SESSION H35L-1279

Using hydrologic forecasts from the Hydrologic Ensemble Forecast Service (HEFS) for forecast informed reservoir operations (FIRO)

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Example 1: Develop ensemble forecast operations (EFO) to improve reservoir storage reliability without increasing downstream flood risk (Coyote Valley Dam, Lake Mendocino, California; Delaney et al., 2020)

Fig 4. Coyote Valley Dam in Lake Mendocino, Upper Russian river basin, CA. Lake Mendocino has a drainage area of 105 mi² and a total capacity of 111 thousands of acre-feet (taf). Flood control by USACE and Water supply by Sonoma water

February 8, 1986 Forecast

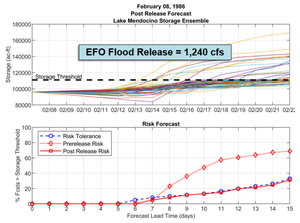

Fig 5. EFO forecasted storage for February 8,1986 (top) and the risk forecast

Lake Mendocino Storage

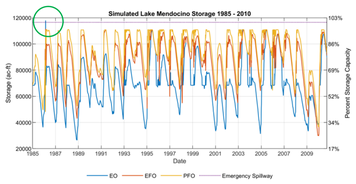

Fig 6. Lake Mendocino simulated daily storage levels for 1985 to 2010 where EO, and PFO denote existing operations and perfect forecast operations, respectively; PFO uses actual flows in place of using flow ensembles

Example 2: Demonstrate forecast quality via hindcasting (Folsom reservoir, American River, CNRFC; Whitin, 2020)

Fig 7. Folsom reservoir, American river basin, CA has a drainage area of 1875 mi² and a total capacity of 976 taf.

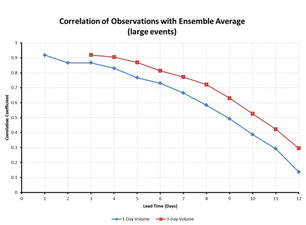

Fig 8. Correlation of observations with ensemble average as a function of lead time

FOLSOM 3-DAY AVERAGE FLOW
(MEAN ENSEMBLE FORECAST VS. OBSERVED)

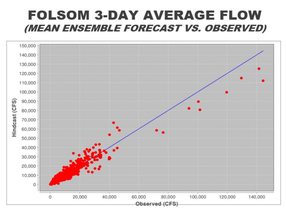

Fig 9. Scatter plot of mean ensemble forecasts and observations

HEFS can support drinking water supply and flood forecasts, affecting millions of lives

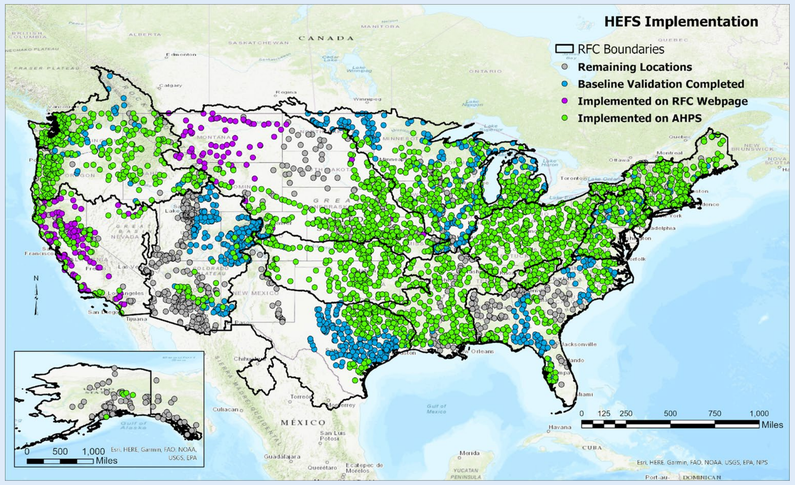

Fig 1. HEFS validation and implementation locations (as of 31 Oct, 2022) where 3061 locations have been validated and 2122 locations are displayed on the Advanced Hydrologic Prediction Service (AHPS)

- National Weather Service's (NWS) Office of Water Prediction (OWP) and River Forecast Centers (RFCs) are expanding coverage of the Hydrologic Ensemble Forecast Service (HEFS) across the US, supported by validation, to all streamflow locations on the AHPS (https://water.weather.gov/ahps/).

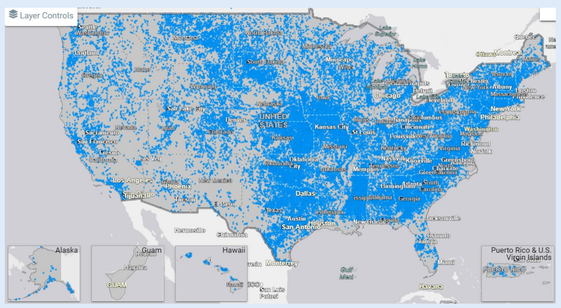

Fig. 2. 91784 dams in the US (source: https://nid.sec.usace.army.mil/#/)

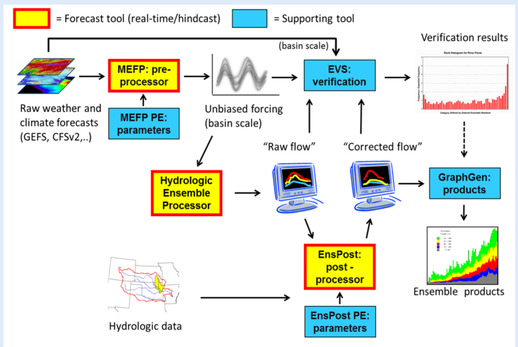

Fig 3. HEFS modeling, calibration, validation, and visualization components (Demargne et al., 2014), including meteorological Ensemble Forecast Processor (MEFP), Ensemble Post-Processor (EnsPost), MEFP parameter estimator (MEFP PE) and EnsPost PE, Ensemble Verification System (EVS; Brown et al., 2008), and Graphics Generator (GraphGen)

Example 3: Test alternative operations to support Delaware Aqueduct outage (NYCDEP Bureau of Water Supply)

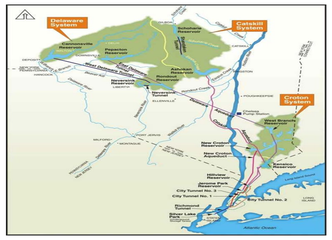

Fig 10. NYC water supply system has 19 reservoirs with ~2000 mi² drainage area. 1.1 billions of gallons (BG) of water to 9.8 million New Yorkers. 570 BG storage capacity managed by NYCDEP

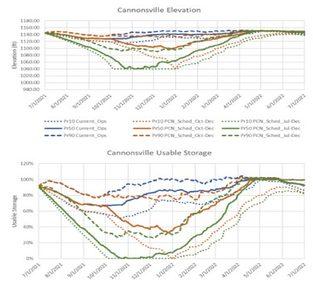

Fig 11. Cannonsville elevation (top) and usable storage (bottom) where blue, brown and green lines represent current operations, Oct-Dec drawdown, and Jul-Dec drawdown, respectively

Reservoir Name	Jun 1st Probability of Refill (Ave Trace Max May 15th – Jun 15th)		
	Current Ops	PCN Scheduled Oct-Dec	PCN Scheduled Jul-Dec
Pepacton	91.9	74.9	63.9
Cannonsville	95.3	71.4	65.4
Neversink	95.3	76.7	70.2

Table 1. June 1st probability of refill by 3 alternative operations where PCN stands for Pepacton, Cannonsville, Neversink.

Example 4: Support RFC operations to deliver clean water to New York City (Ashokan reservoir, NY, NERFC)

Fig 12. Ashokan reservoir. Esopus Creek at Cold Brook (MTRN6HUD; 192 mi²) provides inflows to the reservoir.

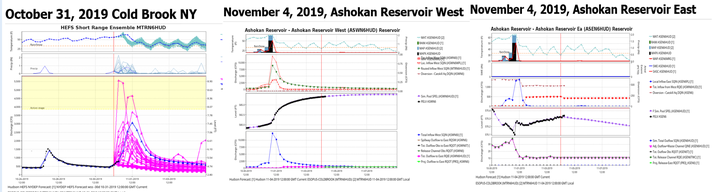

Fig 13. (a) HEFS forecasts at MTRN6HUD on Oct 31, 2019, (b) Discharge and water level at Ashokan reservoir west, and (c) and at Ashokan reservoir east

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