CBRFC 2023
Stakeholder Meeting

Station C: Water Supply
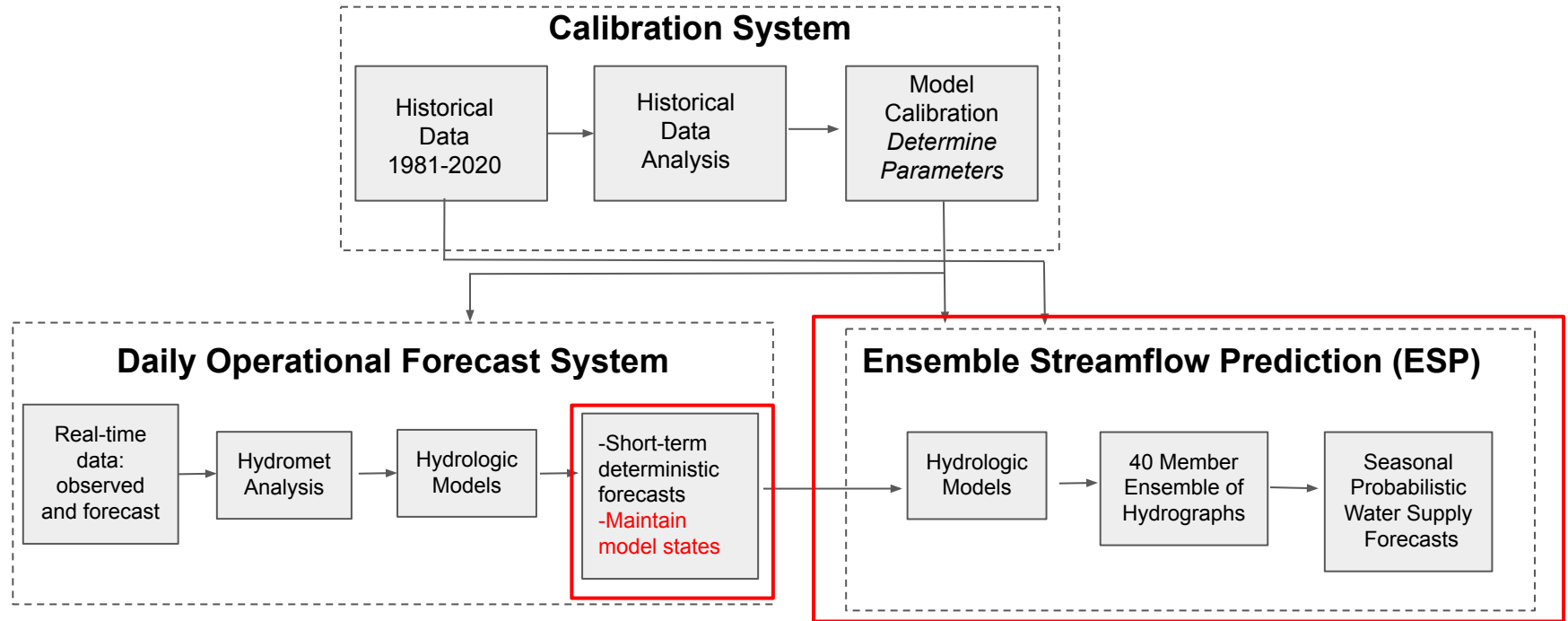
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National Weather Service

Station C - Water Supply
- ESP description/methodology (slides) **(10min)**
    - Basic description
    - Modes
    - Forcings
    - ENSO weighting
- Forecast Process: April 1 Demo **(20 min)**
- Water Supply Products Review **(10 min)**

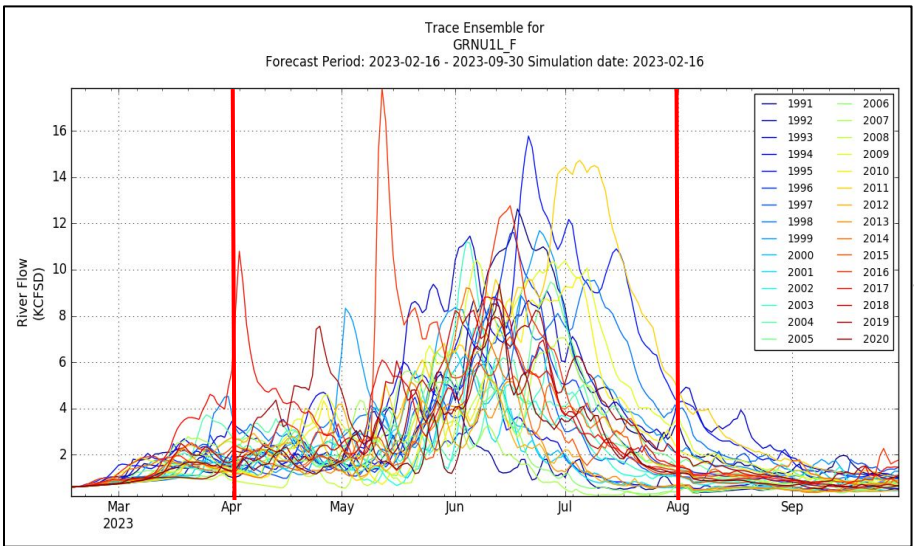# NWS River Forecast System - 3 Interconnected Components

Ensemble Streamflow Prediction (ESP)

- Start with current model conditions of snowpack, soil moisture and simulated flow
  - ***These are the saved model states from the daily operational run***
- Apply precipitation and temperature from each historical year from 1991-2020
  - A forecast hydrograph, or trace, is generated for each of the 30 years
- Results are used to produce probabilistic forecasts
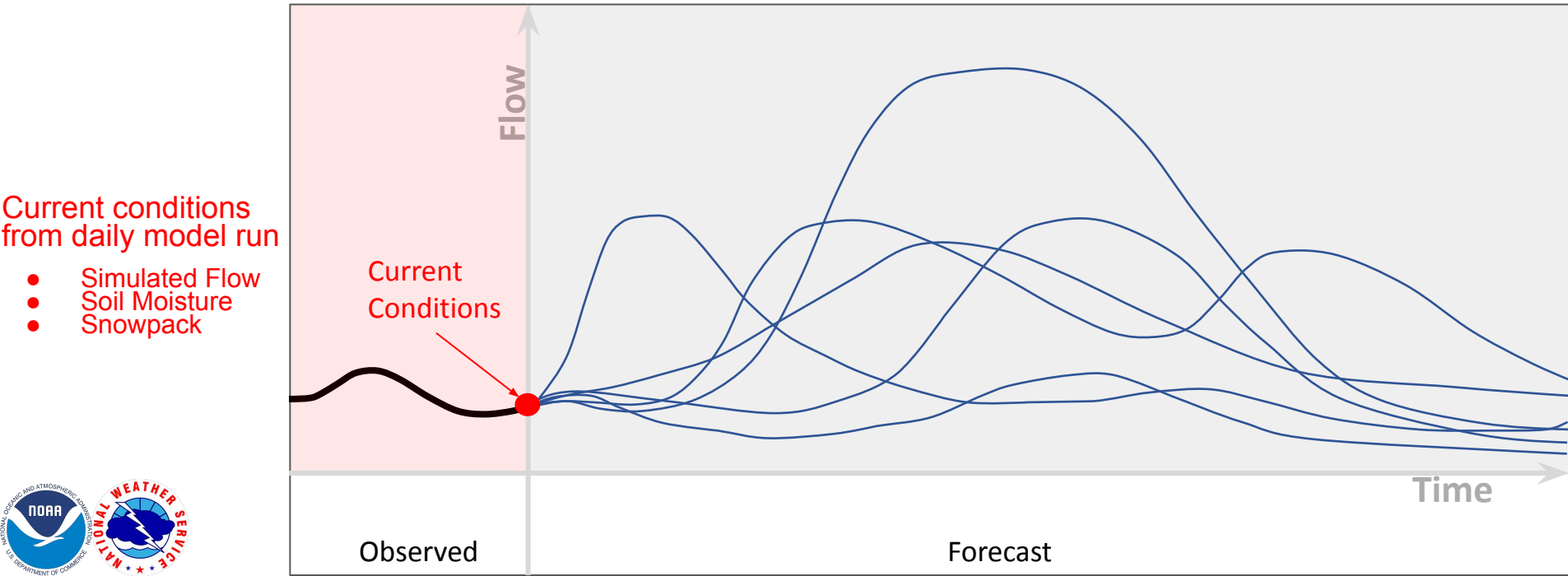
Ensemble Streamflow Prediction (ESP)

Flaming Gorge Reservoir Example

Trace Ensemble for
GRNU1L_F
Forecast Period: 2023-02-16 - 2023-09-30 Simulation date: 2023-02-16

Empirical Sample Points:
Period: 2023-04-01 - 2023-07-31
    UnRegNoQPF

Year	Value
1991	1108.48
1992	486.59
1993	1238.41
1994	731.32
1995	1357.04
1996	878.68
1997	719.86
1998	1167.37
1999	1190.87
2000	584.86
2001	578.90
2002	592.10
2003	787.12
2004	718.48
2005	877.04
2006	521.13
2007	511.28
2008	650.34
2009	1307.32
2010	961.59
2011	1561.96
2012	560.71
2013	535.88
2014	780.20
2015	685.27
2016	1243.03
2017	1070.08
2018	919.88
2019	1090.43
2020	673.68

Chances of Exceeding Volume KAF for
GRNU1L_F
Forecast Period: 2023-04-01 - 2023-07-31
Simulation date: 2023-02-16

Period: 2023-04-01 - 2023-07-31
    UnRegNoQPF

Pct	Value
90%	522.61
80%	580.09
70%	657.34
60%	719.03
50%	783.66
40%	903.40
30%	1084.32
20%	1186.17
10%	1300.89

Green - Flaming Gorge Reservoir (GRNU1)
Period: Apr-Jul, Official 50% Forecast (2023-02-15): 830 kaf (86% Average)
ESP is Unregulated and No Precipitation Forecast Included

1. The flows are summed into volumes for the period of interest (typically April 1 – July 31)
2. Exceedance values are calculated
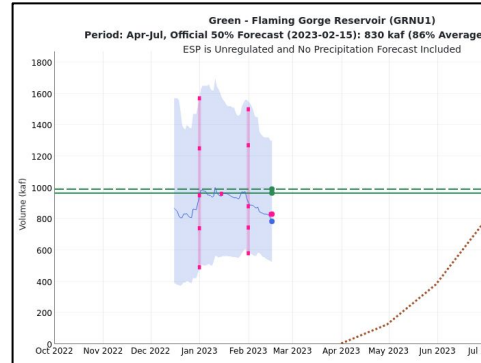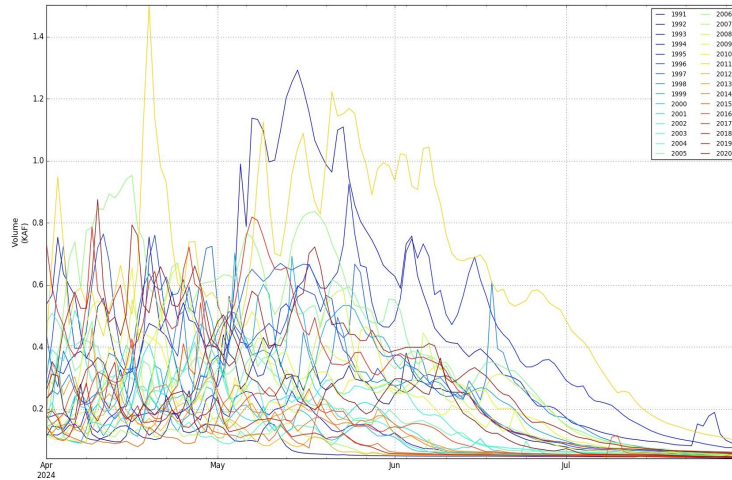3. These are the basis for the official probabilistic forecasts

Ensemble Streamflow Prediction (ESP): Modes

Unregulated Mode

- Reservoirs ignored
- Measured diversions set to zero
- Unmeasured depletions still removed
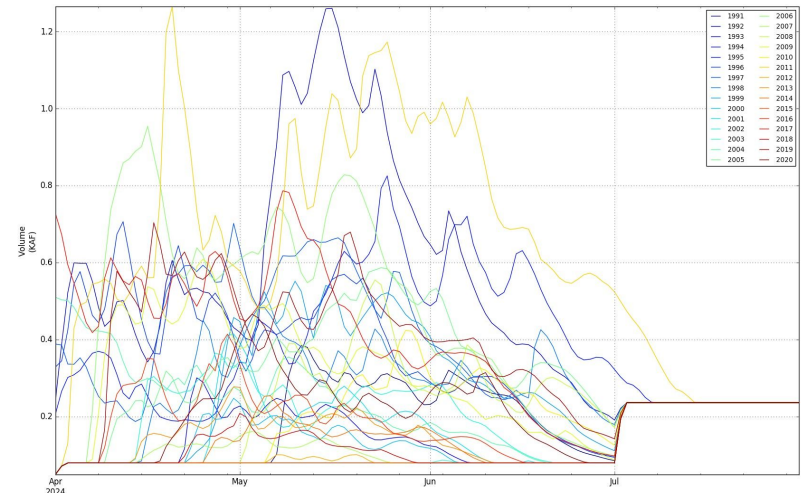- **Used for Water Supply volume forecasts**

Regulated Mode

- Reservoirs use rules defined in model
  - Releases set based on time of year or elevation of reservoir.
  - Spill, pass flow
- Diversions use historical data
- Unmeasured depletions still removed
- **Used mostly for Peak Flow forecasts**

East Canyon Reservoir Outflow

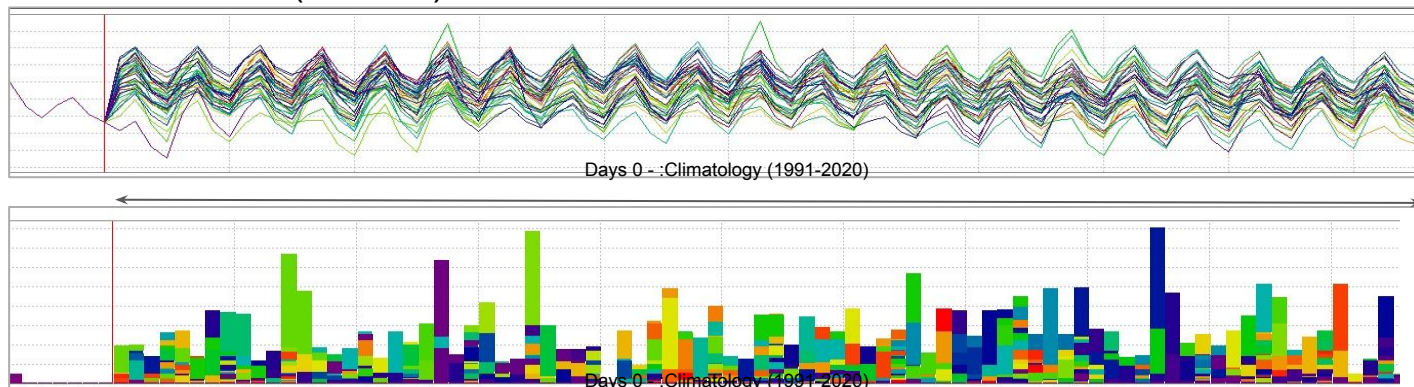
East Canyon Reservoir Outflow

Ensemble Streamflow Prediction (ESP): Forcing Options

Option #1: Forecast Precipitation and Temperature (w/QPF*) then historical data
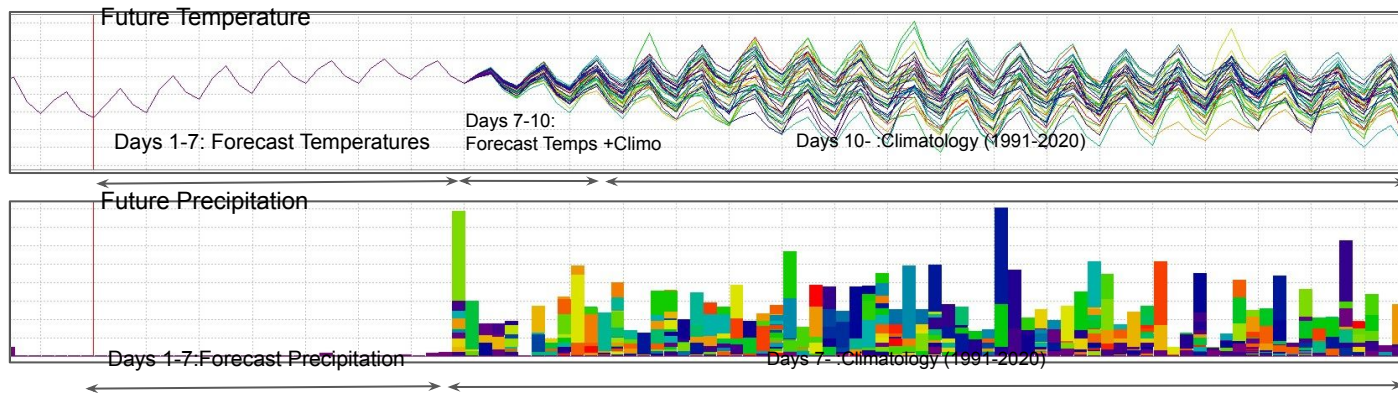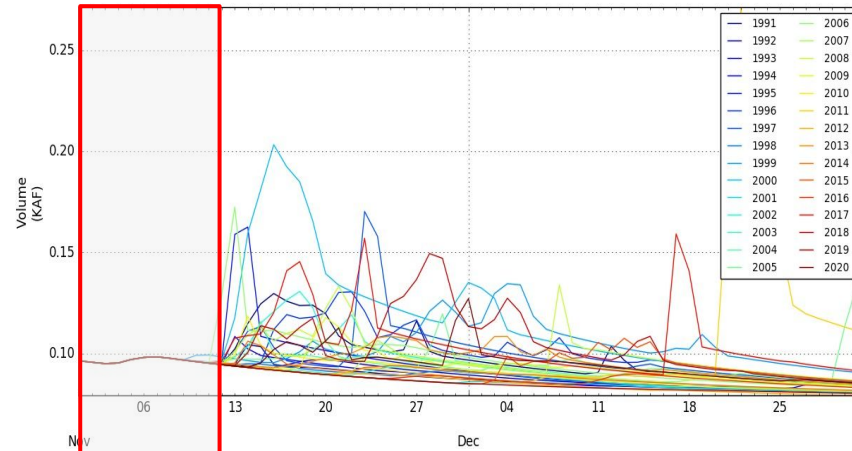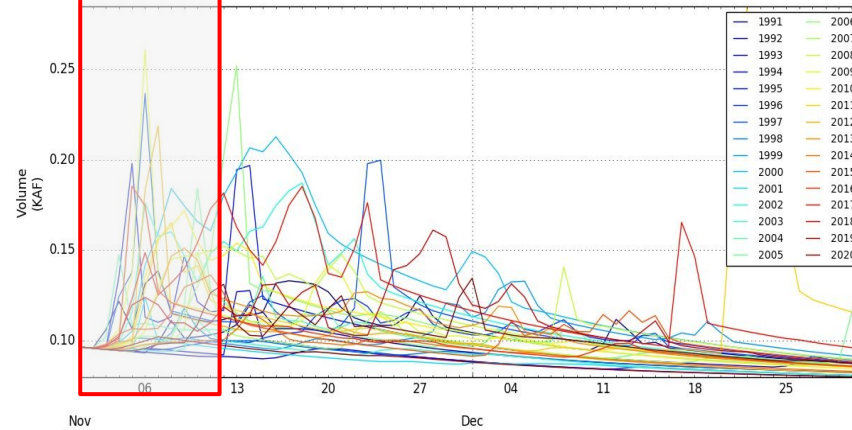

Option #2: Historical Data (no/QPF)

*QPF=Quantitative Precipitation Forecast

Ensemble Streamflow Prediction (ESP): Forcing Options

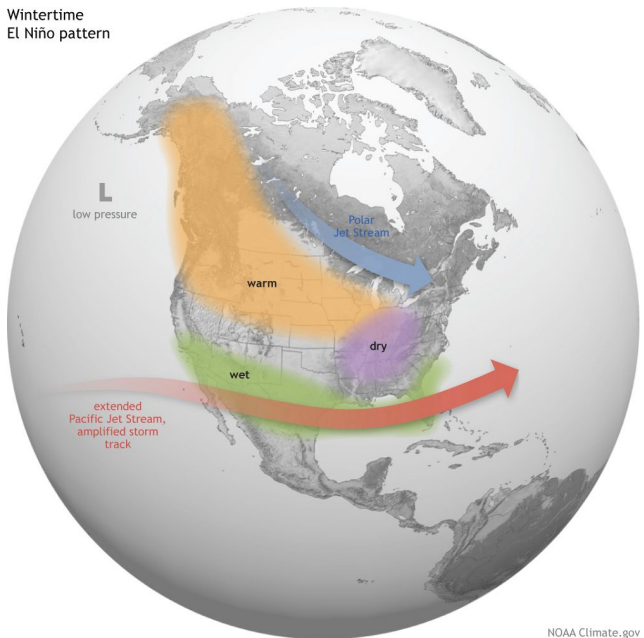Option #1: Forecast Precipitation and Temperature (w/QPF) ⟶ 30 Forecast Hydrographs

Option #2: NoQPF

ENSO Weighting: Lower Basin


Wintertime El Niño pattern

1981	0	0
1982	0	0
1983	0	0
1984	0	0
1985	0	0
1986	0	0
1987	0	0
1988	0	0
1989	1	1
1990	0	0
1991	0	0
1992	0	0
1993	0	0
1994	0	0
1995	0	0
1996	1	1
1997	0	0
1998	0	0
1999	1	1
2000	1	1
2001	1	1
2002	1	1
2003	0	0
2004	0	0
2005	0	0
2006	1	1
2007	0	0
2008	1	1
2009	1	1
2010	0	0
2011	0	0
2012	1	1
2013	0	0
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	1	1
2019	0	0
2020	0	0

- **Lower Basin**

- **Based on Fall ENSO indices**

- **Analogous years identified (nearest neighbors method)**

11 Nearest Years

Salt - Roosevelt, Nr (SLRA3)
Period: Jan-May, Observed Volume: 43.1 kaf (11% Average, 17% Median)
ESP is Unregulated and No Precipitation Forecast Included
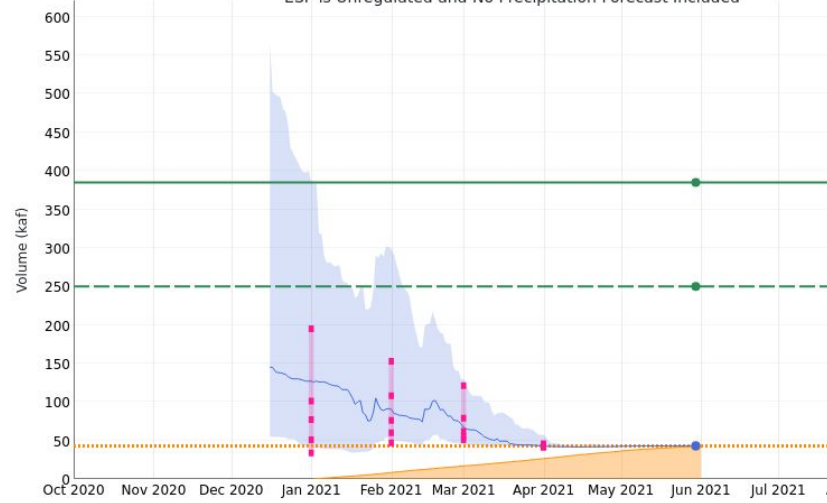
	Jan 1, 2021 Forecast	**2021 Observed Value**
Raw ESP	127	43.1
ENSO Weighted Forecast	77	43.1