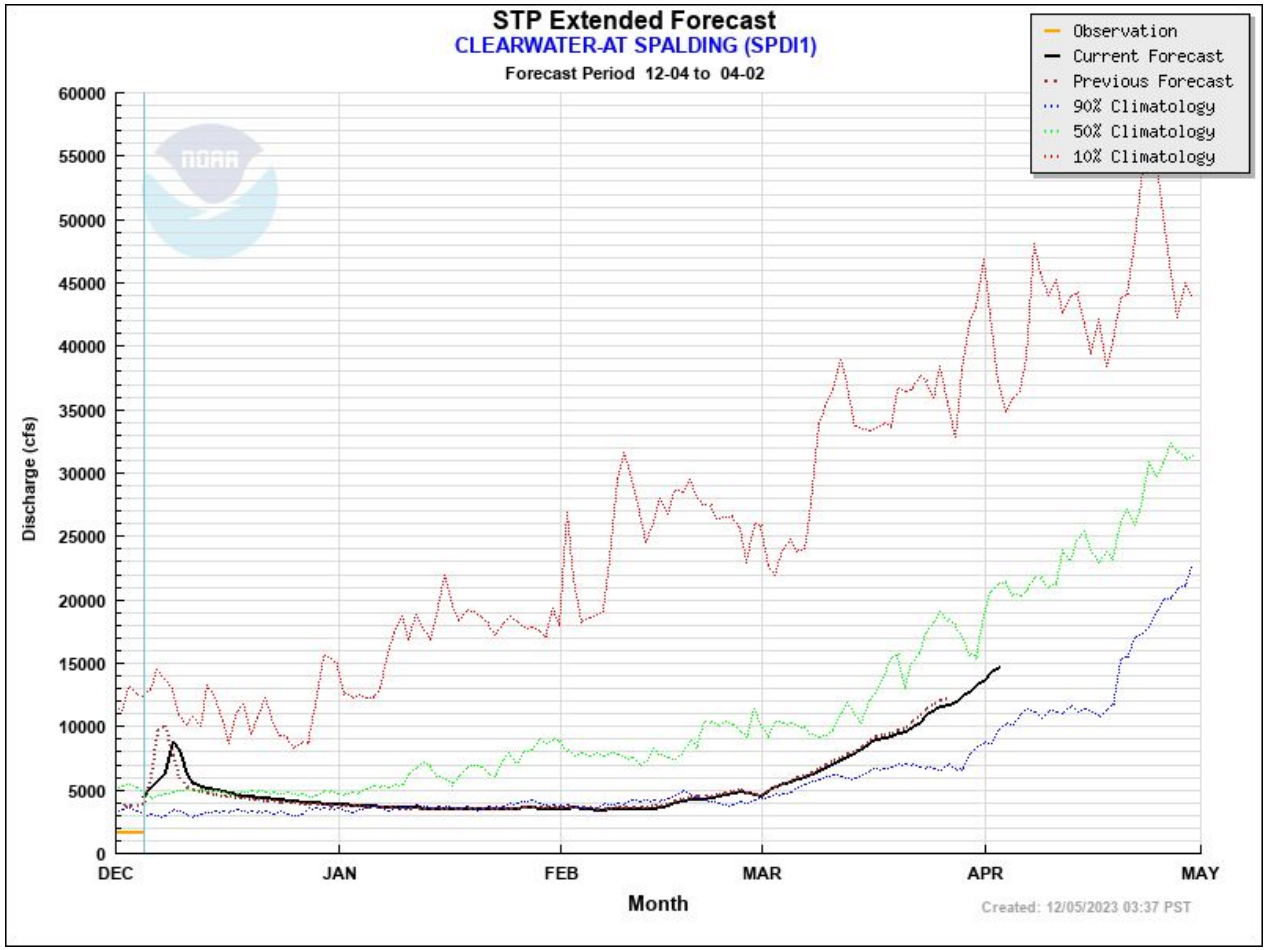
Extension of ESP forcing years to include weather from WY2023



ESP Forcing:
Historical Weather Years 1981-2022

STP: Single Trace Procedure (120 Extended Forecast)

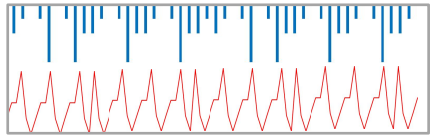




NWRFC Hydrology Model (CHPS*) Basics

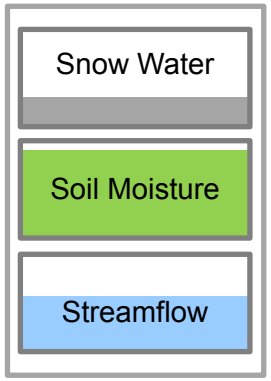
Forcings: *Obs & Fcst*

- ***Precipitation***
- ***Temperature***



Model Operations

- ***Snow***
- ***Soil Moisture***
- ***Consumptive Use***
- ***Regulation***
- ***Routing***



Hydrologic Output

- ***River Stage Height***
- ***Pool Elevation***
- ***River Flow Rate (Ex: Discharge in CFS)***
- ***River Volume Over Time (Ex: Runoff in KAF)***

* Community Hydrologic Prediction System (CHPS)

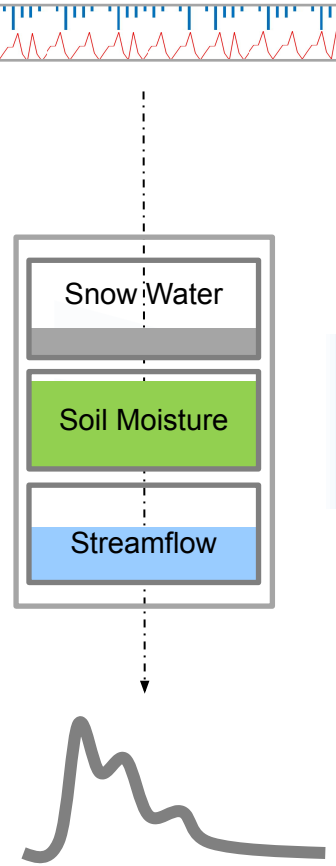
CHPS: Multiple Configurations

Natural Forecast (adjusted runoff)

River Forecast (matches obs)

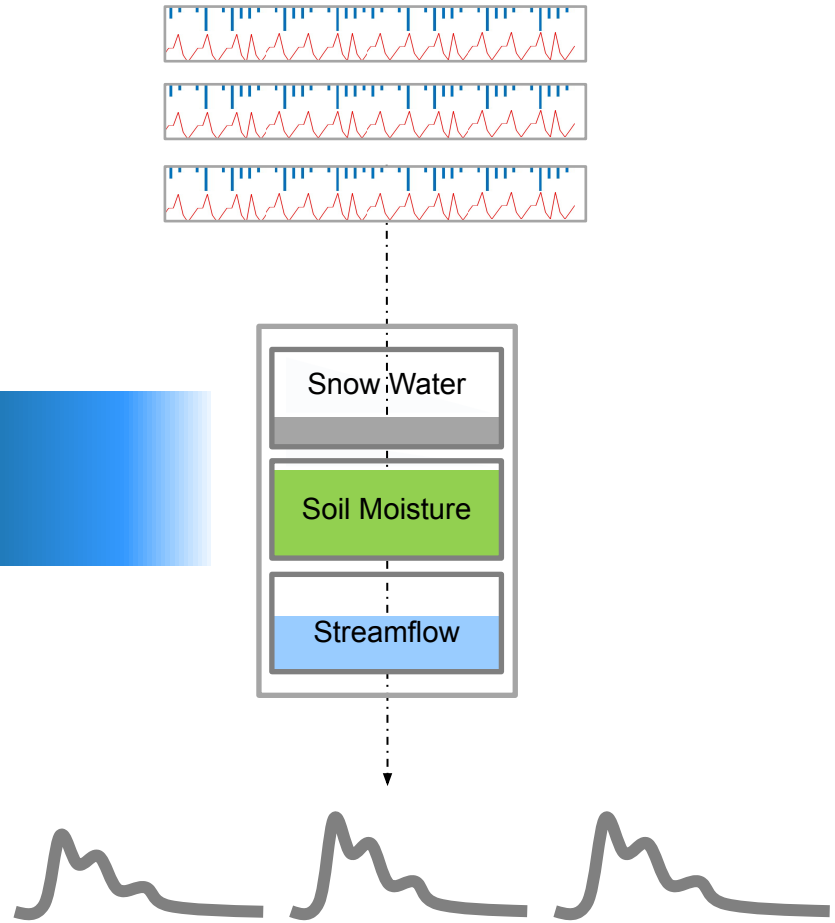
CHPS: Multiple Forcing Configurations

Deterministic Mode



Same Model Operations
& Shared States

Ensemble Mode



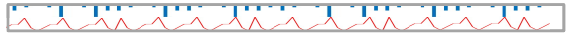
Spaulding 10 Day River Forecast (includes USACE Dworshak Regulation)

Precipitation & Temperature Forcings

Sources:

Temperature
Days 1-10: NWS Nat Blend of Models

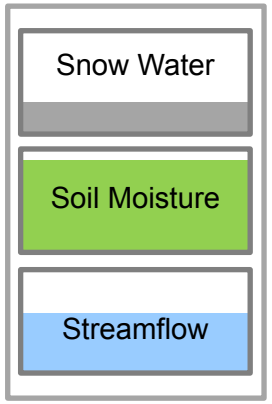
Precipitation
Days 1-2: NWS Weather Forecast Offices
Days 3-7: NWS Weather Prediction Center
Days 8-10: NWS Nat Blend of Models



Days 1 - 10

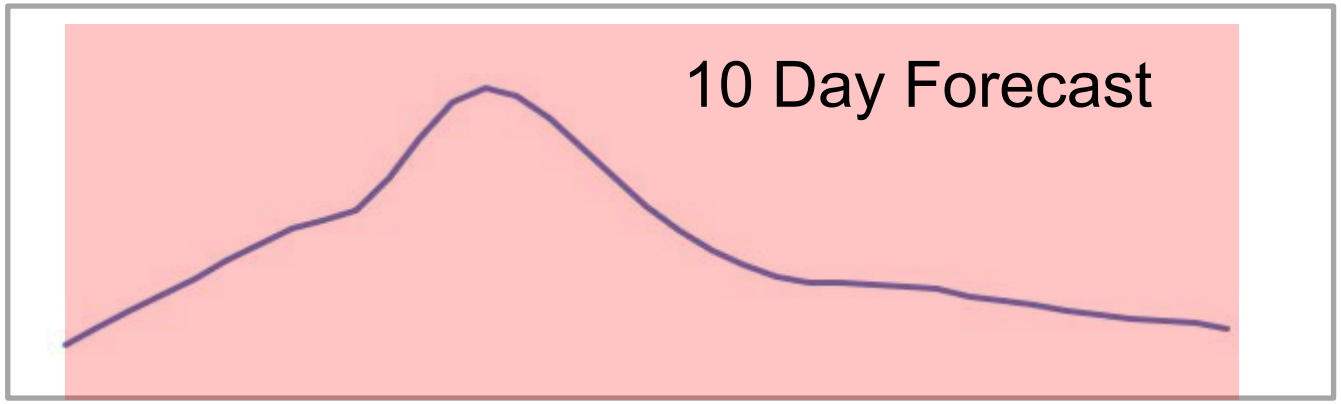
10 Day River Forecast Forcing:
10 Day Weather Forecast (WFO/WPC/NBM)

Hydrologic Model

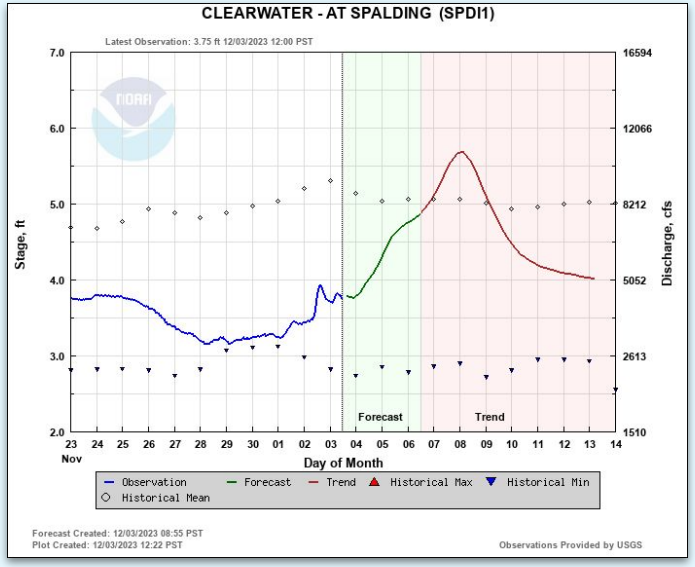


Model Tuned to
Current Conditions

Hydrologic Model Output

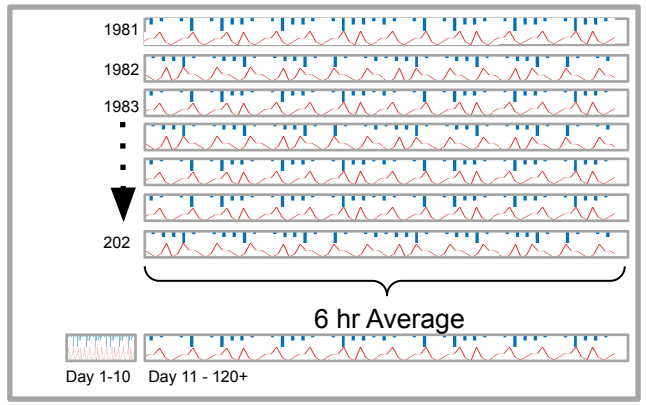


10 Day River Forecast
Product Example

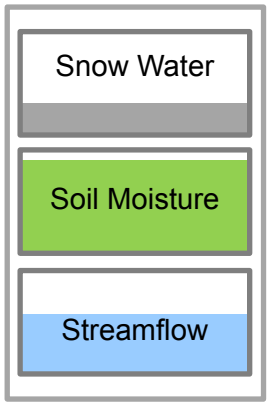


Spaulding STP - Unadjusted (includes USACE Dworshak Regulation)

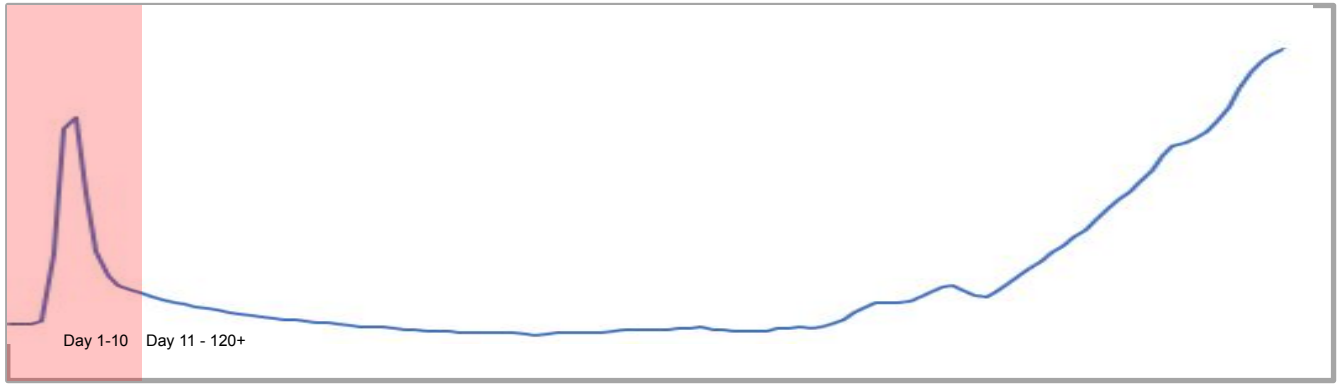
Precipitation & Temperature Forcings



Hydrologic Model



Hydrologic Model Output

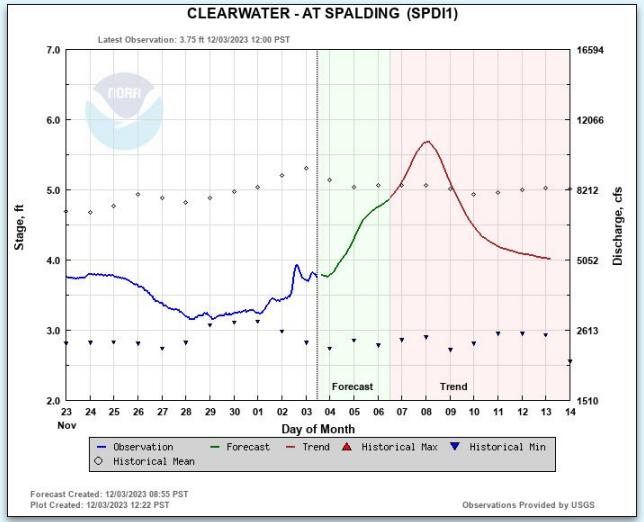


STP Forcing:
Days 1-10: Deterministic Weather Forecast
Days 11+: 6 hr Mean of Historical Weather
Years 1981-2022

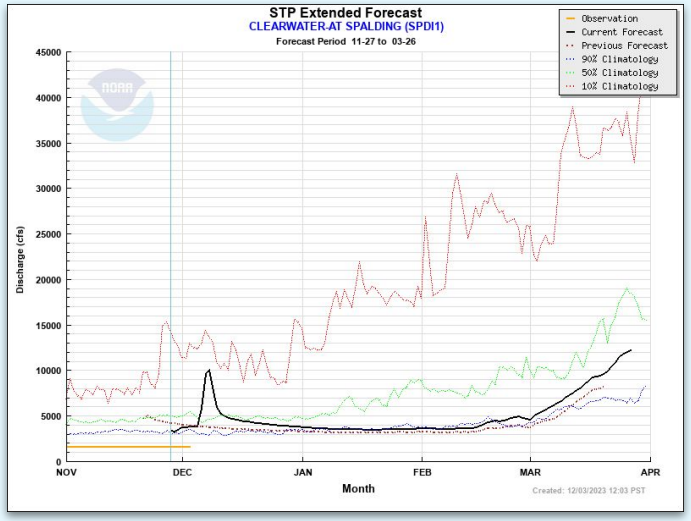
Model Tuned to Current Conditions

- First 10 days equals deterministic 10 Day River Forecast
- First 120+ days used for STP

10 Day River Forecast Product Example

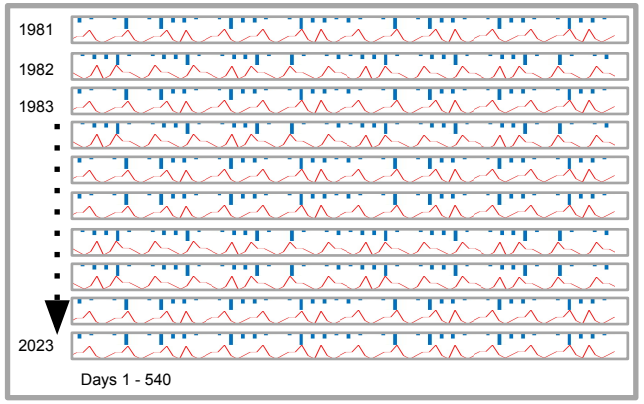


120 Day STP Product Example



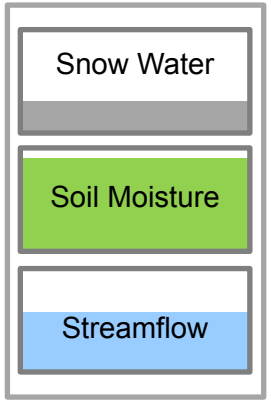
Spaulding ESP0 - Water Supply (simple adjustment for Dworshak storage)

Precipitation & Temperature Forcings



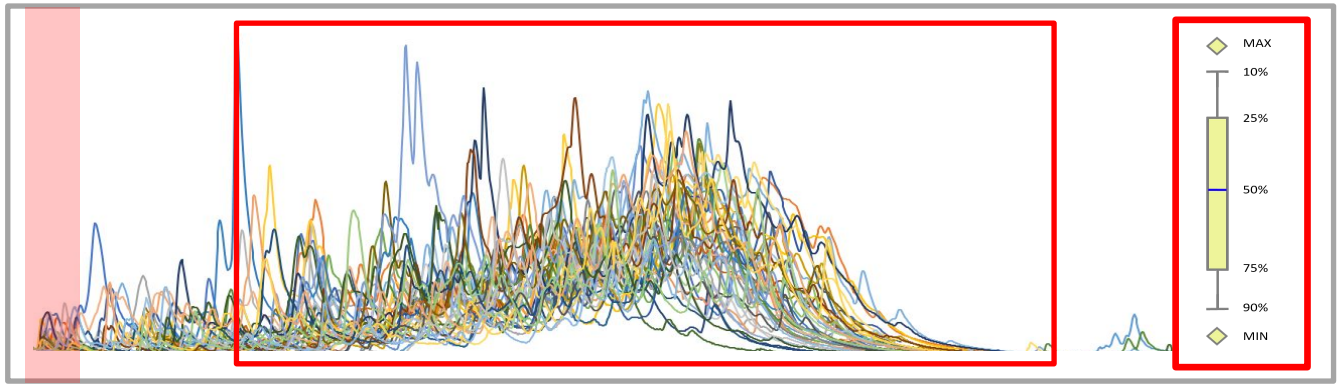
ESP0 Forcing:
Historical Weather Years 1981-2022

Hydrologic Model



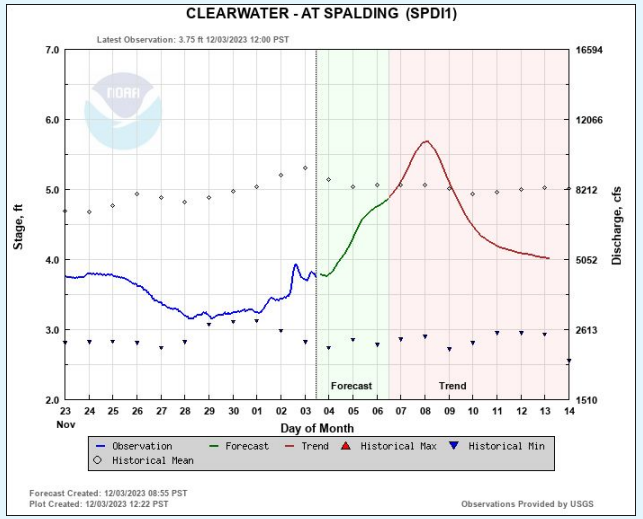
Model Tuned to
Current Conditions

Hydrologic Model Output

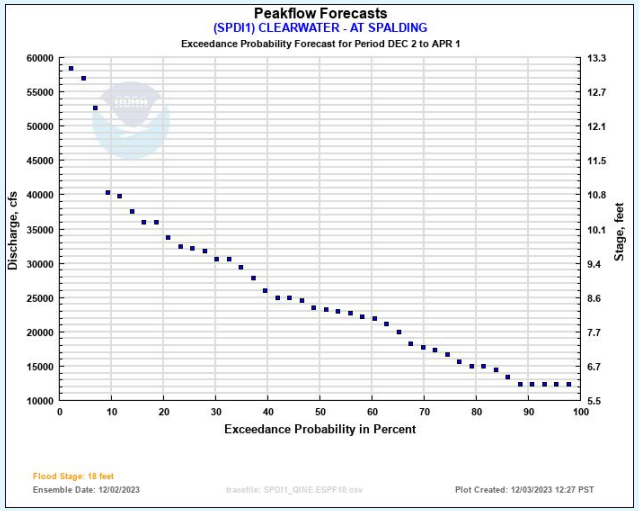


- Ensemble throughout (no weather forecast for days 1-10)
- Provides a ‘baseline’ comparison to ESP10 and impact of 10 day weather forecast.

10 Day River Forecast Product Example

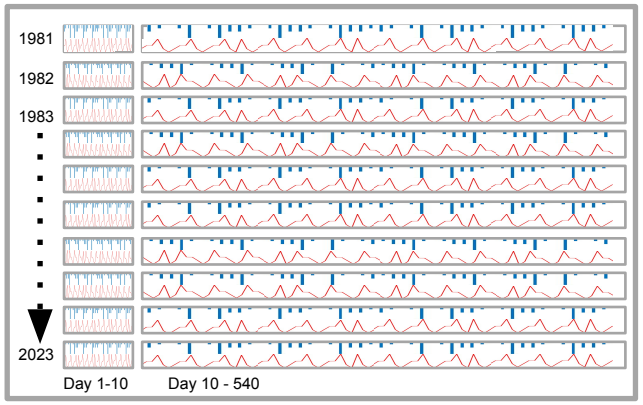


120+ Day Peak Flow Exceedance Probability Product Example

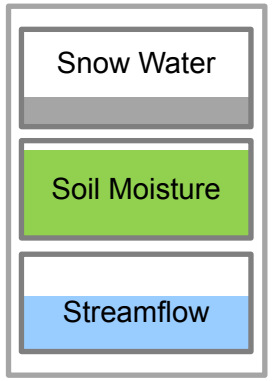


Spaulding ESP10 - Water Supply (simple adjustment for Dworshak storage)

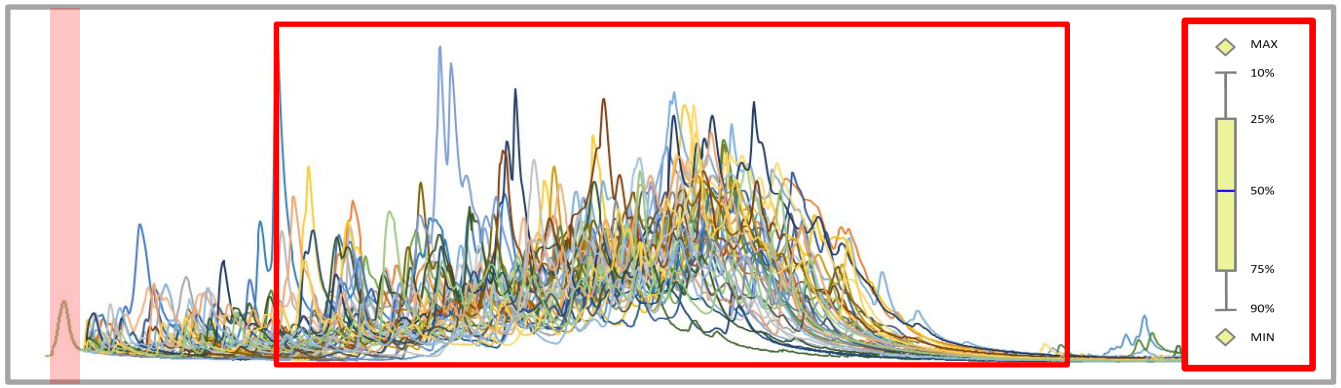
Precipitation & Temperature Forcings



Hydrologic Model



SPDI1W_SQIN.ESPF10

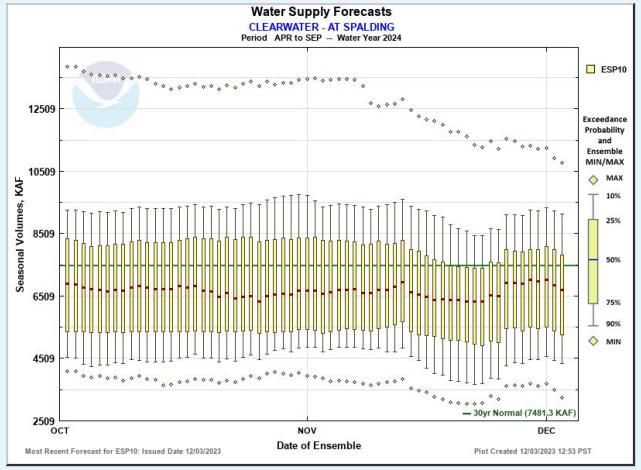


ESP10 Forcing:
Days 1-10: Deterministic Weather Forecast
Days 11+: Historical Weather Years 1981-2022

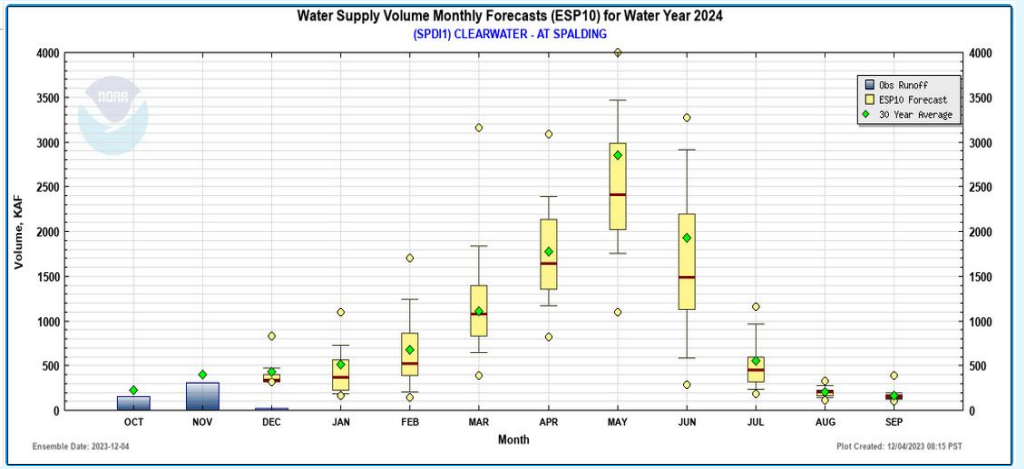
Model Tuned to Current Conditions

- First 10 days is deterministic
- Ensembles for monthly and seasonal periods ranked to produce exceedance probabilities (expressed as box plots)

Seasonal WS Product Example

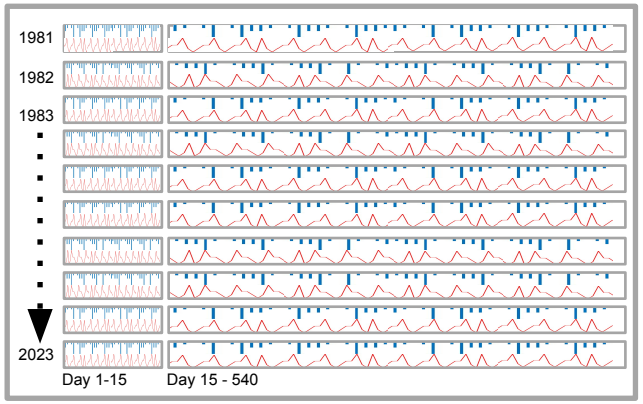


Monthly WS Product Example



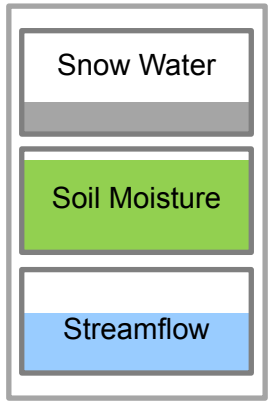
Spaulding HEFS unadjusted/WS/Natural (experimental)

Precipitation & Temperature Forcings

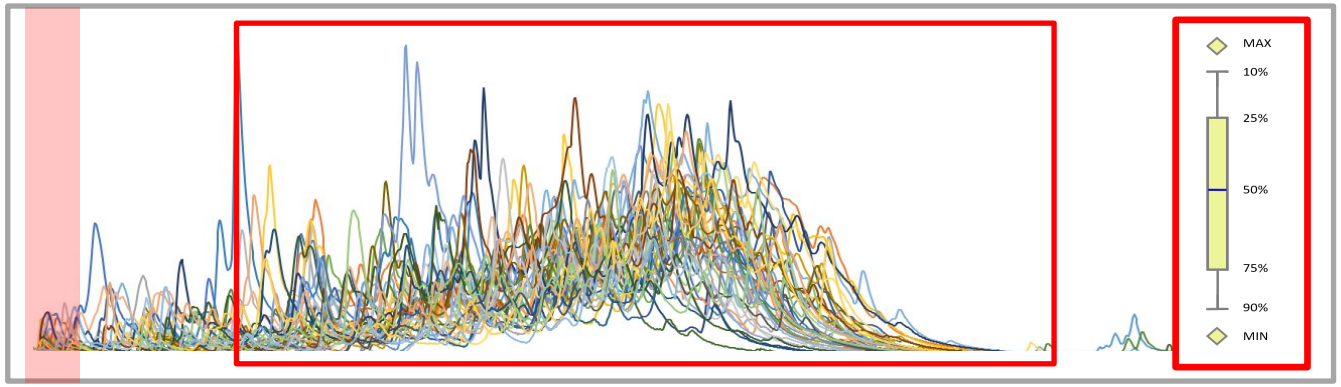


HEFS Forcing (ESPM):
Weather Ensemble based on GEFS Mean
Uses Meteorologic Ensemble Forecast System

Hydrologic Model

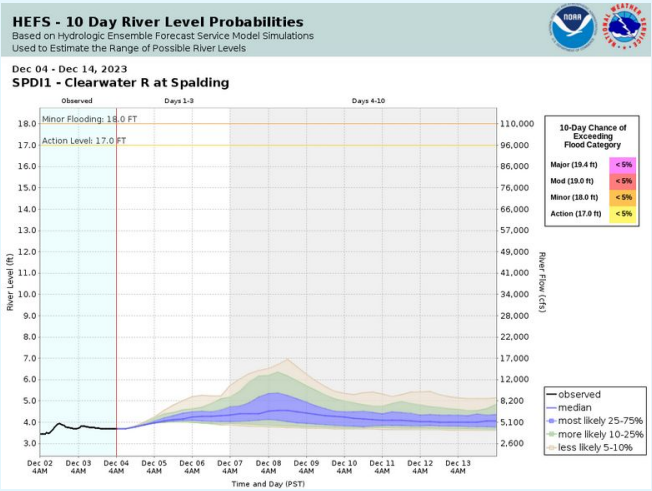


Model Tuned to
Current Conditions

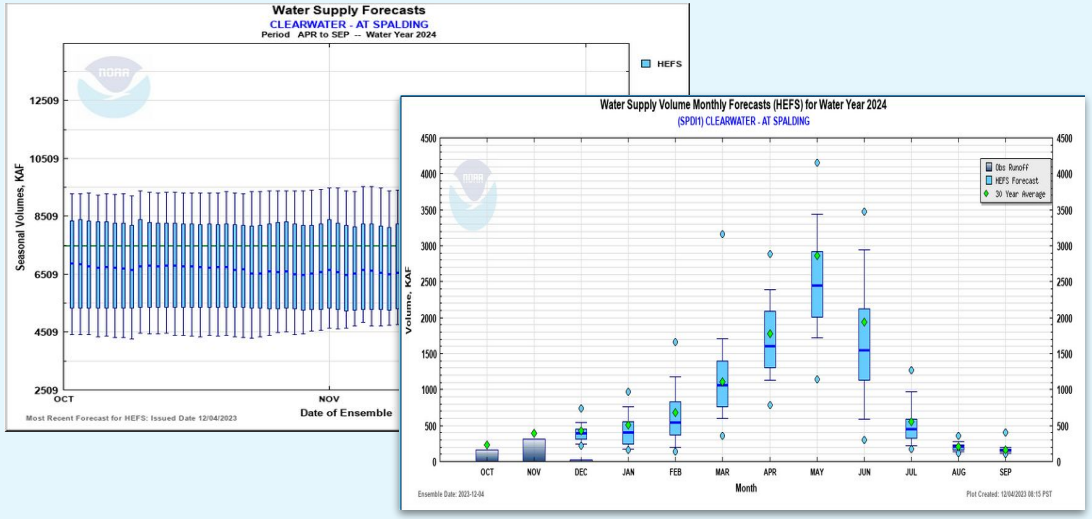


- First 15 days are ensembles; informed by weather forecasts
- HEFS version available in three configurations (unadj/WS/NAT)
- Basis of NWRFC ‘experimental’ seasonal forecast

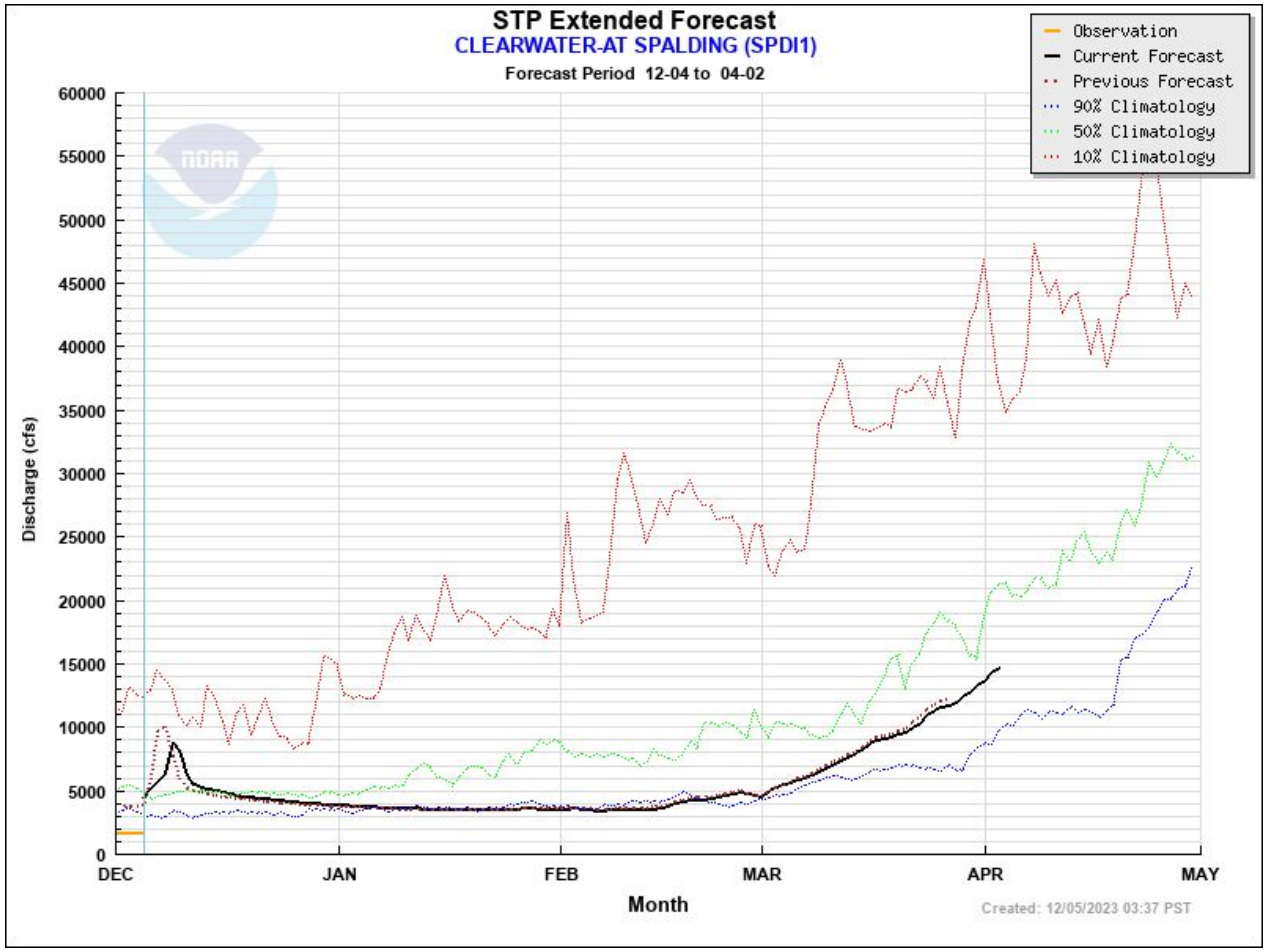
10 Day Probabilistic Product Example



Monthly and Seasonal WS Product Examples



STP: Single Trace Procedure (120 Extended Forecast)

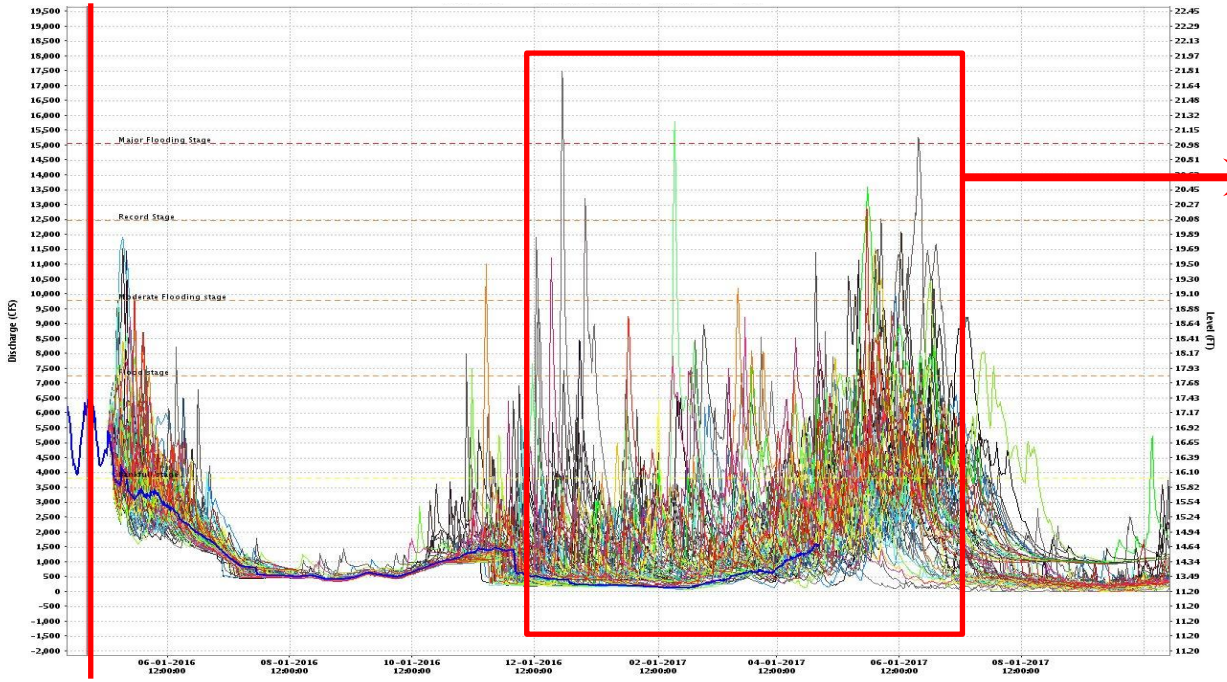


- STP is a joint NWRFC/USACE product based on NWRFC hydrologic forecasts and USACE regulation
- Produced at request of USACE
- NWRFC model tuning is independent of USACE coordination
- Typically issued on Mondays
- The public version is a subset of a larger run available to USACE
- Questions about the content generally involve regulation (USACE is the source for answers)

Thanks!

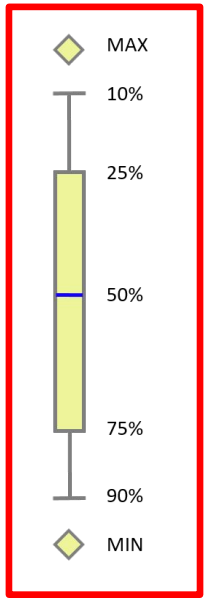
ESP Communicated as Exceedance Probabilities

'Spaghetti' Plot: each trace is result of the current model state forced by a given weather 'year'



Forecast Creation Time

Forecast Period (e.g. Apr-Sep)



Boxplot Summary

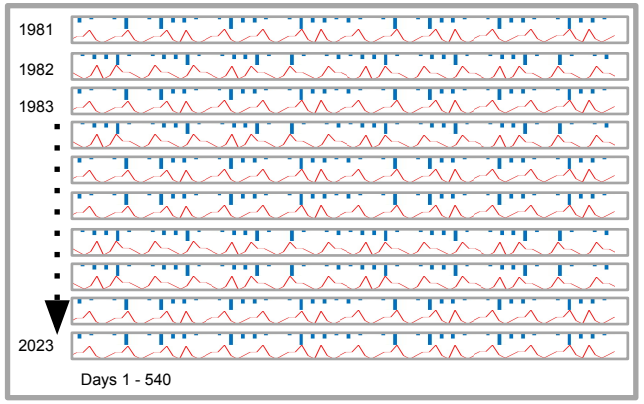
Each ensemble outcome is a hydrograph

Each hydrograph has a volume (area under trace)

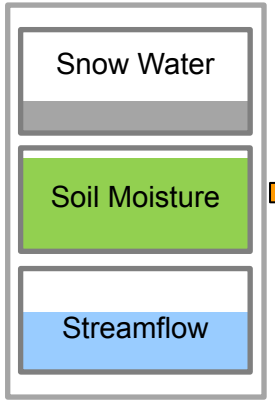
The 50% exceedance value represents the median of the ranked ensemble volumes

Forcing Template #1

Precipitation & Temperature Forcings



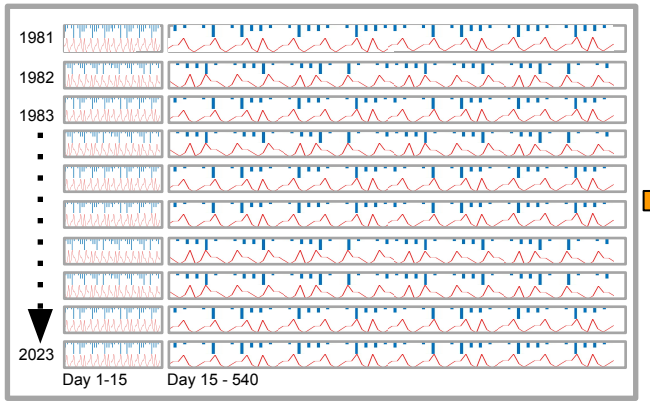
Hydrologic Model



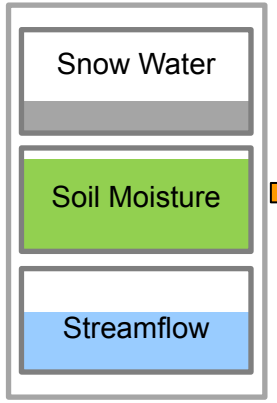
ESP0 Forcing:
Historical Weather Years 1981-2022

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



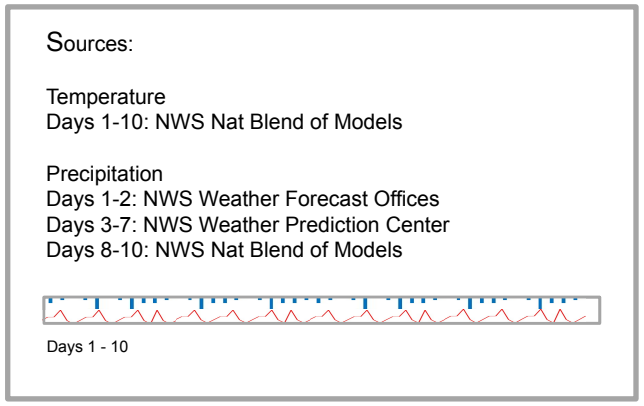
Hydrologic Model



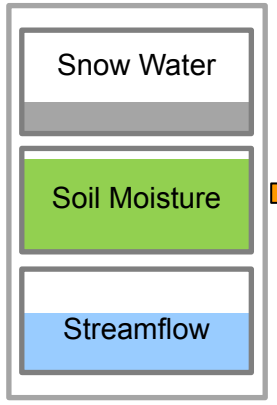
HEFS Forcing (ESPM):
Weather Ensemble based on GEFS Mean
Uses Meteorologic Ensemble Forecast System

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



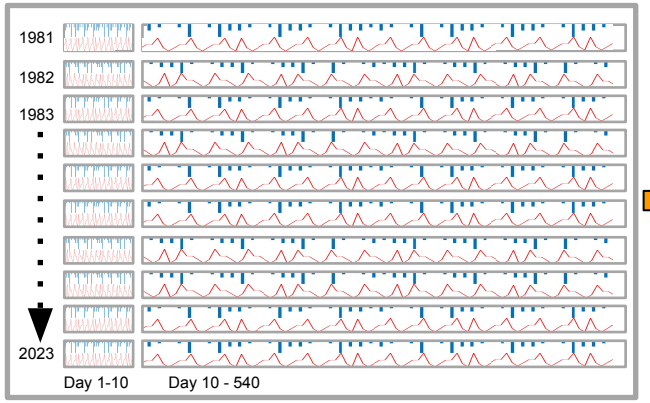
Hydrologic Model



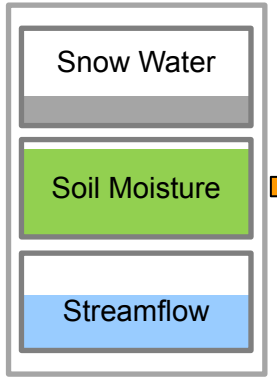
10 Day River Forecast Forcing:
10 Day Weather Forecast (WFO/WPC/NBM)

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



Hydrologic Model

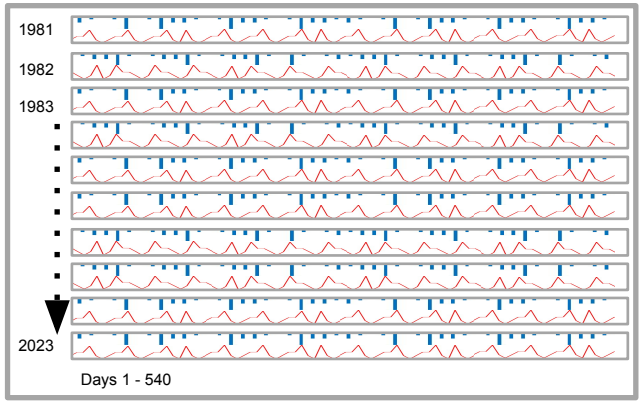


ESP10 Forcing:
Days 1-10: Deterministic Weather Forecast
Days 11+: Historical Weather Years 1981-2022

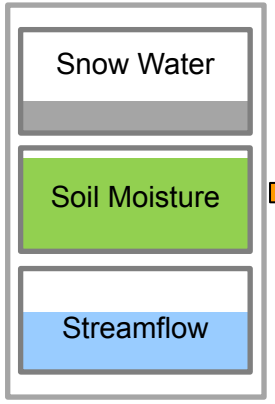
Model Tuned to
Current Conditions

Forcing Template #1

Precipitation & Temperature Forcings



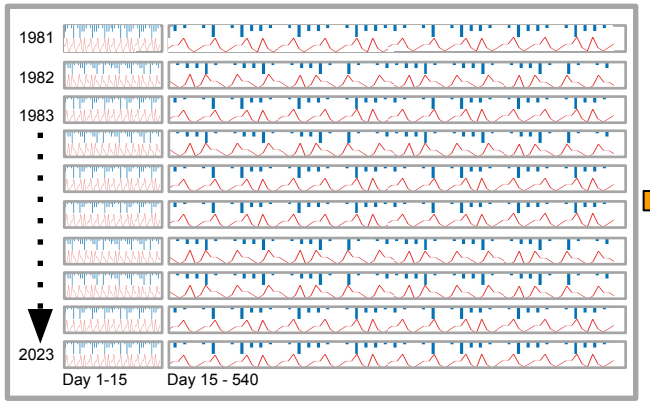
Hydrologic Model



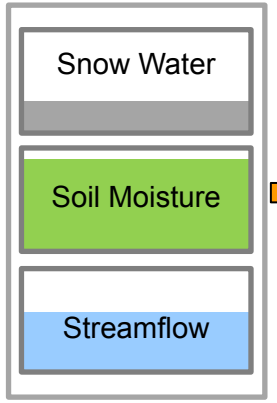
ESP0 Forcing:
Historical Weather Years 1981-2022

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



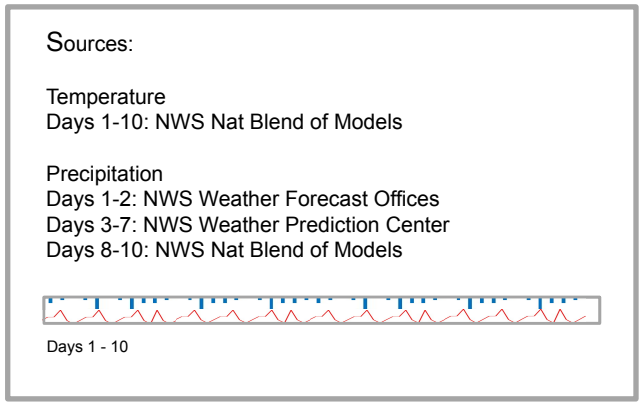
Hydrologic Model



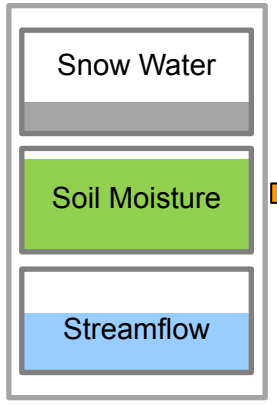
HEFS Forcing (ESPM):
Weather Ensemble based on GEFS Mean
Uses Meteorologic Ensemble Forecast System

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



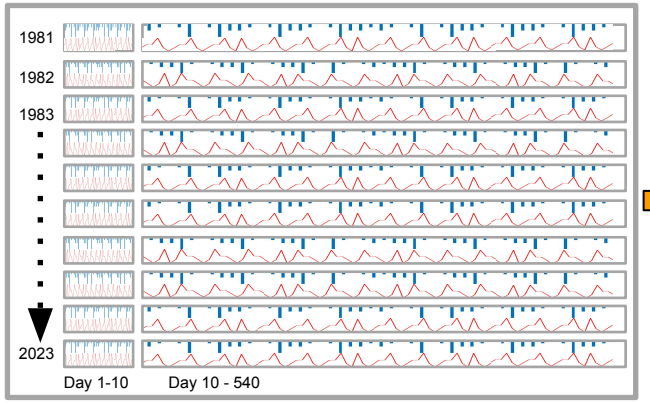
Hydrologic Model



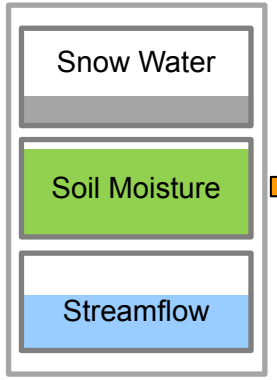
10 Day River Forecast Forcing:
10 Day Weather Forecast (WFO/WPC/NBM)

Model Tuned to
Current Conditions

Precipitation & Temperature Forcings



Hydrologic Model

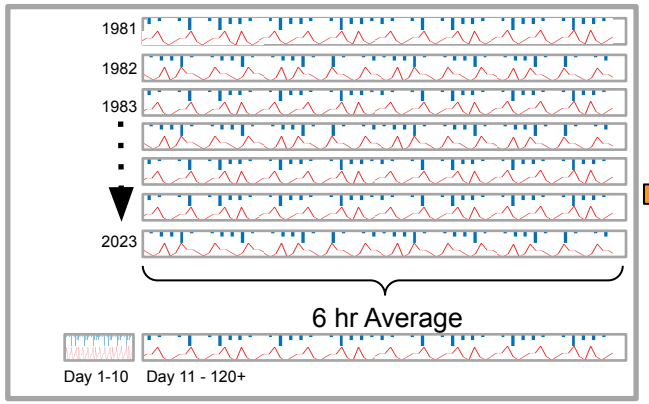


ESP10 Forcing:
Days 1-10: Deterministic Weather Forecast
Days 11+: Historical Weather Years 1981-2022

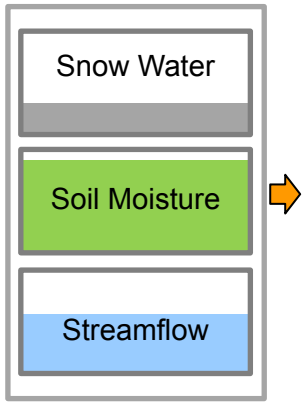
Model Tuned to
Current Conditions

Forcing Template #2

Precipitation & Temperature Forcings



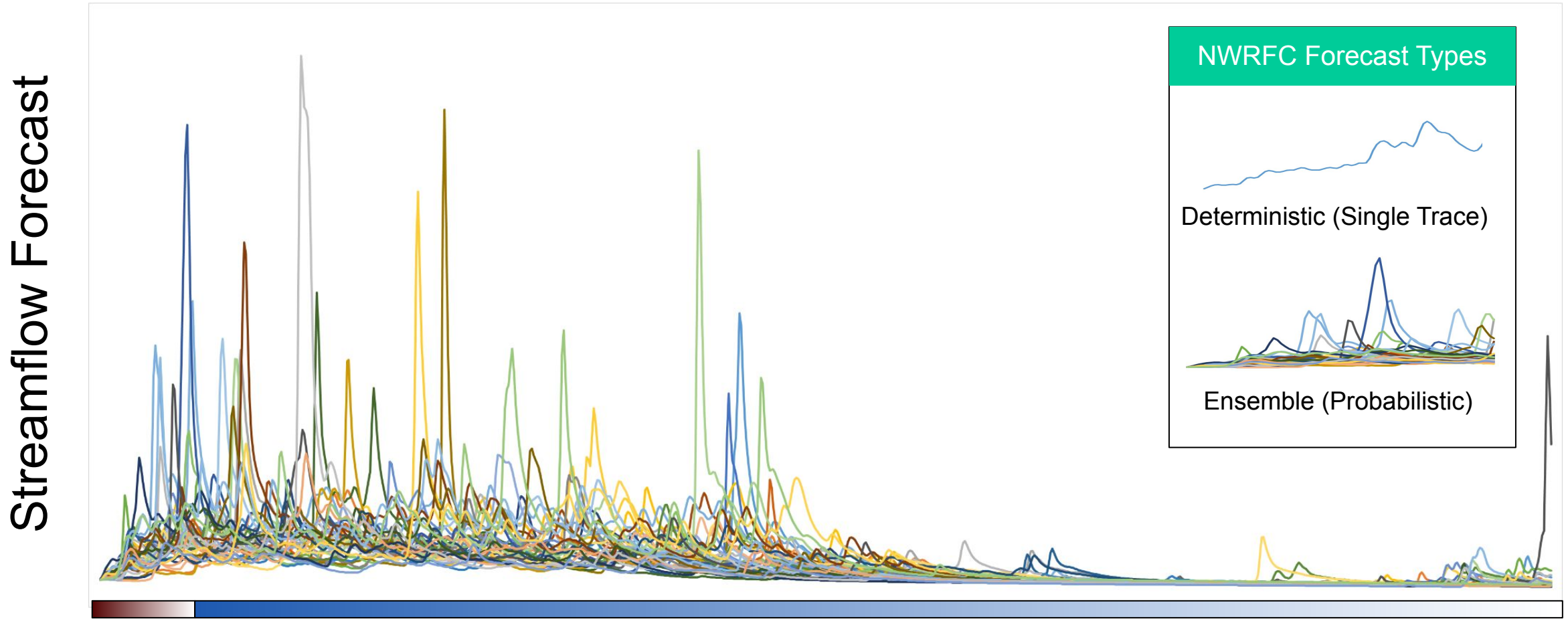
Hydrologic Model



STP Forcing:
Days 1-10: Deterministic Weather Forecast
Days 11+: 6 hr Mean of Historical Weather
Years 1981-2022

Model Tuned to
Current Conditions

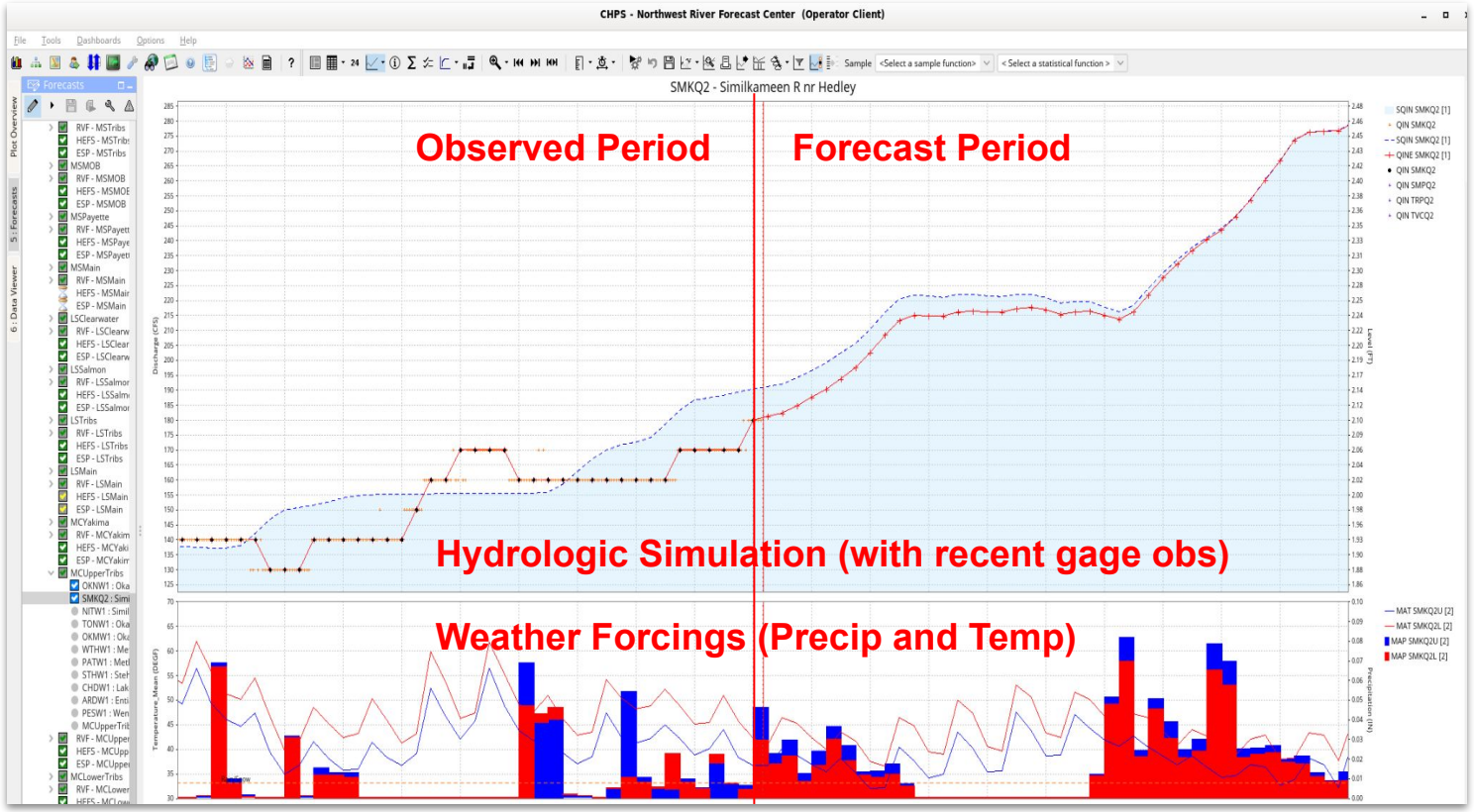
Temporal Scale of NWRFC Forecast Services



Baseline NWS River Forecast Center Model: CHPS

Community Hydrologic Prediction System

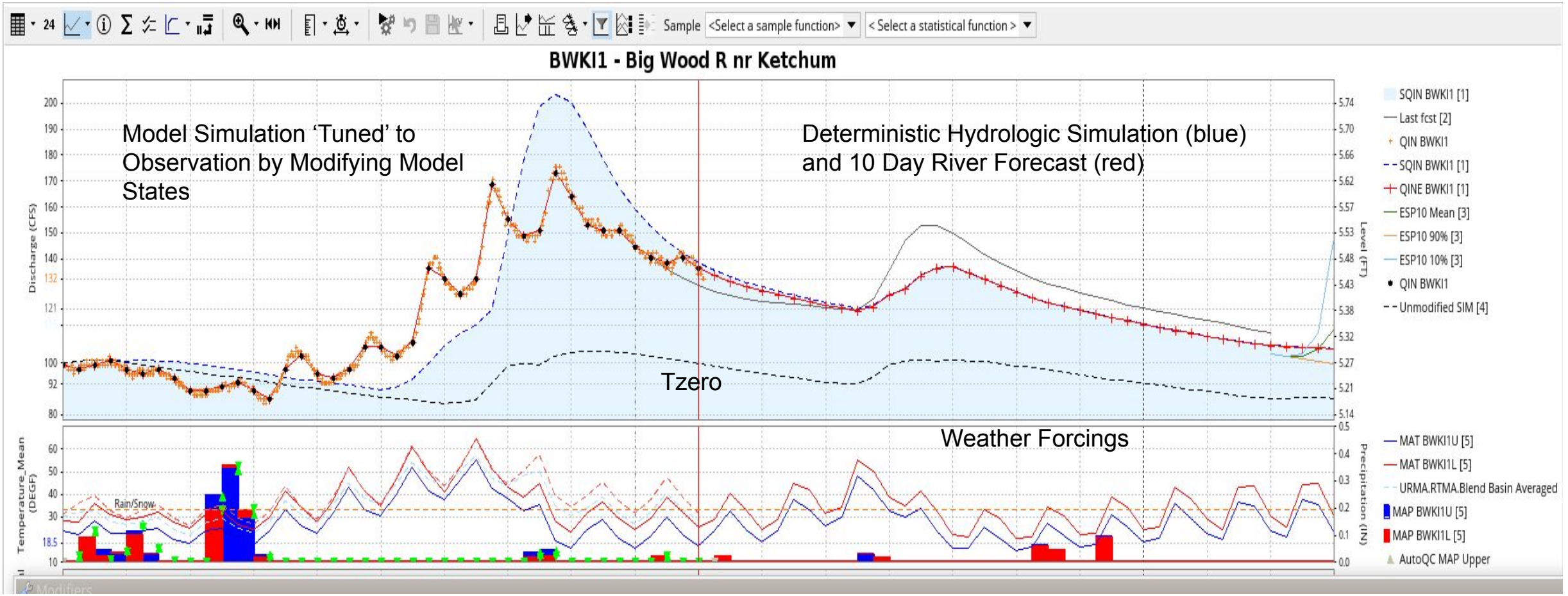
- NWS implementation of Deltares Delft-FEWS



CHPS Characteristics

- Calibrated against a long record
- Real-time application
- Forecaster in the loop

CHPS Model Classifiers

- Lumped
  - Elevation banded
  - Semi-distributed
- Conceptual (some physical)
- Continuous
  - 1 and 6 hour time step

NWRFC Model User Interface Example