

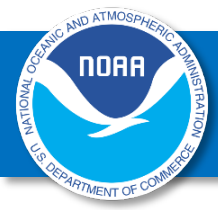
Northwest River Forecast Center



Updates to Techniques, Products, and Services for WY2020

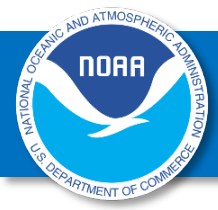
Steve King
Service Coordination Hydrologist
NOAA/NWS/Northwest River Forecast Center
Portland, OR





Overview of WY2020 NWRFC Changes

- **Changes to water supply (ensemble) forecast techniques**
- Update to weather forecast models used by NWRFC
- Rollout of NWS Hydrologic Ensemble Forecast Service
- Recalibration of NWRFC models using historical gridded dataset
- Enhancements to NWRFC products and services



21st Century Forecasting Trends

The Rise of Grids

- Gridded weather models to force water models
- Gridded weather observations to force water models
- Historical gridded weather to calibrate water models

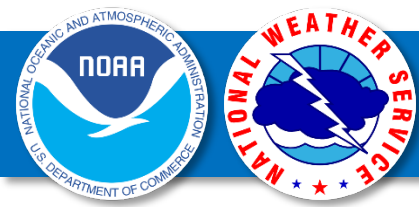
The Rise of Ensemble Techniques

- Deterministic models don't communicate confidence
- Ensembles help understand risk

The Rise of Automated Methods

- Weather models continue to improve
- Leverage strengths of computers (and humans)



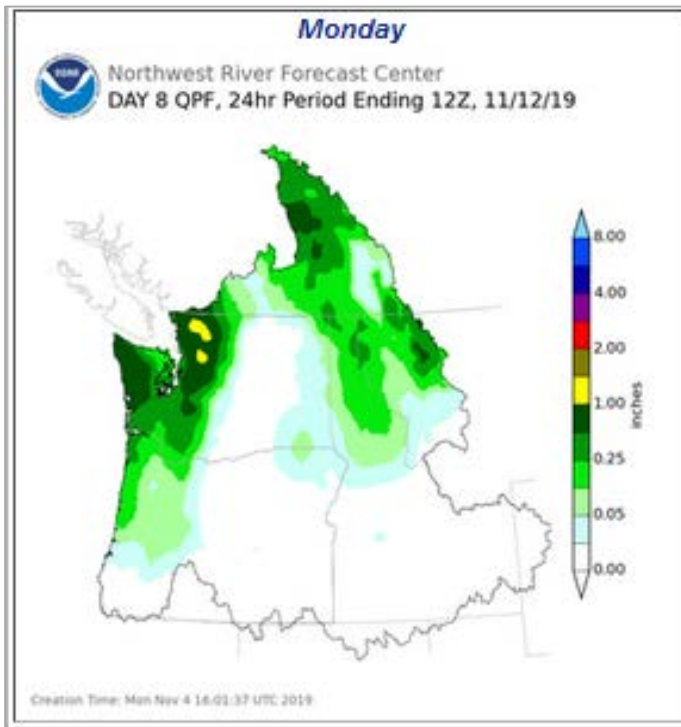


Increased use of NWS National Blend of Models (NBM)

10 Day Weather Forcing Elements for NWRFC Hydrology Model

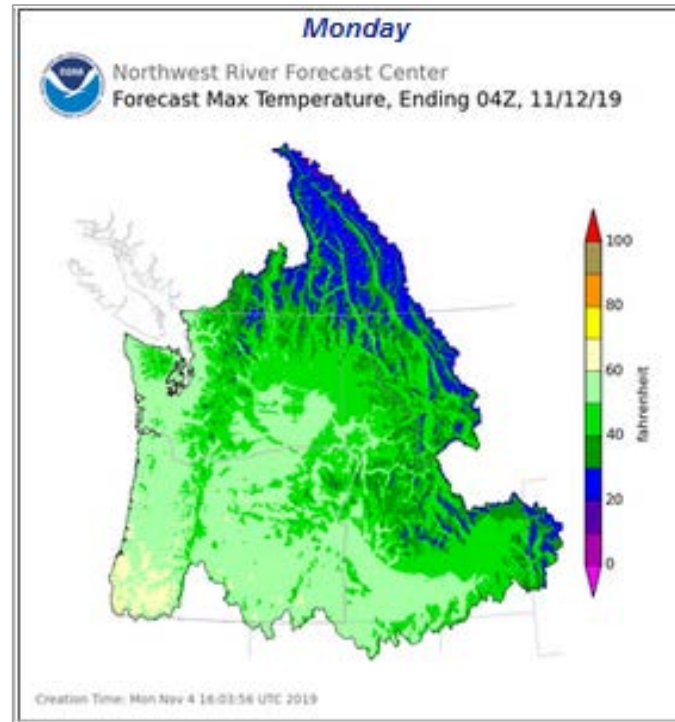
Precipitation (Fall 2019)

- National Blend (NBM)
- NWS Weather Offices



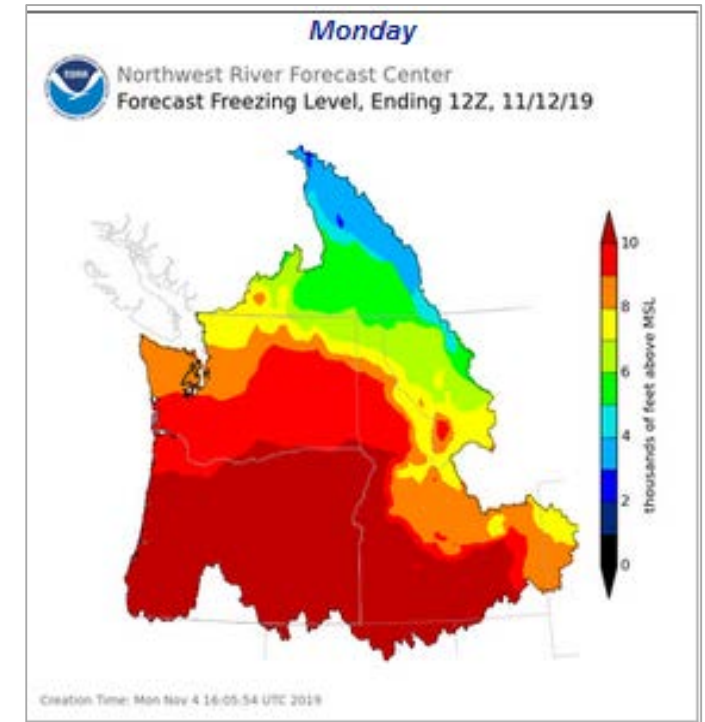
Temperature (Fall 2018)

- National Blend (NBM)

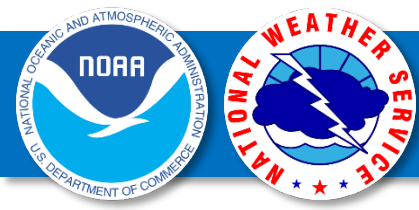


Snow Level** (Date TBD)

- National Blend (NBM)

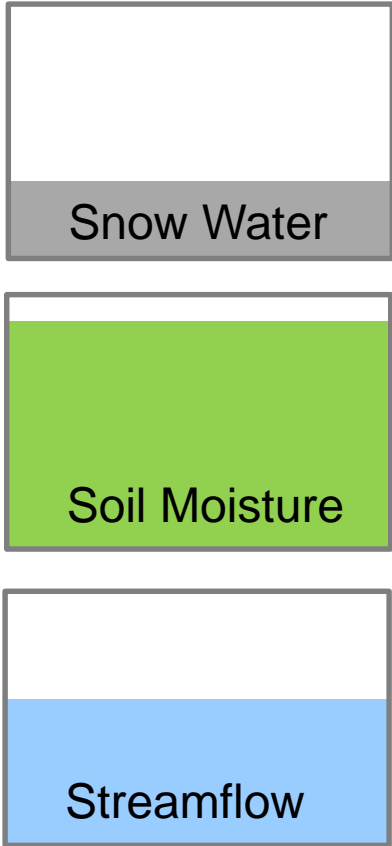


**Freezing Level web products will be replaced with snow level

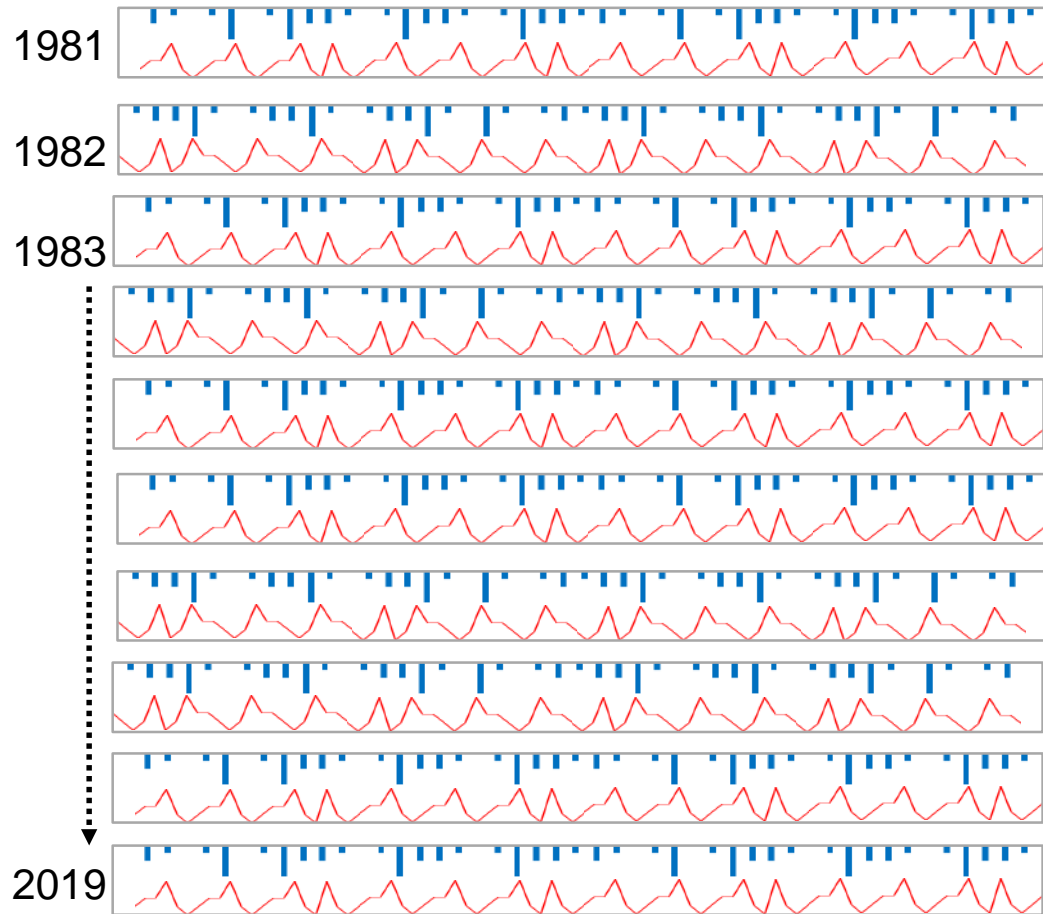


Overview of Ensemble Streamflow Prediction

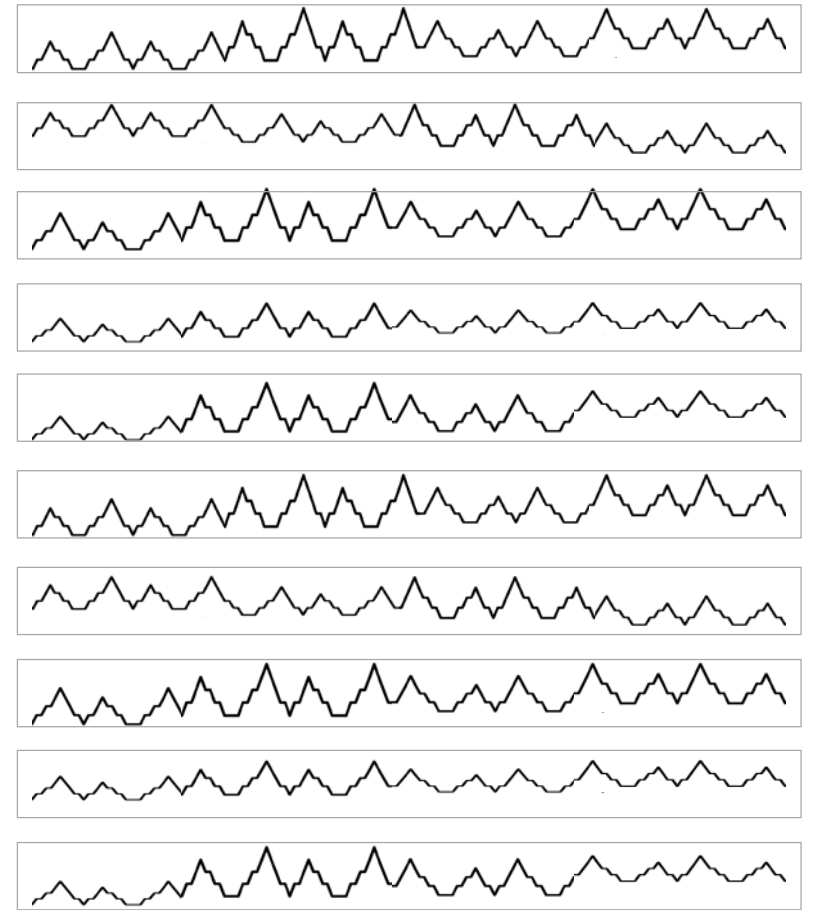
Current Model States



Combined with Historical Weather Forcings



Produces River Forecast Ensemble

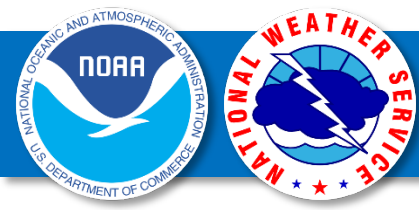


Antecedent Conditions

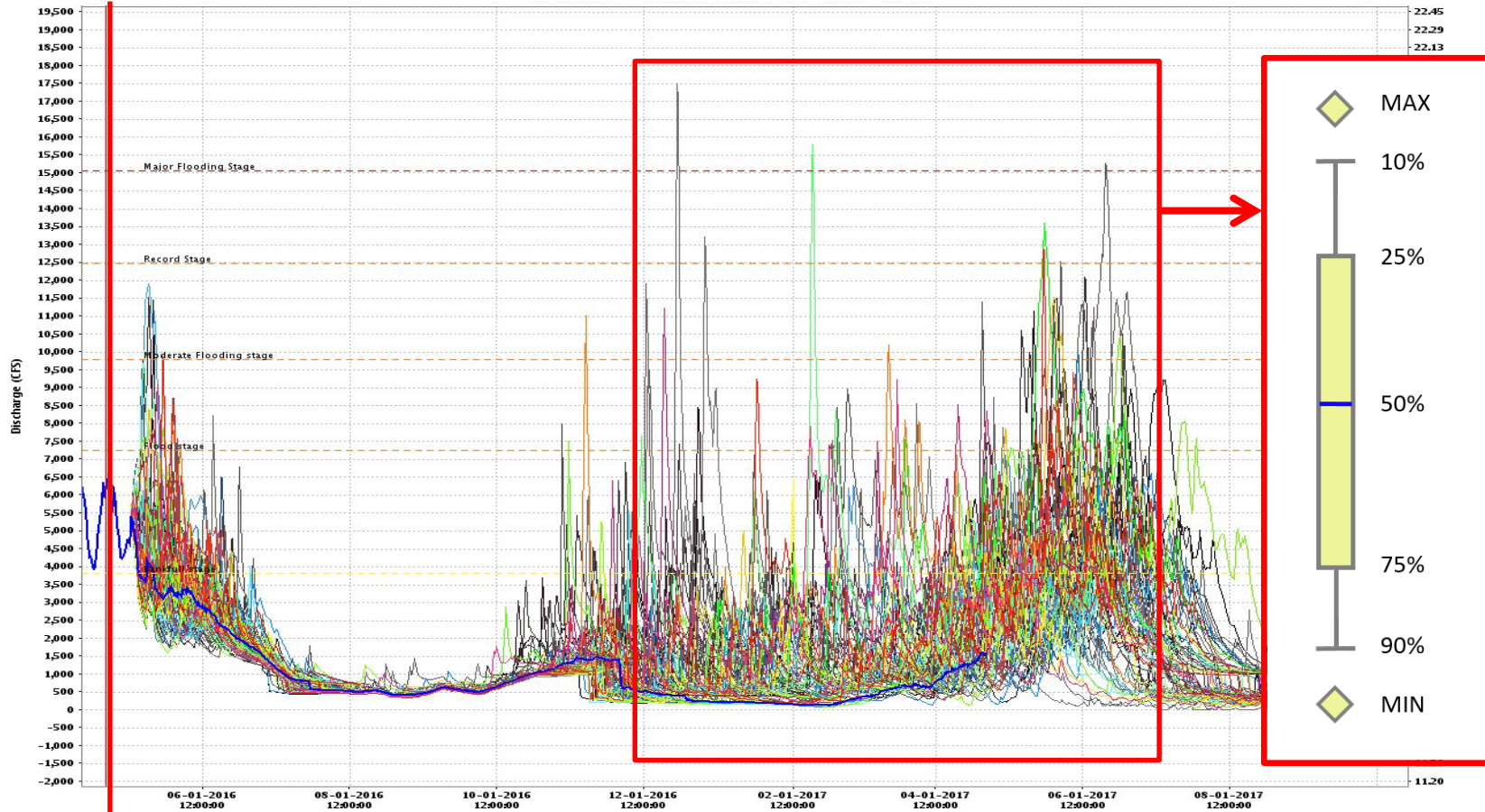
Precipitation & Temperature 'Forecasts'

Equally Likely River Outcomes

Assumes past and future distributions are equal



ESP Communicated as Exceedance Probabilities



Each ensemble outcome is a hydrograph

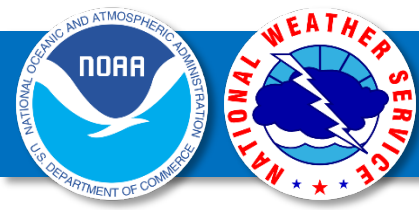
Each hydrograph has a volume (area under trace)

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

Forecast
Creation Time

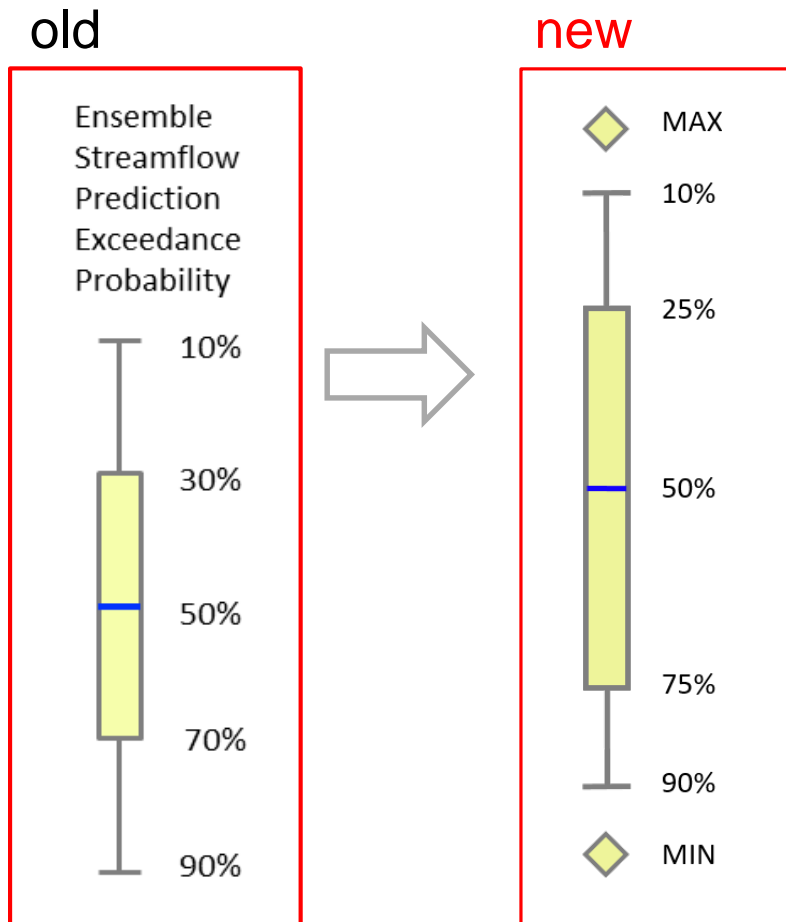
Forecast Period
(e.g. Jan - Jul)

Boxplot
Summary



WY2020: Update to ESP Summary Statistics

NWRFC Box Plot Construction

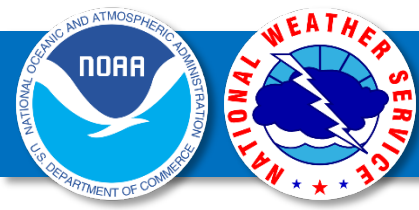


Replaced 30/70 with 25/75:
50% of outcomes represented by Interquartile Range (25-75%)

Added Max and Min:
Max and Min equal largest/smallest volumes of the ensemble

For 39 year Ensemble (1981-2019)

- Max = 2.5% Exceedance
- Min = 97.5% Exceedance



WY2020: Retiring of ESP 5 Flavor

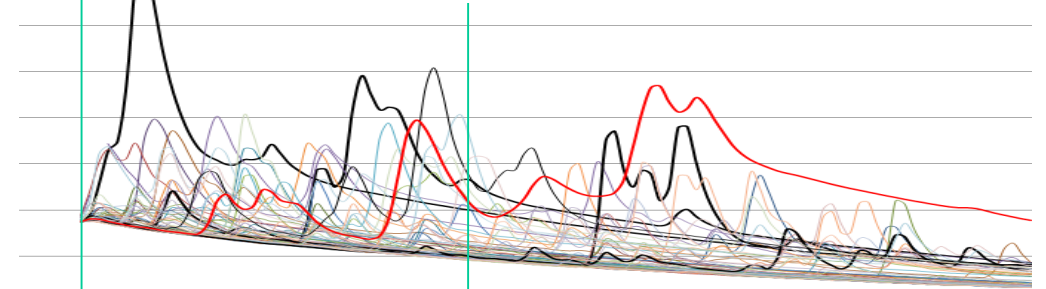
n days of short term weather forecasts can be combined with a given historical weather year.

Previously NWRFC offered 3 flavors of ESP
(**n = 10, 5, 0**)

- ESP10 = NWS Official Water Supply
- ESP 0 = Reference
- ESP 5 previously used to set flood control targets for Columbia River Treaty
 - CRT member agencies have adapted ESP10
 - **ESP5 Removed from NWRFC Product Suite**

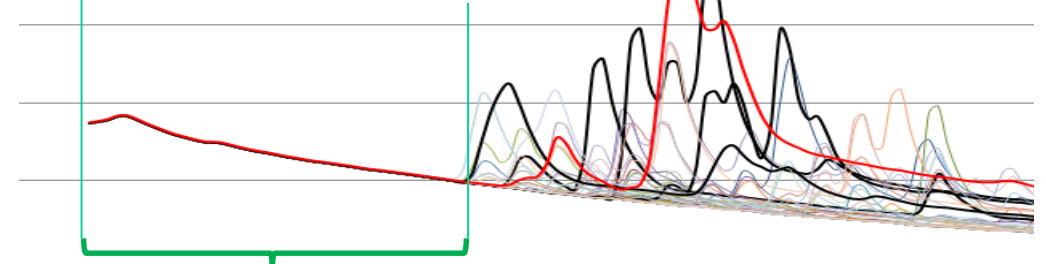
Forecast Weather Forcing Based on Historical Record

ESP 0, $n = 0$



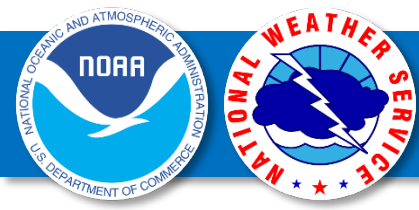
Deterministic Weather Forecast Used for first 10 Days
(Replacing Historical Record for first 10 Days)

ESP 10, $n = 10$



First 10 Days of Run

In this example, 10 day weather forecast is much drier than historical climatology



Rollout of Hydrologic Ensemble Forecast Service

Next Generation ESP = HEFS

Similar to ESP, but with big advantages including a more sophisticated accounting of weather forecast uncertainty

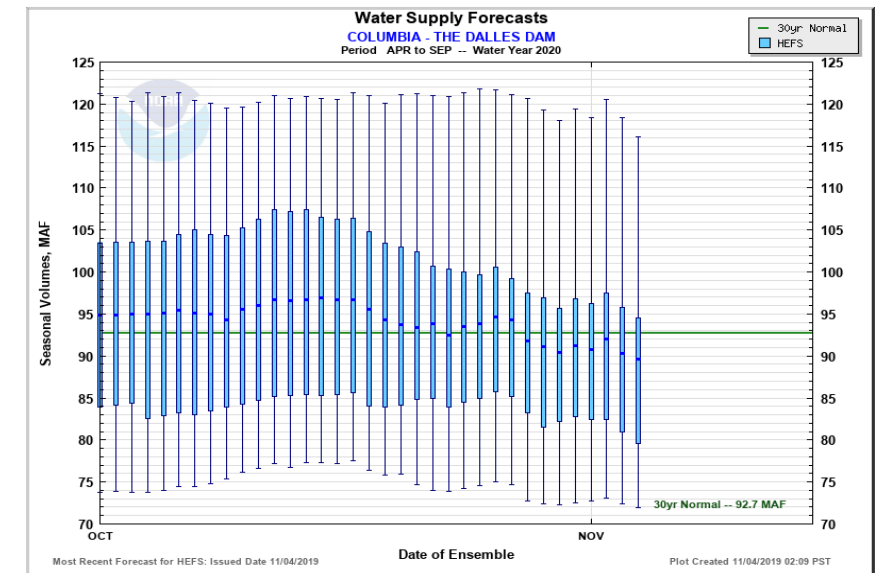
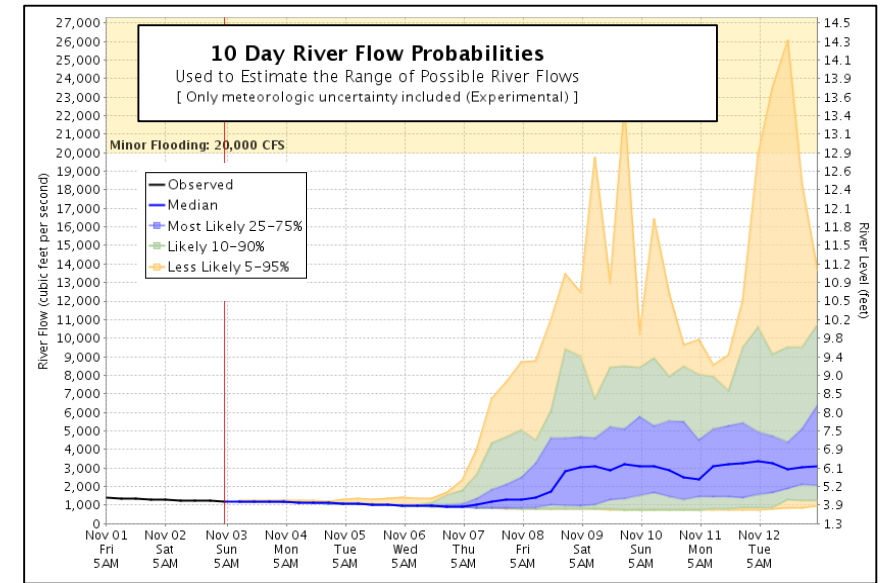
First 15 days of HEFS forced with weather ensembles based on downscaled Global Ensemble Forecast System (GEFS)

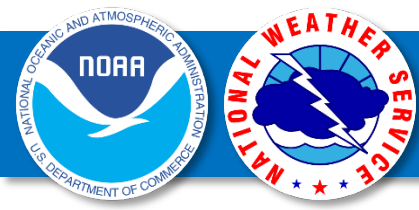
Capabilities (experimental):

- Probabilistic River Forecasts (short-term)
- Monthly and seasonal forecasts

Postured for future enhancements

- Leverages weather model improvements
- Hydrologic Bias Correction
- Climate Forecast Skill





WY2020 Update to ESP Weather Forcing Years

For WY2020:

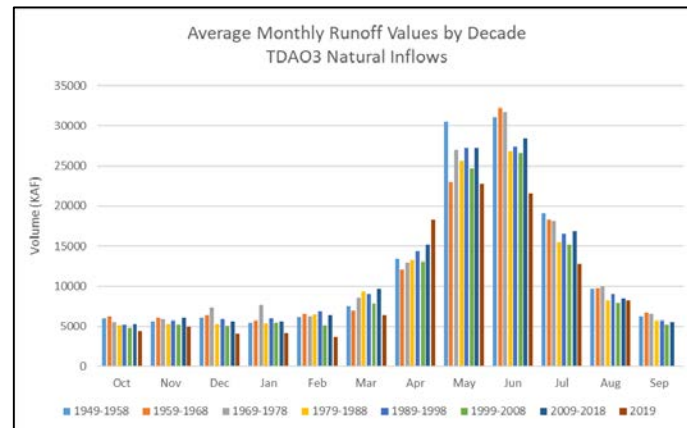
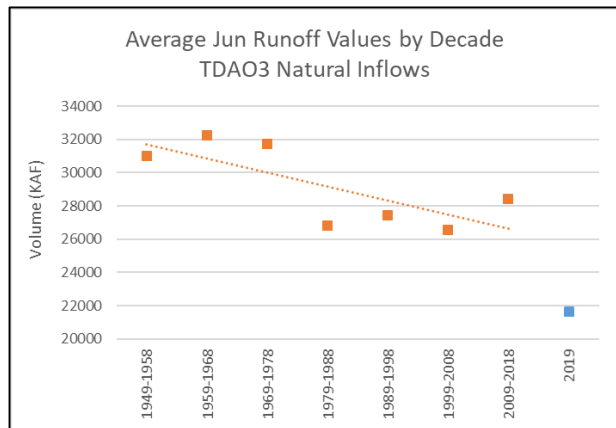
Weather years 1981-2019 used in ESP

Compares favorably to 30yr Normals:

- 1981-2010
- 1991-2020

More accurate representation of:

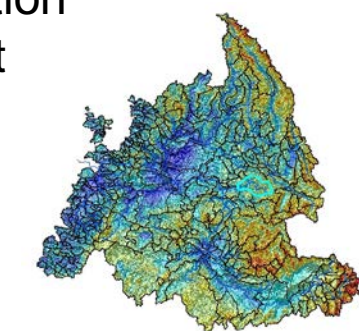
- Current state of climate
- Weather forecast for upcoming year
- Better characterization of spring temperature



Update paves way for NWRFC model recalibration using new high-resolution, gridded weather dataset

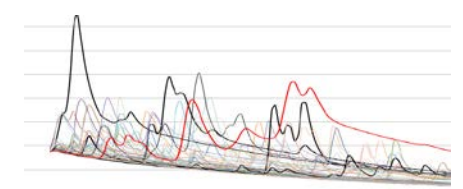
Gridded Weather Forcings

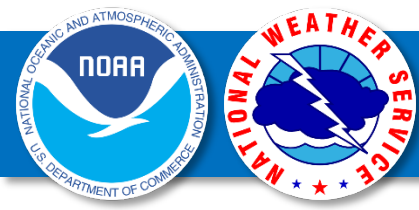
- Hourly time step
- 1 km² resolution
- 1980-present



NWRFC Use:

- Calibration Dataset
- ESP Weather Forcings





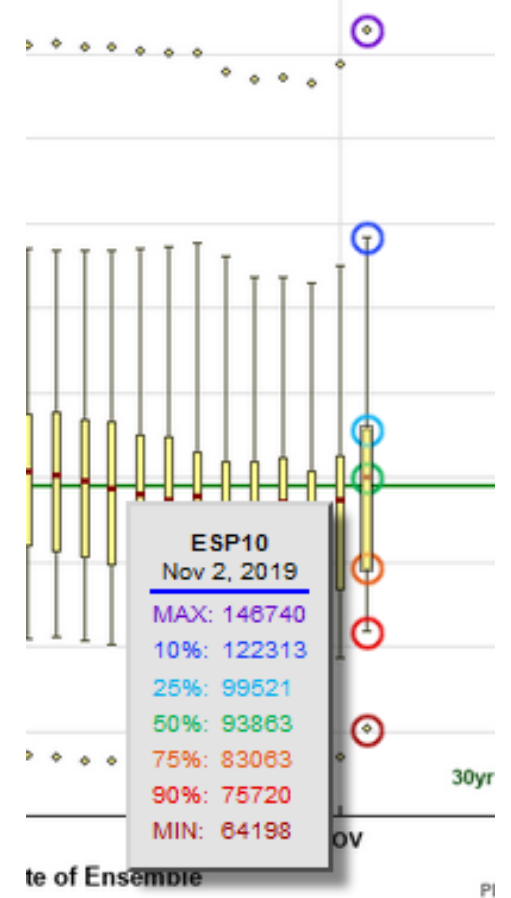
WY2020 Updates to NWRFC Webpage

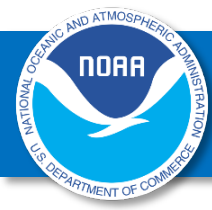
New Water Supply Labels:

- ESP10 = Official Water Supply
- HEFS = Experimental
- ESP0 = Reference

COLUMBIA - THE DALLES DAM (TDAO3) Forecasts for Water Year 2020					
Official Water Supply					
ESP with 10 Days QPF Ensemble: 2019-11-02 Issued: 2019-11-02					
Forecast Period	Forecasts Are in KAF				30 Year Average (1981-2010)
	90 %	50 %	% Average	10 %	
APR-SEP	75720	93863	101	122313	92704
APR-JUL	64091	80491	101	103325	79855
APR-AUG	69957	88138	101	115405	87532
JAN-SEP	94245	114153	100	147943	114216
JAN-JUL	82588	99856	99	129489	101368
OCT-SEP	108252	129361	99	166607	130518
Experimental Water Supply					
HEFS with 15 days EQPF Ensemble: 2019-11-02 Issued: 2019-11-02					
APR-SEP	73117	91999	99	120564	92704
APR-JUL	62775	79833	100	102342	79855
APR-AUG	68776	87272	100	113223	87532
JAN-SEP	89764	113268	99	147224	114216
JAN-JUL	78264	100200	99	128690	101368
OCT-SEP	104607	129823	99	163132	130518
Reference					
ESP with 0 Days QPF Ensemble: 2019-11-02 Issued: 2019-11-02					
APR-SEP	74405	93426	101	120533	92704
APR-JUL	62782	80870	101	102050	79855
APR-AUG	68732	88230	101	112889	87532
JAN-SEP	91642	112280	98	146377	114216
JAN-JUL	79315	100476	99	127894	101368
OCT-SEP	106153	130992	100	162638	130518

Plot Updates


 Show Min/Max Ensemble Volume



WY2020 NWRFC Water Supply Webinar Dates

2020 Schedule for <i>Live Water Supply Briefings</i>					
Jan	Feb	Mar	Apr	May	June
9	6	5	2	7	TBD
<i>All presentations held at 10:00am PDT/PST, unless noted otherwise</i>					

www.nwrfc.noaa.gov/water_supply/ws_schd.cgi

nwrfc.watersupply@noaa.gov



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浪裏

葛飾屋

Thank you!