Ensemble Post-Processor Update

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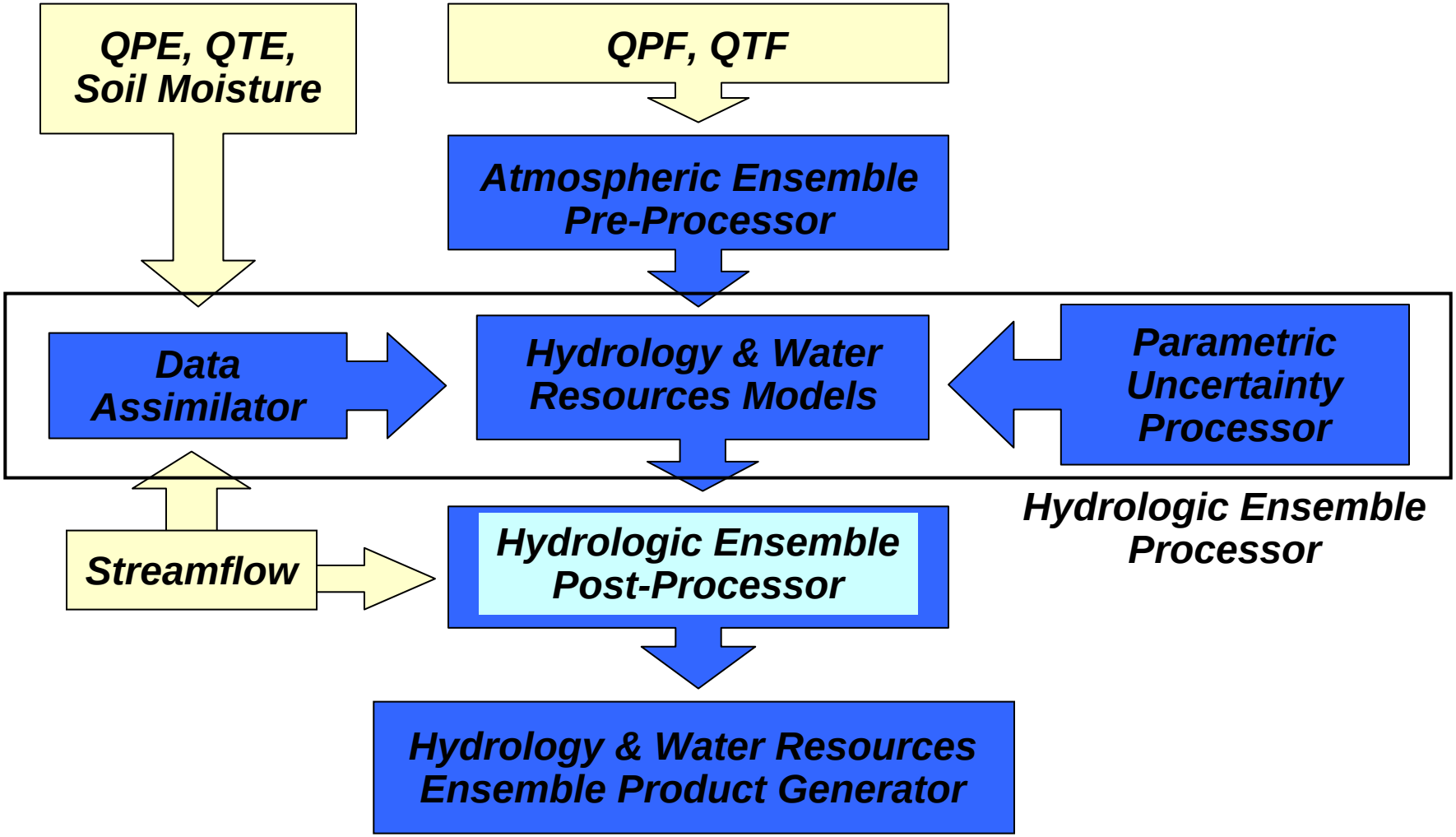
Elements of a Hydrologic Ensemble Prediction System



FY06 Activities

- None
- Fix[1], performance evaluation[2] and enhancement of the current post-processor (Seo et al. 2006, available at http://www.copernicus.org/EGU/hess/hessd/3/1987/hessd-3-1987.htm) were proposed, but not funded

[1]Resolve discrepancy in calibration results between the research version and the operational version

[2]Under idealized MOD conditions

FY07 Activities

- AHPS funding expected
  - Adjust Q capability
  - Improved bias and uncertainty correction
  - Operation at sub-daily time steps (6-hrly)
  - Disaggregation of daily to 6-hrly flows
  - Assessment of sample size requirement (number of ensemble members needed)
  - *Explore statistical modeling of reservoir/regulations via post processor-like tools*

Methodology

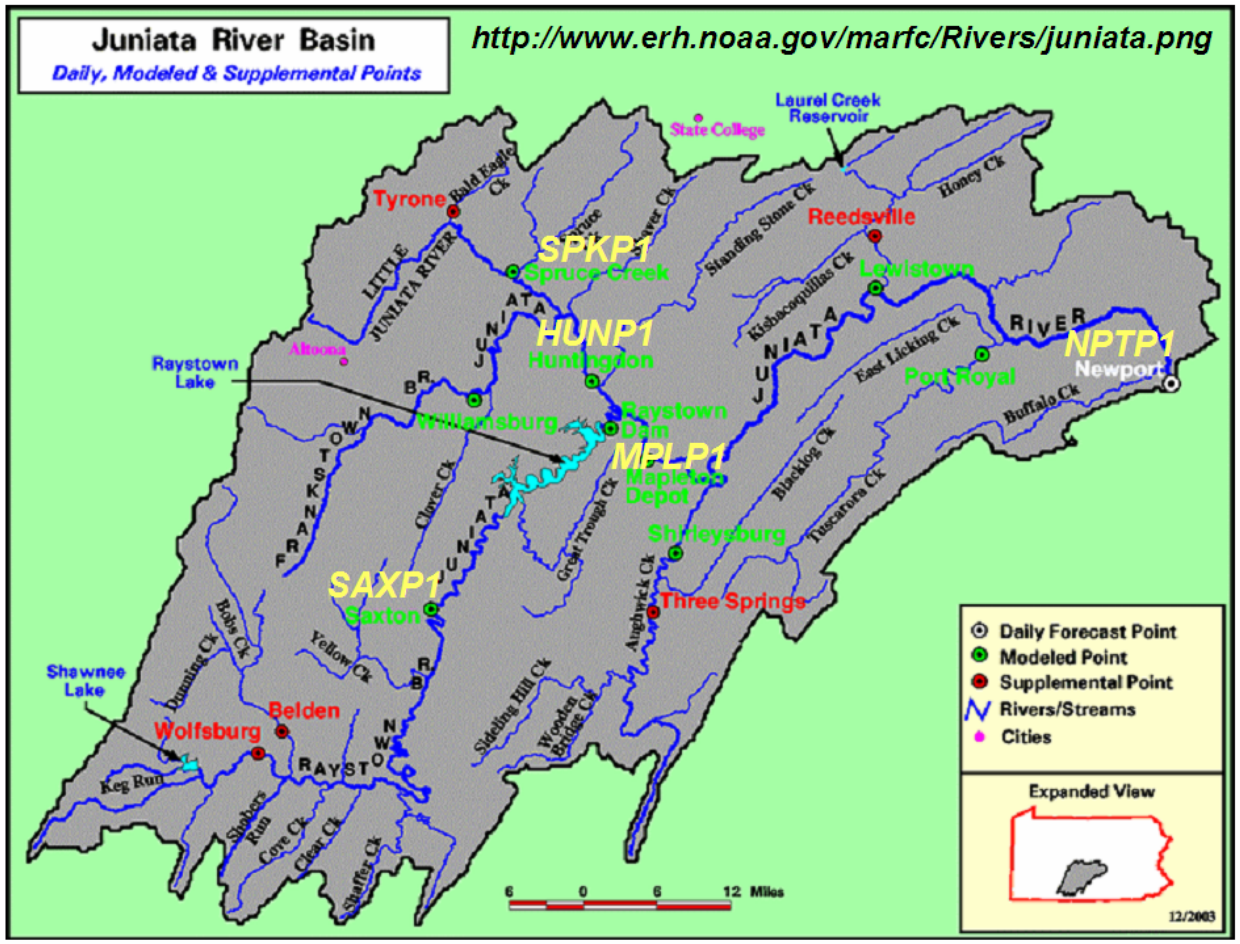
- Recursive linear regression in the normal space
  - Normal transformation is based on normal quantile transformation (NQT) of observed and model-simulated flows (daily)
- $Z^{obs}_{K} = (1-b)\, Z^{obs}_{K-1} + b\, Z^{sim}_{K} + \varepsilon$
  - b, and mean and variance of ε are flow range- (low and high) and seasonality-dependent parameters

Methodology (cont.)

- Deterministic - Bias correction only
  - *Error Model 1*
    - Calculates conditional mean of Q^{obs}_{K} given Q^{obs}_{K-L} and Q^{sim}_{K}
  - *Error Model 0*
    - Performs probability-matching (equivalent to Error Model 1 under b=1,ε=0)
- Stochastic - Bias correction and uncertainty accounting
  - *Error Model 2*
    - Generates ensembles via conditional simulation of Q^{obs}_{K} given Q^{obs}_{K-L} and Q^{sim}_{K}

Examples – MARFC/Juniata

The following 5 slides are excerpted from
http://www.copernicus.org/EGU/hess/hessd/3/1987/hessd-3-1987.htm



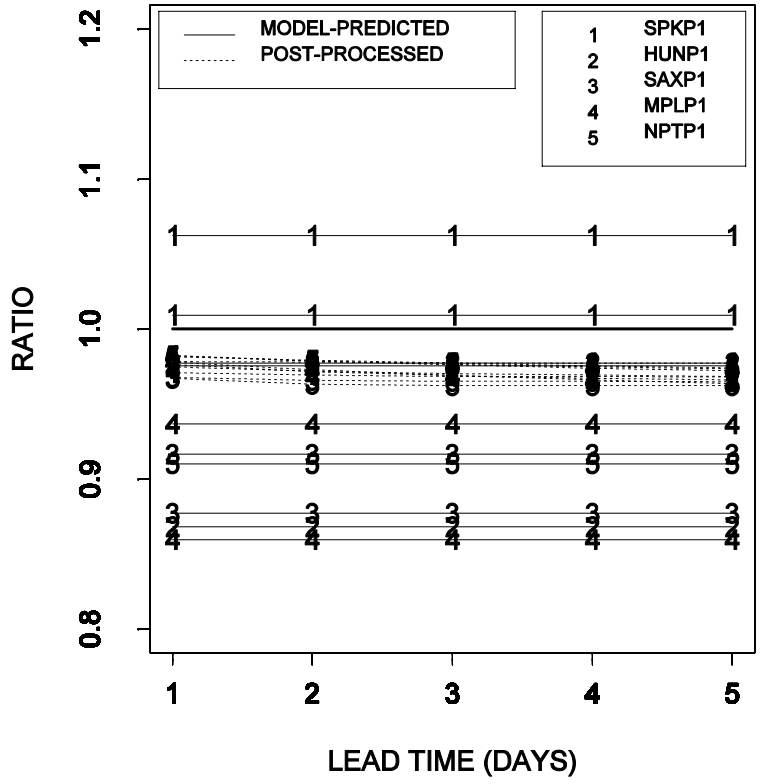


Fig 4. Ratio of the sum of the observed flow to that of the model-predicted (in solid line) or the post-processed (in dotted line) in the parameter estimation period versus lead time (days).

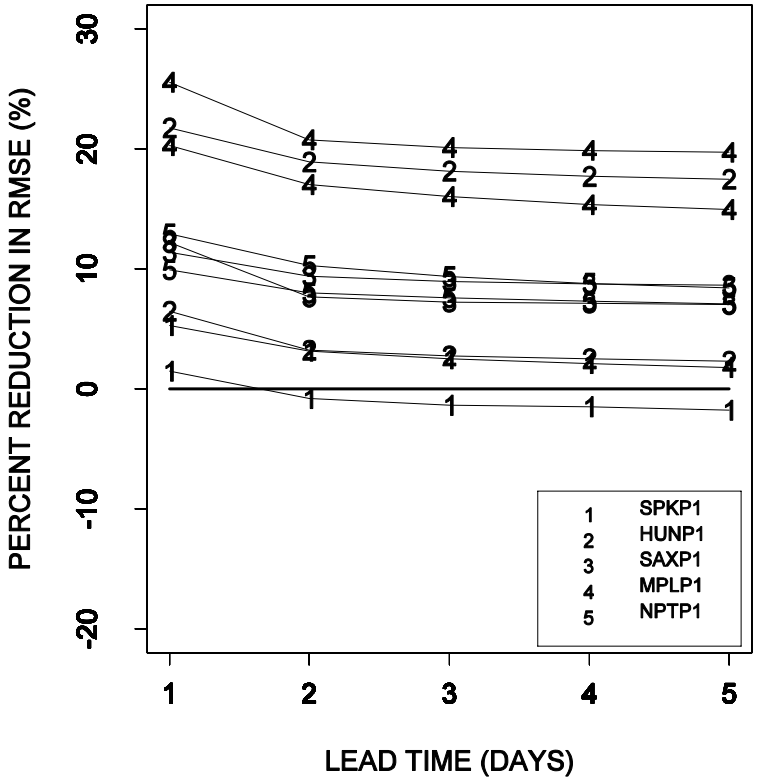


Fig 5. Percent reduction in root mean square error (RMSE) by the post-processed flow over the model-predicted in the parameter estimation periods versus lead time (days).

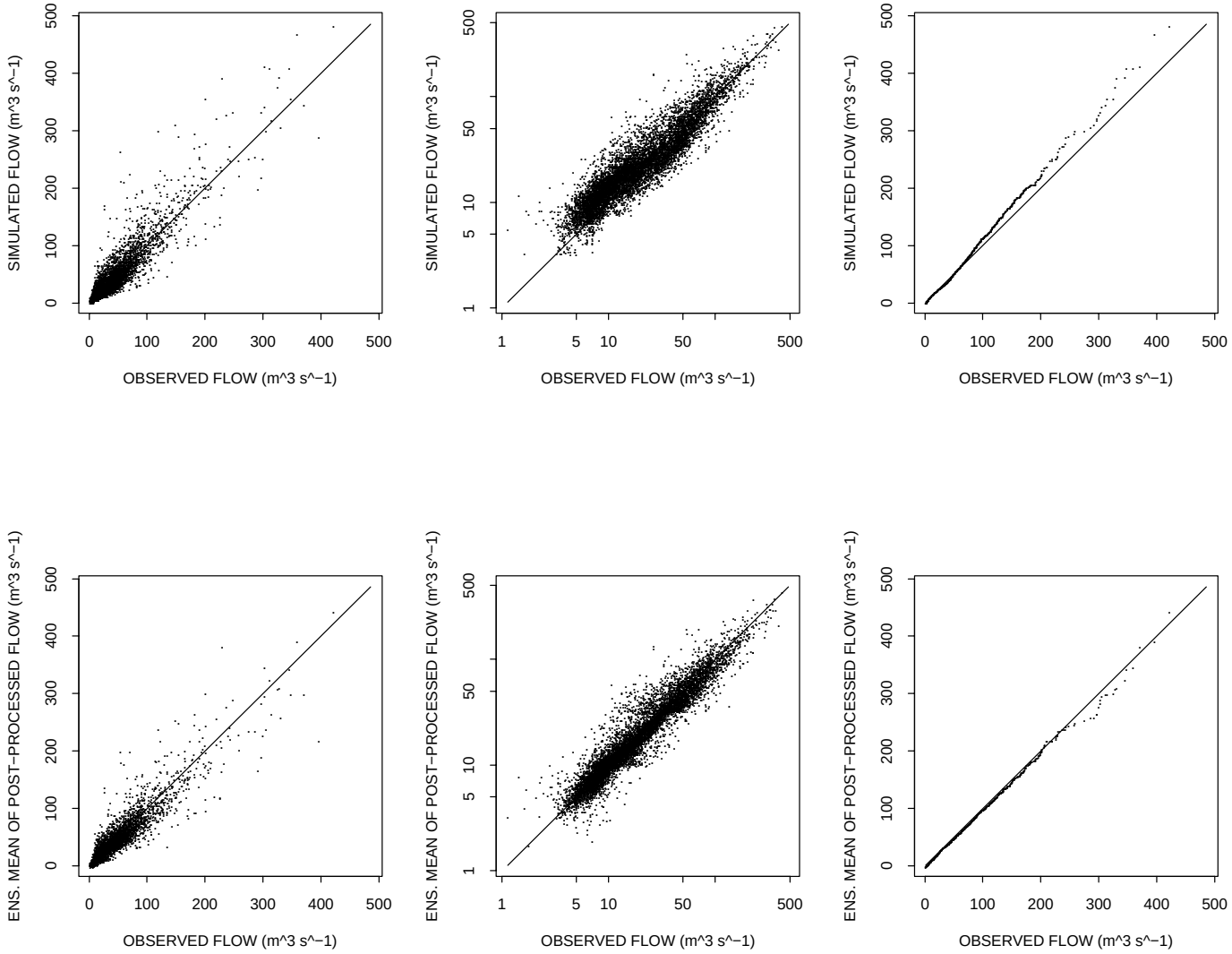


Fig 6. Scatter-plots in linear scale (left panels) and in log scale (middle panels), and quantile-quantile plots (right panels) of daily flow between the observed and the model-simulated flows (upper panels) and between the observed and the post-processed flows (lower panels) at HUNP1 for a parameter estimation period. The lead time is 1 day.

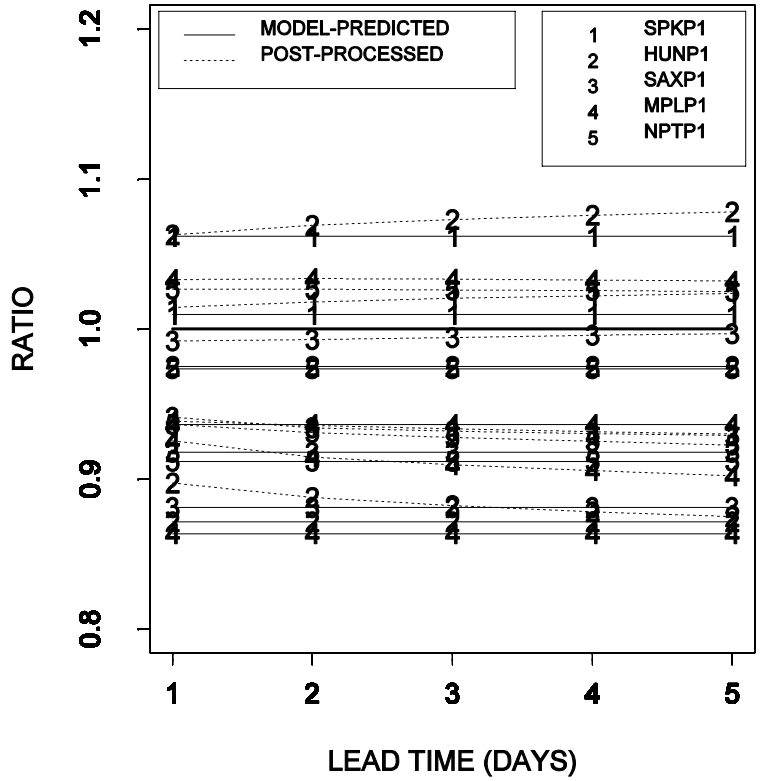


Fig 7. Same as Fig 4, but for the validation periods.

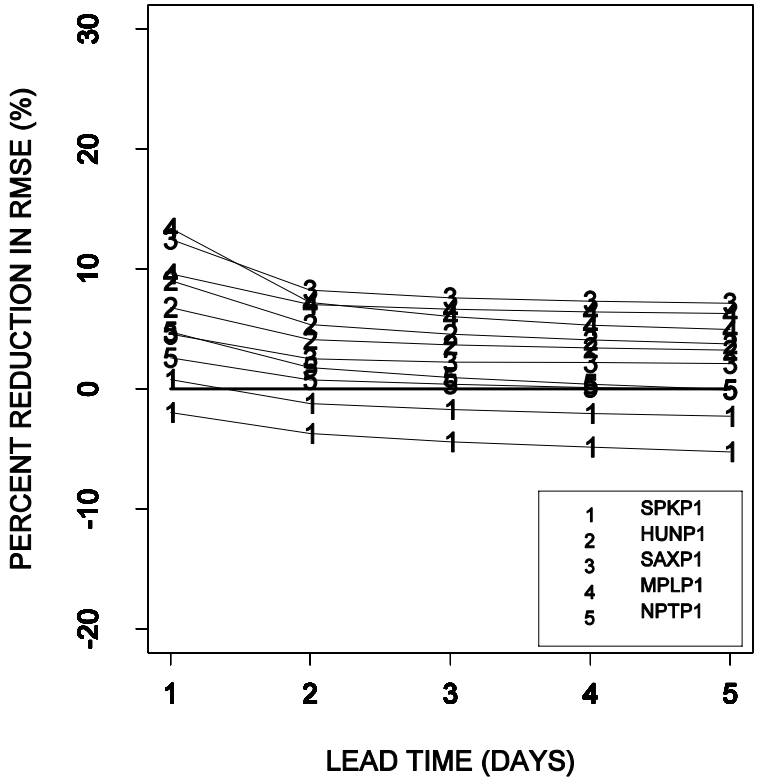
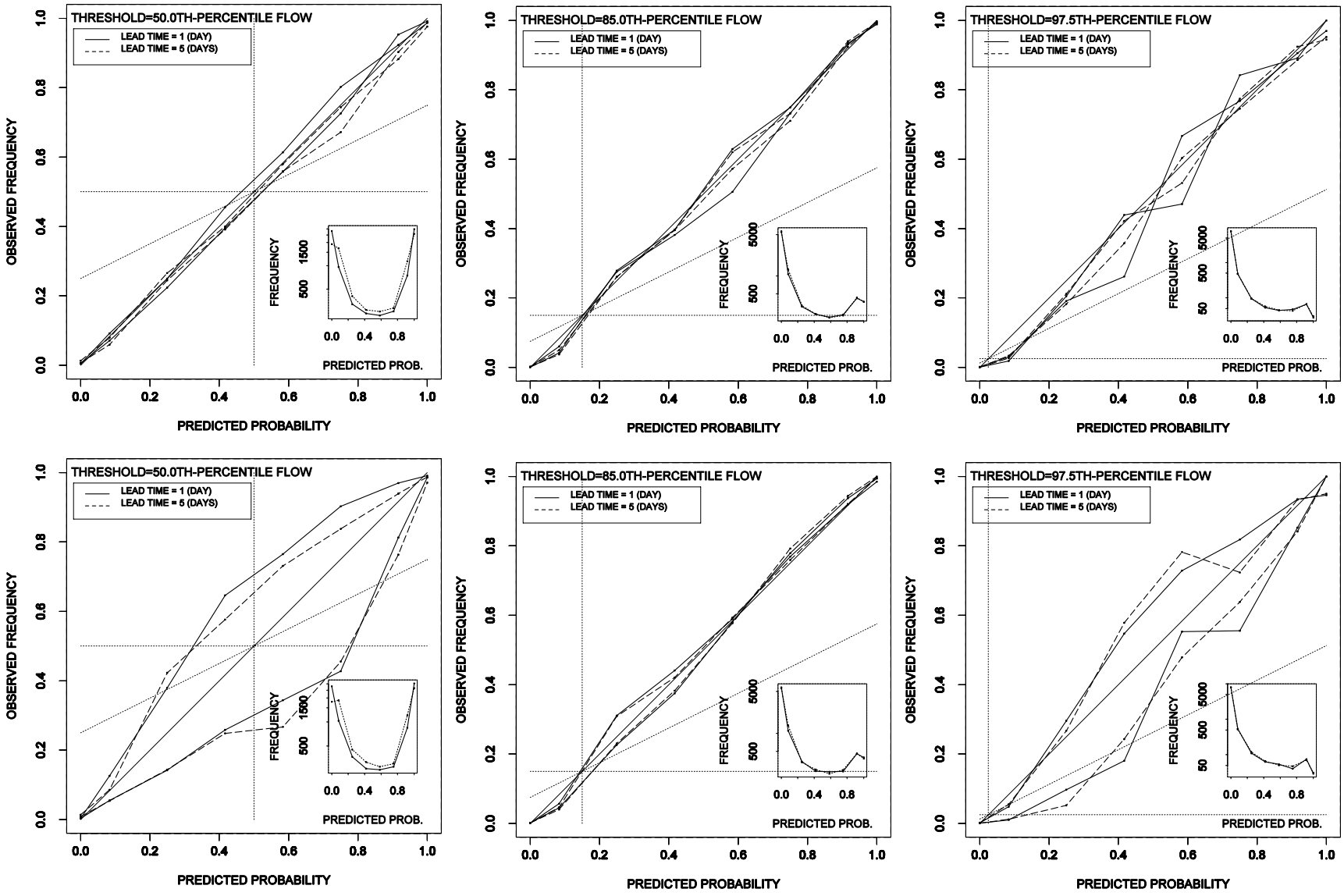


Fig 8. Same as Fig 5, but for the validation periods.

Reliability diagrams of post-processed ensemble flows (daily) at 50th (left), 85th (middle) and 97.5th (right) percentiles for calibration (upper) and validation (lower) periods



Thank you