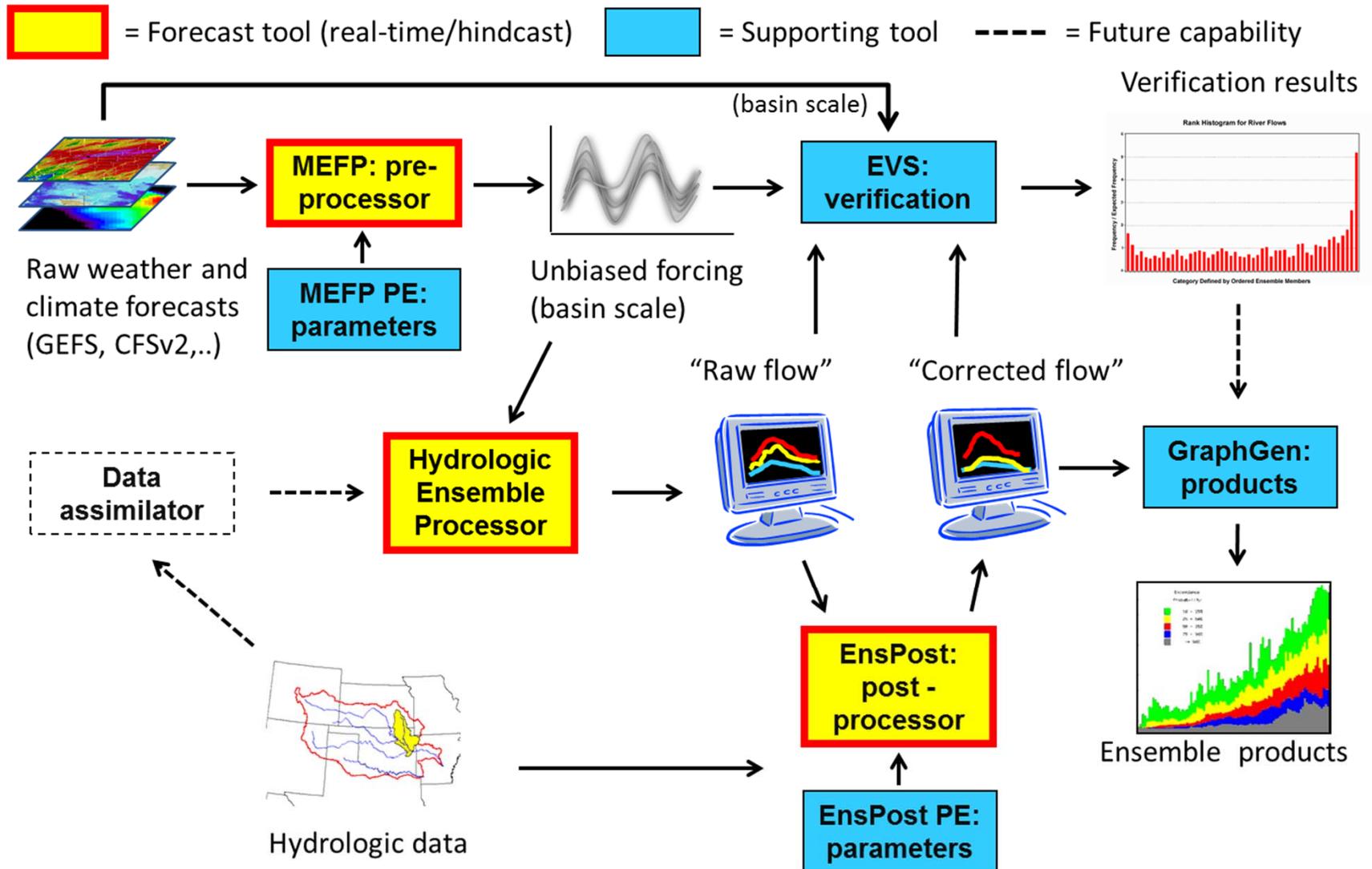# Hydrologic Ensemble Forecast Service (HEFS)
The 6th NCEP Ensemble User Workshop

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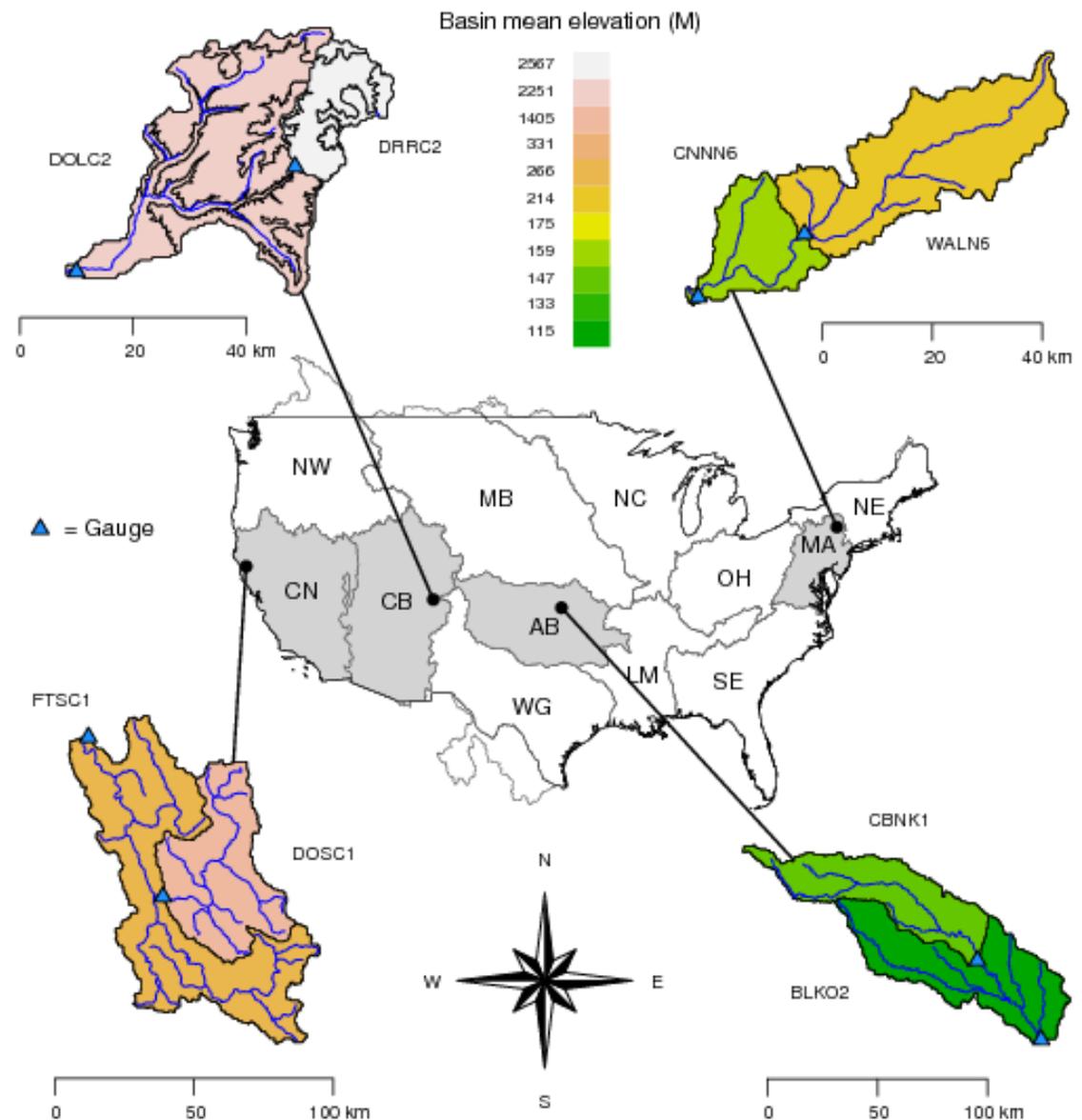# HEFS Components

Streamflow hindcasting with HEFS
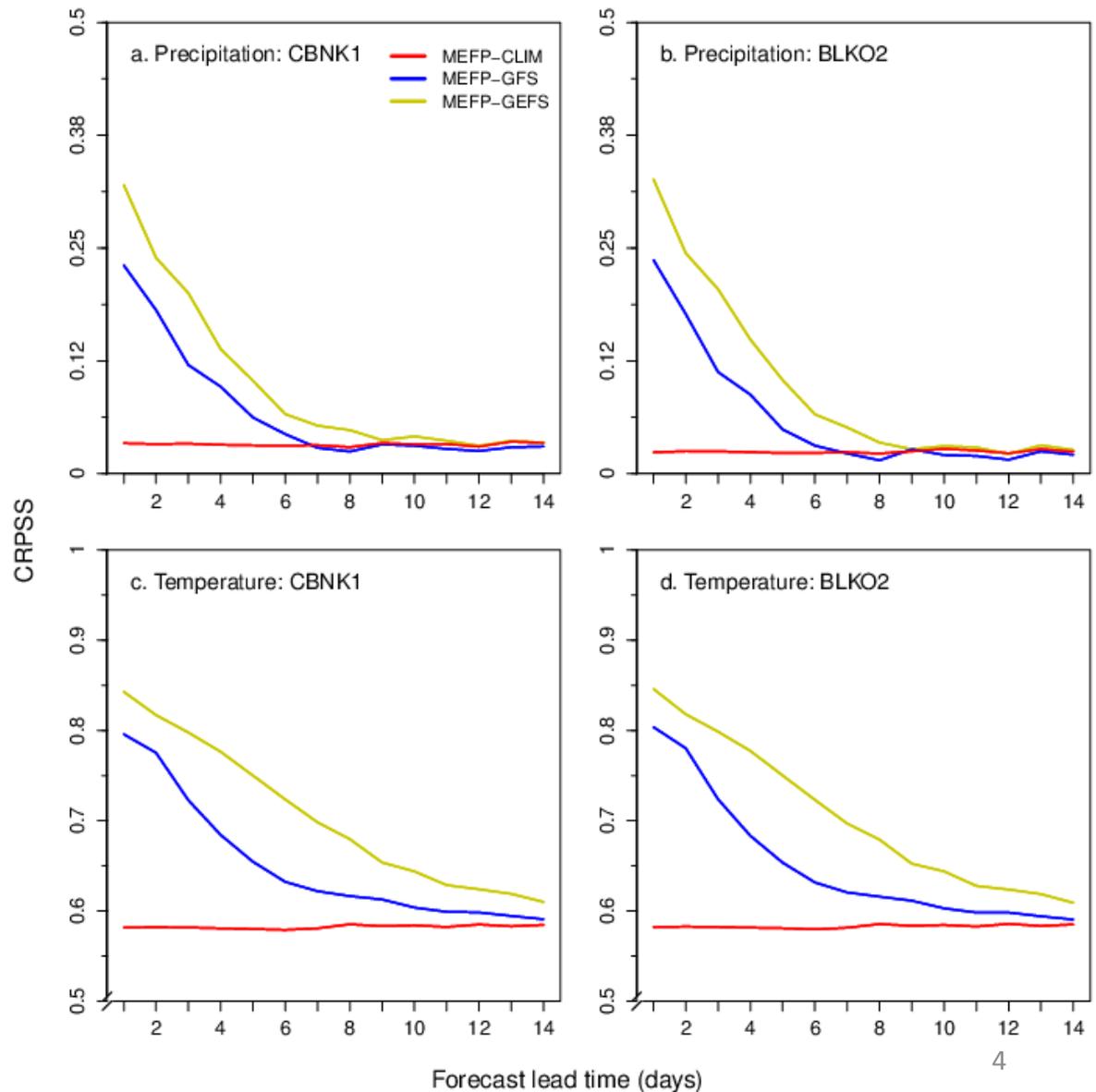
Selected basins

- Four RFCs

- Hindcasts: 1985-1999 (limited by obs. data)

- Upper/lower pairing

- USGS gauge at the outlet of each basin

- Relatively small basins (largest 2000 sq. miles)

- Lower elevations in AB and MA

- Higher elevations in CB and CN

- CB and CN have MAT/MAP sub-basins

Forcing: MEFP-GEFS vs. MEFP-GFS

MEFP-GEFS adds value

- Compared forcing from MEFP-GEFS vs. MEFP-GFS

- Skill (CRPSS) from two basins in ABRFC, precipitation (top) and temperature (bottom)

- Sample climatology as baseline (unconditional) with MEFP conditional climatology also shown (red)

- Raw GEFS improves substantially on GFS and this is reflected in MEFP-GEFS results shown here

- Improvements particularly noticeable in first week for P, longer for T

a. Precipitation: CBNK1 — MEFP–CLIM, MEFP–GFS, MEFP–GEFS

b. Precipitation: BLKO2

c. Temperature: CBNK1

d. Temperature: BLKO2

CRPSS

Forecast lead time (days)

Streamflow: MEFP-GEFS vs. MEFP-GFS

Value also added to flow

- Streamflow skill shown for lower and upper basin in each RFC with MEFP-CLIM baseline

- Results include hydrologic bias-correction

- Skill from hydro. initial conditions dominates early lead times

- GEFS consistently beats GFS once forcing washes through, but hydro. uncertainty is also key

- **On time horizon of ~4-10 days, GEFS adds ~1-2 days in lead time in terms of CRPSS, notwithstanding sampling uncertainty**
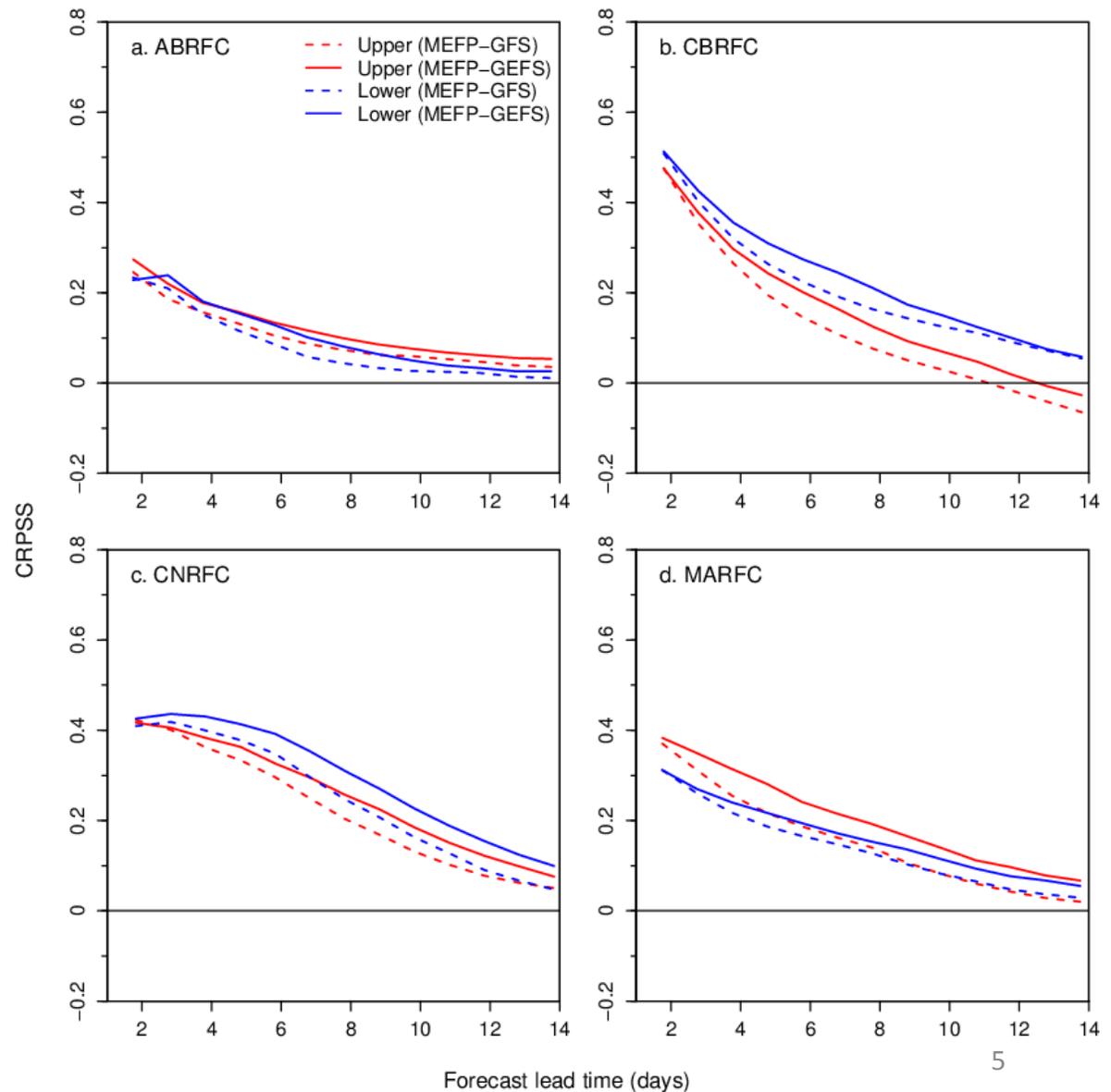
Hydrologic Ensemble Forecast System

Use of Reforecasts

- Implementation and rollout of the Hydrologic Ensemble Forecast System (HEFS) at 13 RFCs (in 2014)
    - 5 RFCs already have partial coverage
    - Calibration of the meteorological component of HEFS, the Meteorological Ensemble Forecast Processor (MEFP)
    - System evaluation through streamflow hindcasting and verification
- Collaboration with other agencies who need HEFS hindcasts, supported by meteorological reforecasts, for high priority operational objectives
    - Example: NYCDEP requires HEFS hindcasts to calibrate and evaluate a decision support tool used to improve water supply to New York City

Hydrologic Ensemble Forecast System

Requirements of GEFS

- Reforecasts - Long period of record to support reliable calibration with reasonably small sampling uncertainty
  - As long as possible, but at least 20 years, every day
  - Including high impact events in the reforecast period is very important
  - Reforecasts currently available 1985-2010
- Operational models to be frozen for a period of several years to allow for downstream applications to transition to new models/reforecast data sets
  - It is time-consuming to re-calibrate and re-evaluate the HEFS with new met models

References

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