



Ensemble Pre-Processor (EPP) Update

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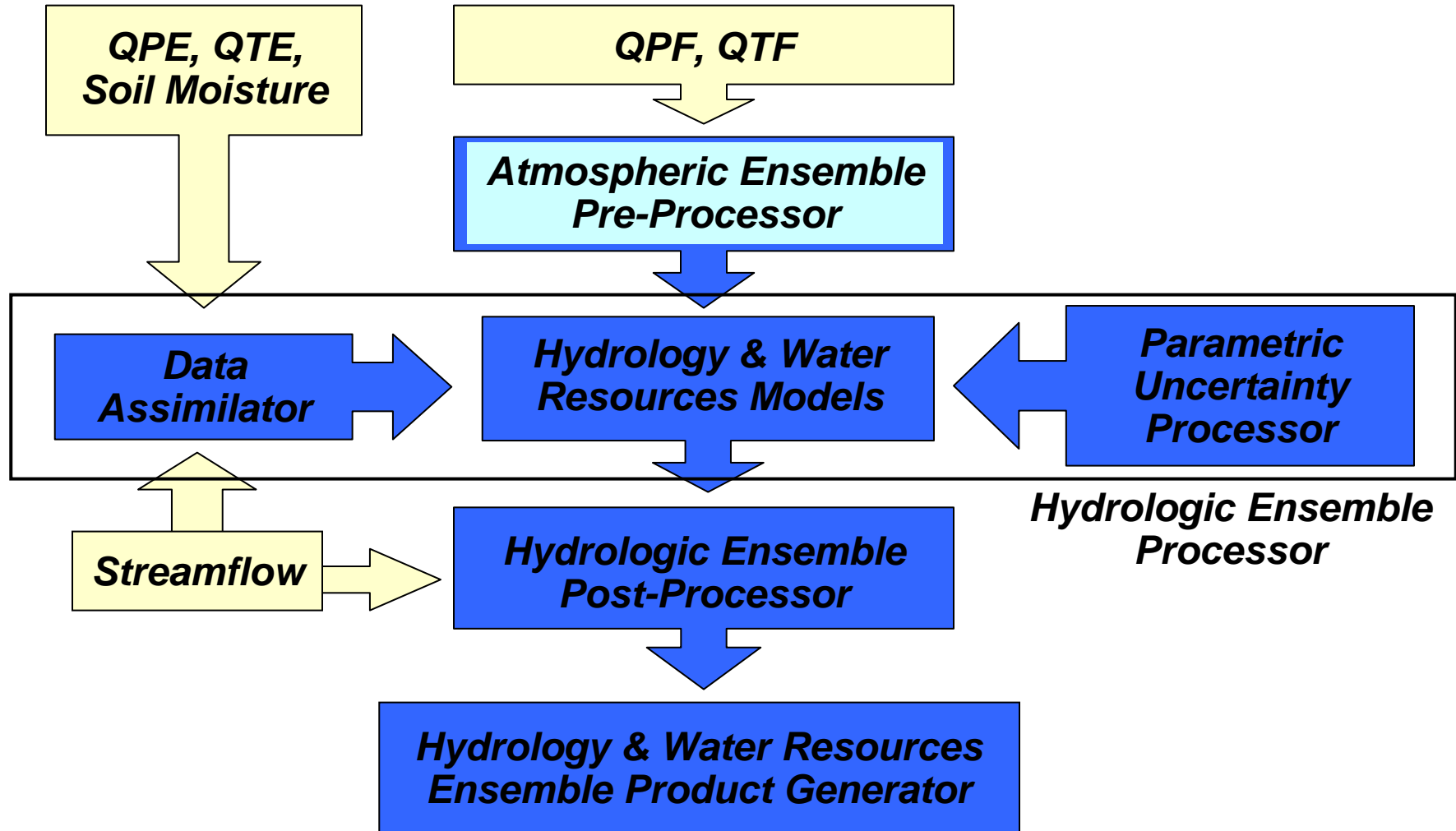
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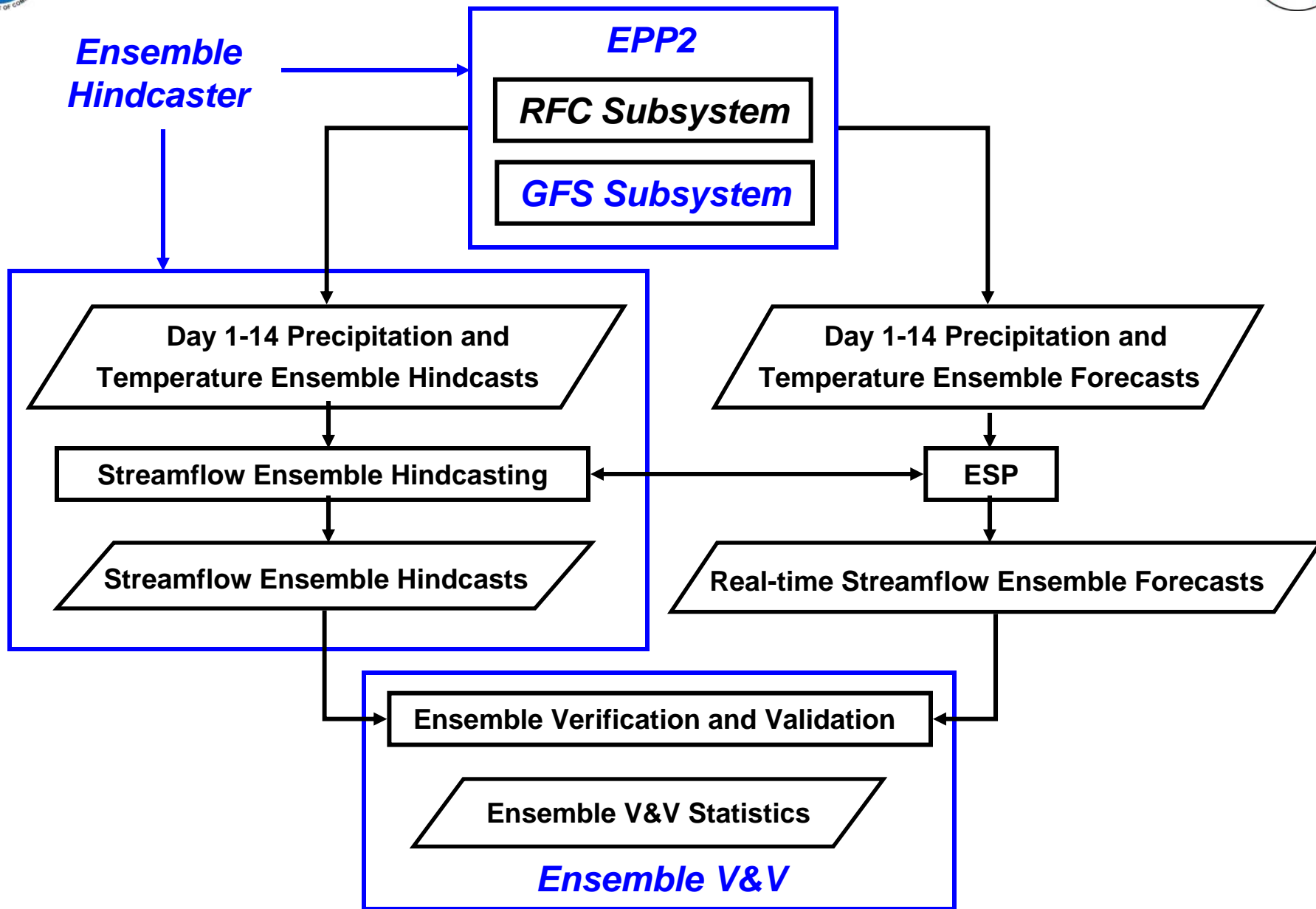


Elements of a Hydrologic Ensemble Prediction System





FY06 Ensemble Projects and their Relationships

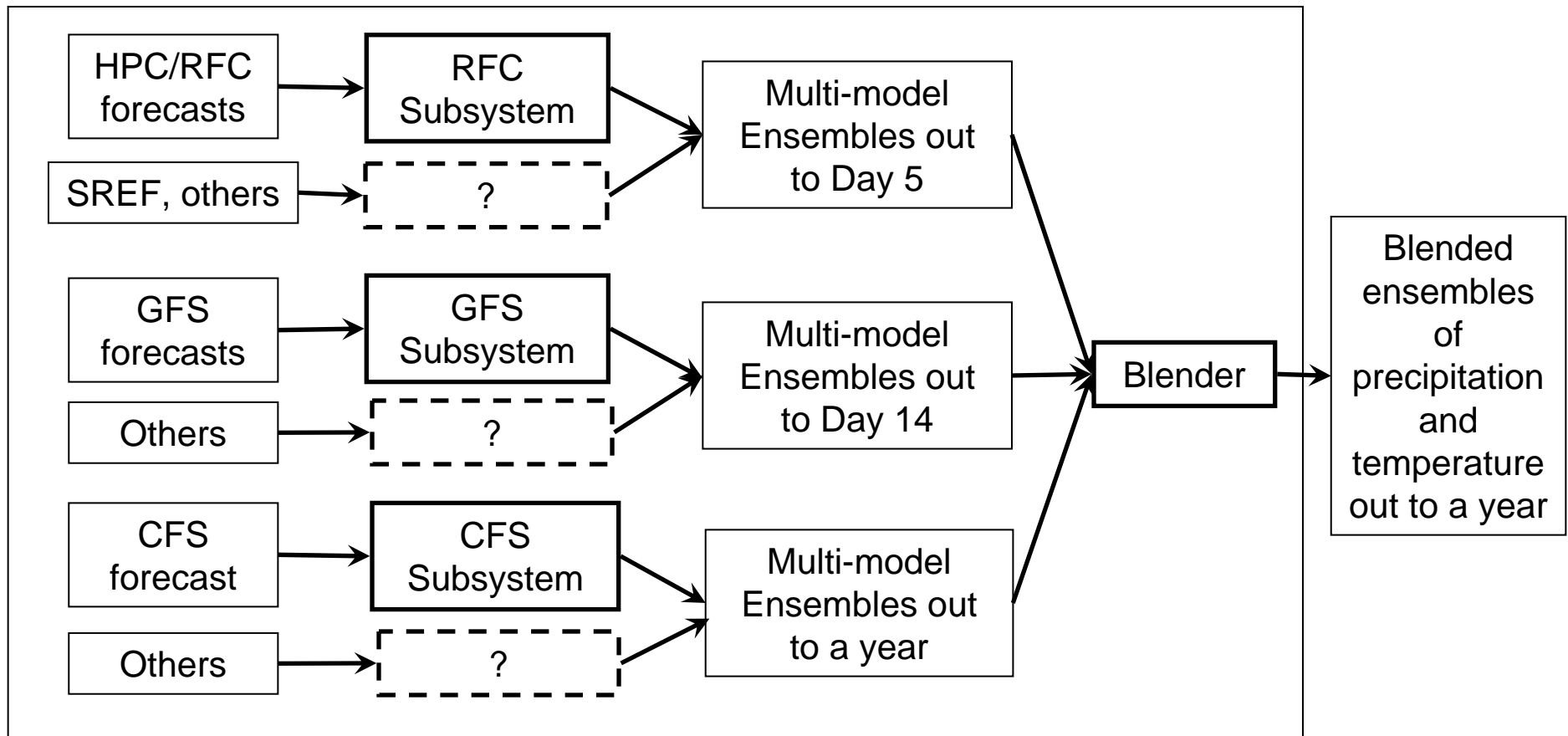




Planned Ensemble Pre-Processor

- To comprise RFC, GFS and CFS Subsystems as basic capabilities for generating short-, medium and long-term ensembles
- To bring in additional forecasts and sources of information

Ensemble Pre-Processor

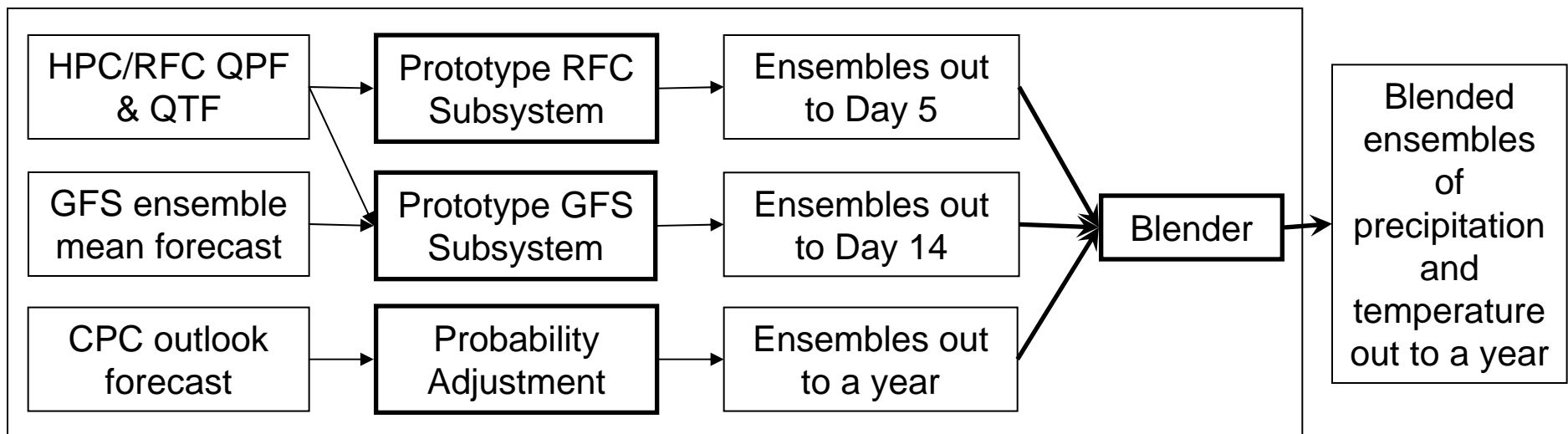




Current Ensemble Pre-Processor

- Generates short-range ensembles from HPC/RFC single-value forecasts (Schaake et al., submitted to HESS; Cong et al., manuscript under preparation, available as Appendices D and C, respectively, in Folder “dj” at http://www.weather.gov/ohd_files/quickpost/index.php)
- Generates medium-range ensembles from ensemble mean from frozen version of NCEP Global Forecast System (GFS) (Schaake et al., submitted to HESS)
- Probability-shifts historical ensembles based on CPC outlook products (Perica et al. 1999)
 - Climatology distribution estimated via re-sampling to reduce sampling uncertainty

Ensemble Pre-Processor





Status & FY06 Activities

- GFS Subsystem
 - A new version has been developed
 - Generates precipitation and temperature ensembles out to Day 14 from single-value GFS ensemble mean and HPC/RFC forecast
 - Has been in experimental operation at CNRFC
 - Installed at CBRFC in Sep, 2006
 - Installed at OHD in Nov, 2006
 - See John Schaake's "EPP GFS Subsystem" presentation for details



Status & FY06 Activities (cont.)

- RFC Subsystem
 - Built on ENS_PRE_S
 - Has been in experimental operation at AB- and MARFCs
 - Models joint probability distribution between 6-hr MAP/MAT and HPC/RFC single-value forecast of precipitation/temperature
 - Requires multi-year archive of 6-hr MAP, 6-hr QPF, 6-hr MAT, and forecast of 24-hr Tmin and Tmax
 - Generates short-term precipitation/temperature ensembles in 2 steps:
 - Construction via stratified sampling of conditional distribution of observed precipitation/temperature given single-value forecast of precipitation/temperature
 - Probability matching of historical ensembles via Schaake Shuffle (Clark et al. 2004)
 - Generates long-term ensembles from historical traces using resampled climatology
 - Operates in real-time and hindcasting modes
 - Written in Fortran and C++; Korn shell script for hindcasting mode



Status & FY06 Activities (cont.)

- RFC Subsystem (cont.)
 - Implemented new (old?) techniques to improve precipitation ensembles:
 - Explicit modeling and accounting of precipitation intermittency (Herr and Krzysztofowicz 2005; Cong et al., manuscript under preparation)
 - A more flexible regression model with explicit parameter optimization
 - Essentially a simpler version of the technique used in the ensemble post-processor (Seo et al. 2006)
 - The optimization provides the user (i.e. the RFC) with some control over how the ensembles may behave, particularly for large precipitation events
 - See Limin Wu’s “Ensemble Pre-Processor” and D.-J. Seo’s “Ensemble verification II” presentations on Thu for details

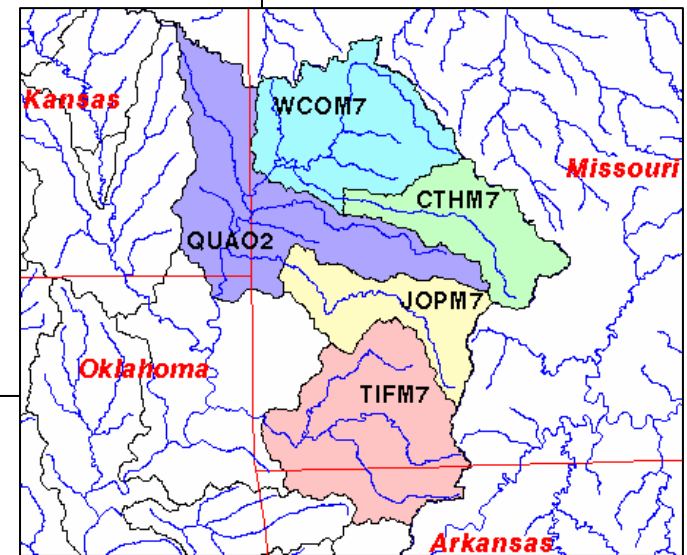


Aggregated Verification Results for flows at 5 ABRFC test basins

Comparison of Hydrologic and Input
Uncertainties

Comparison of streamflow from GFS
Subsystem and EPPII outputs
i.e. RFC Subsystem

*Julie Demargne, HEP team
October 2006*



*See Julie Demargne's "Ensemble verification II"
presentation on Thu for details*

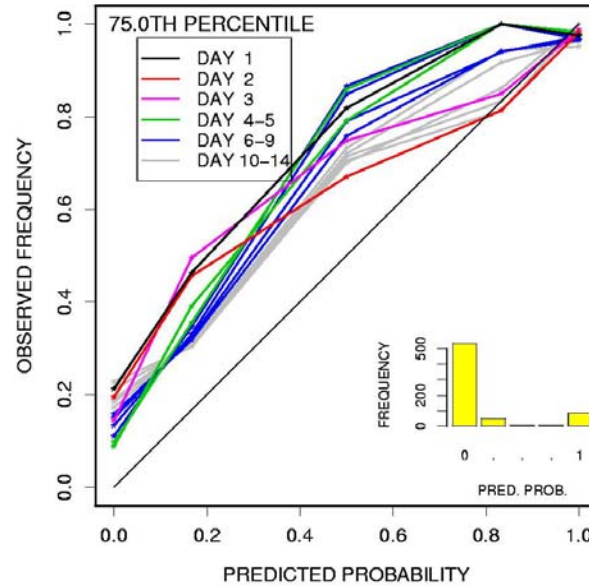


Reliability
Diagram
(agreement
between forecast
probability and
mean observed
frequency) for a
range of threshold
percentiles for the
24-hr annual flow

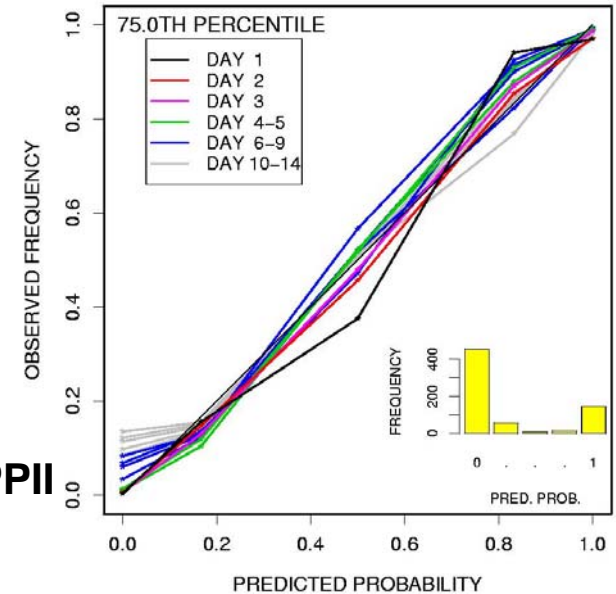
With 5 bins

*Deviation from
diagonal gives
conditional bias*

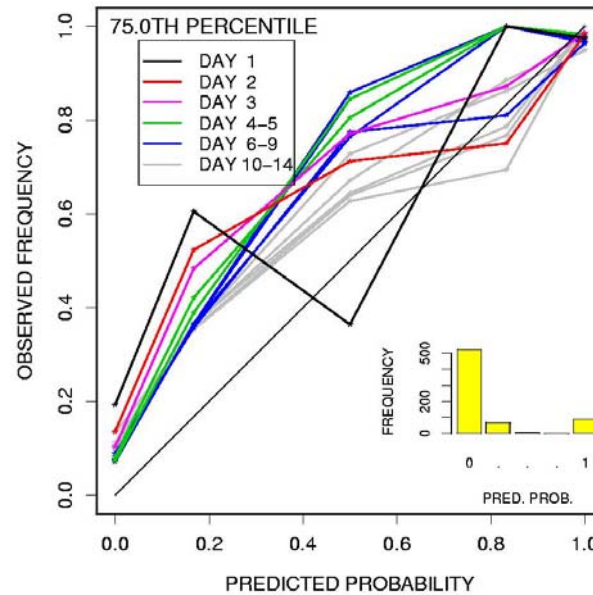
Reliability Statistics



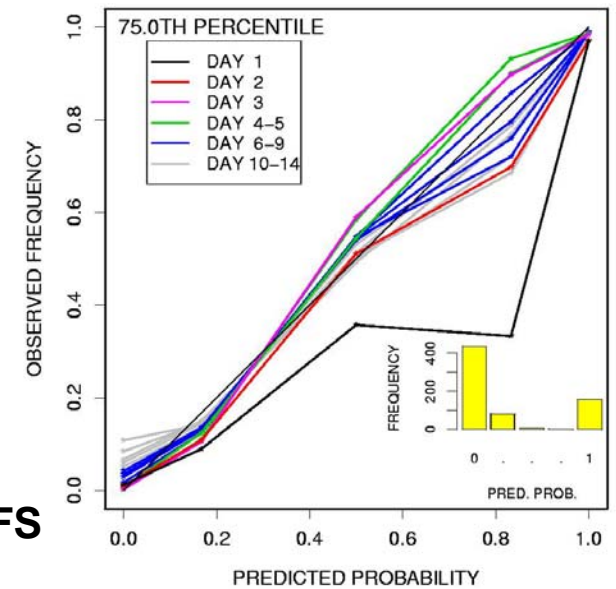
EPPII



Reference flow: observed



Reference flow: simulated



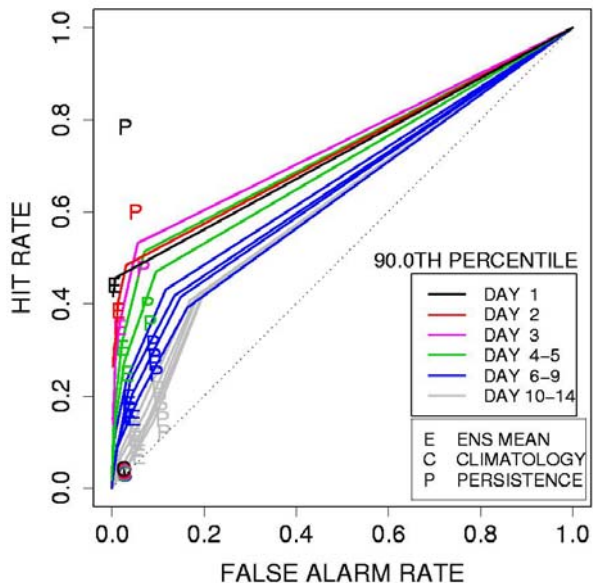
GFS



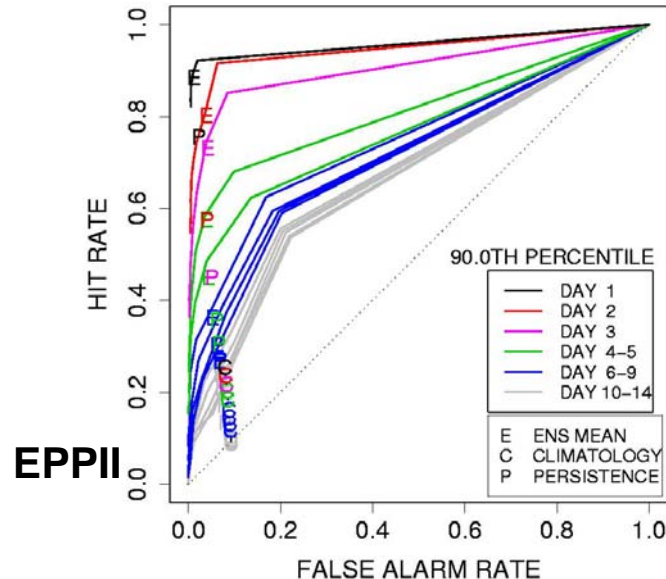
ROC Statistics



ROC
(ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr annual flow

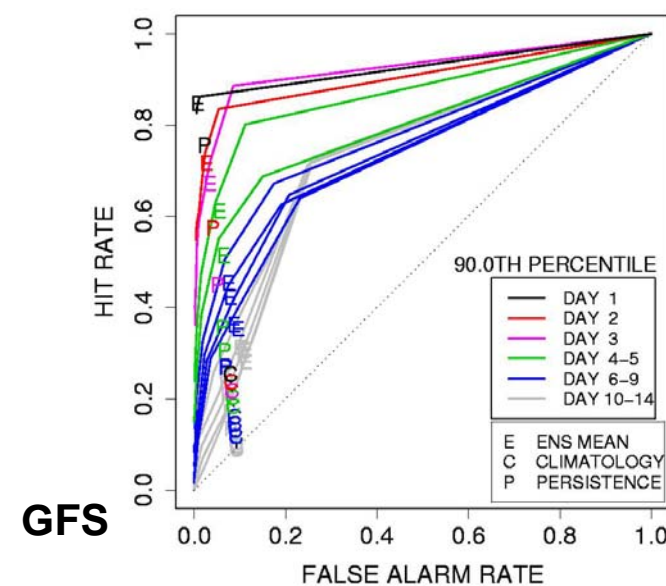
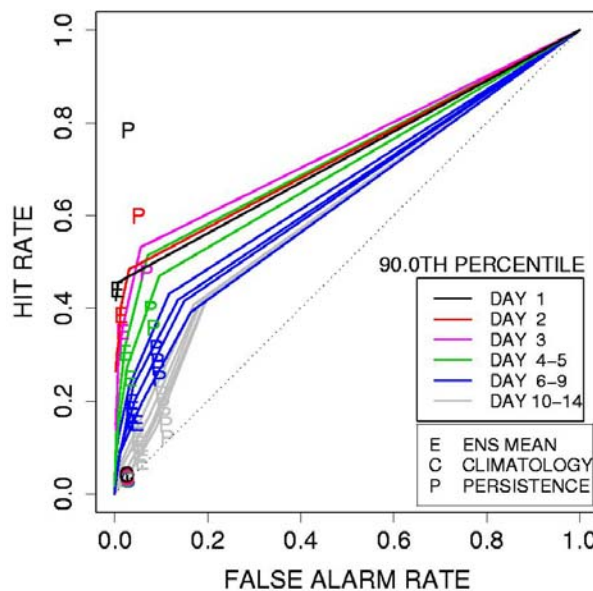


Reference flow: observed



Reference flow: simulated

Perfect scores:
 $HR = 1$ and $FAR = 0$



GFS



FY07 Activities

- AHPS funding expected to:
 - Test, validate and comparatively verify the EPP2 GFS Subsystem
 - Integrate/interface the GFS Subsystem in/with EPP2, test the prototype software, validate the science, and comparatively verify the performance
 - This capability extends the forecast lead time to Day 14 by the use of GFS ensemble mean forecasts of precipitation and temperature
 - Improve EPP2
 - Improve ensemble generation techniques to reduce conditional bias in large precipitation amounts to improve reliability of precipitation ensembles
 - Benchmark performance and data requirement from independent validation
- The plan is to produce a single, unified ensemble pre-processor, EPP3 (see the RTO plan presentation on Wed)



Thank you