

FISH50 Hydrology Forecasts for the Southeastern US

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PWSU_CIWG workshop Oct 5

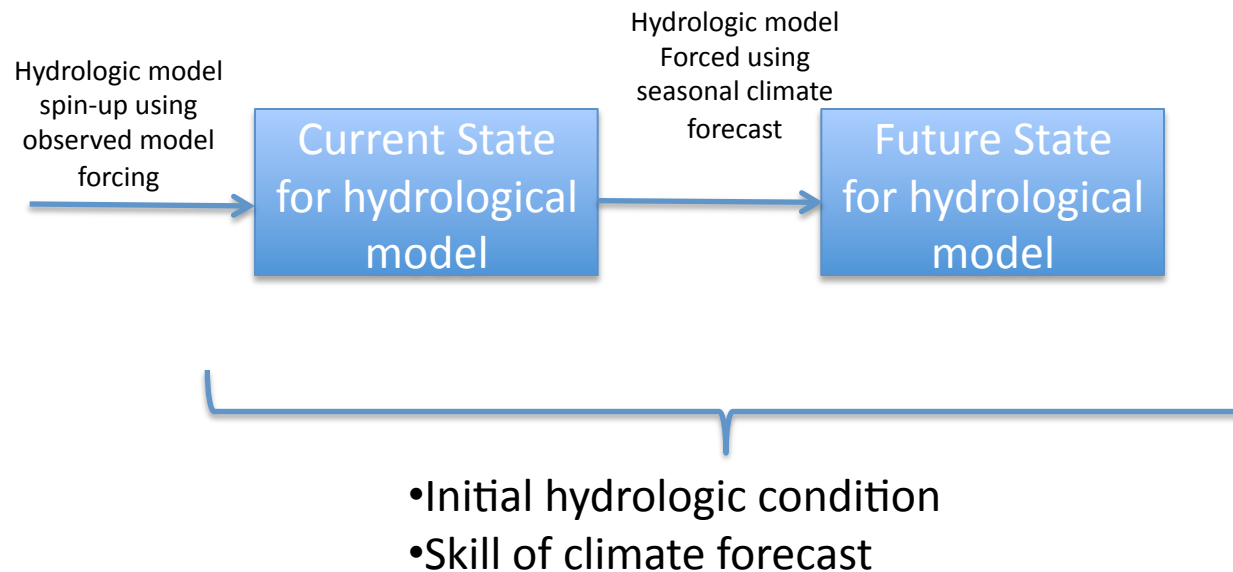
Orlando

Objectives

- Use the FISH50 results to obtain stream flow forecasts over 28 watersheds in the SEUS
- Compare deterministic and probabilistic hydrological forecasts
- Examine the role of bias correction of FISH50 on stream flow forecasts

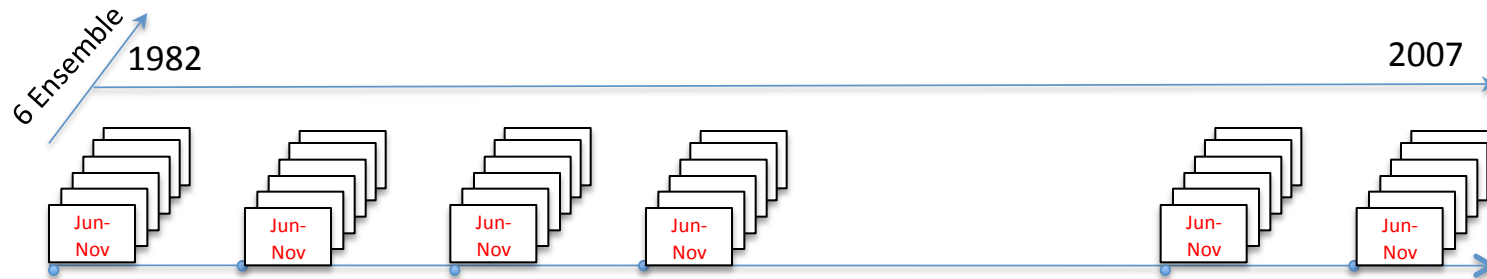
Seasonal hydrologic forecast

- Regression
- Ensemble streamflow prediction



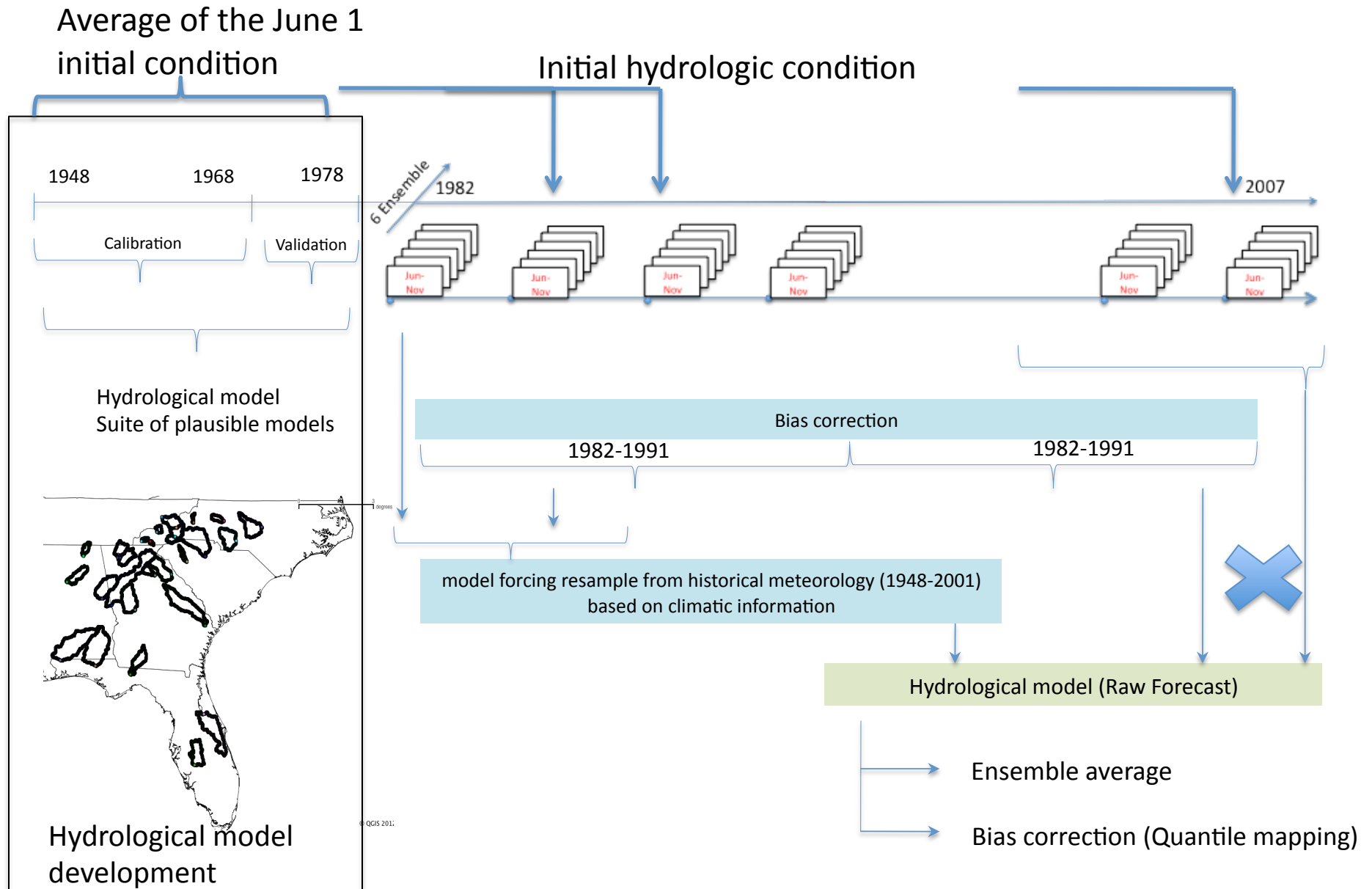
- Relative role depends upon lead time, hydrologic regime, season

Experimental seasonal Hindcast: Florida Climate Institute FSU Seasonal Hind cast at 50 Km

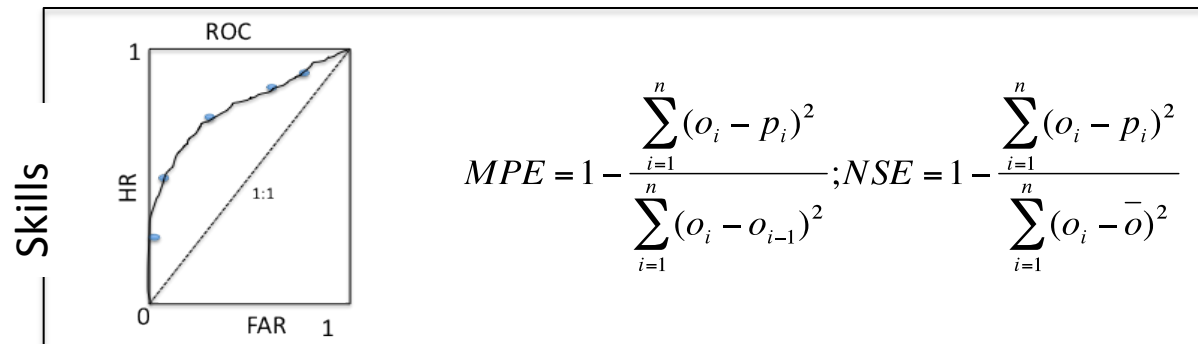
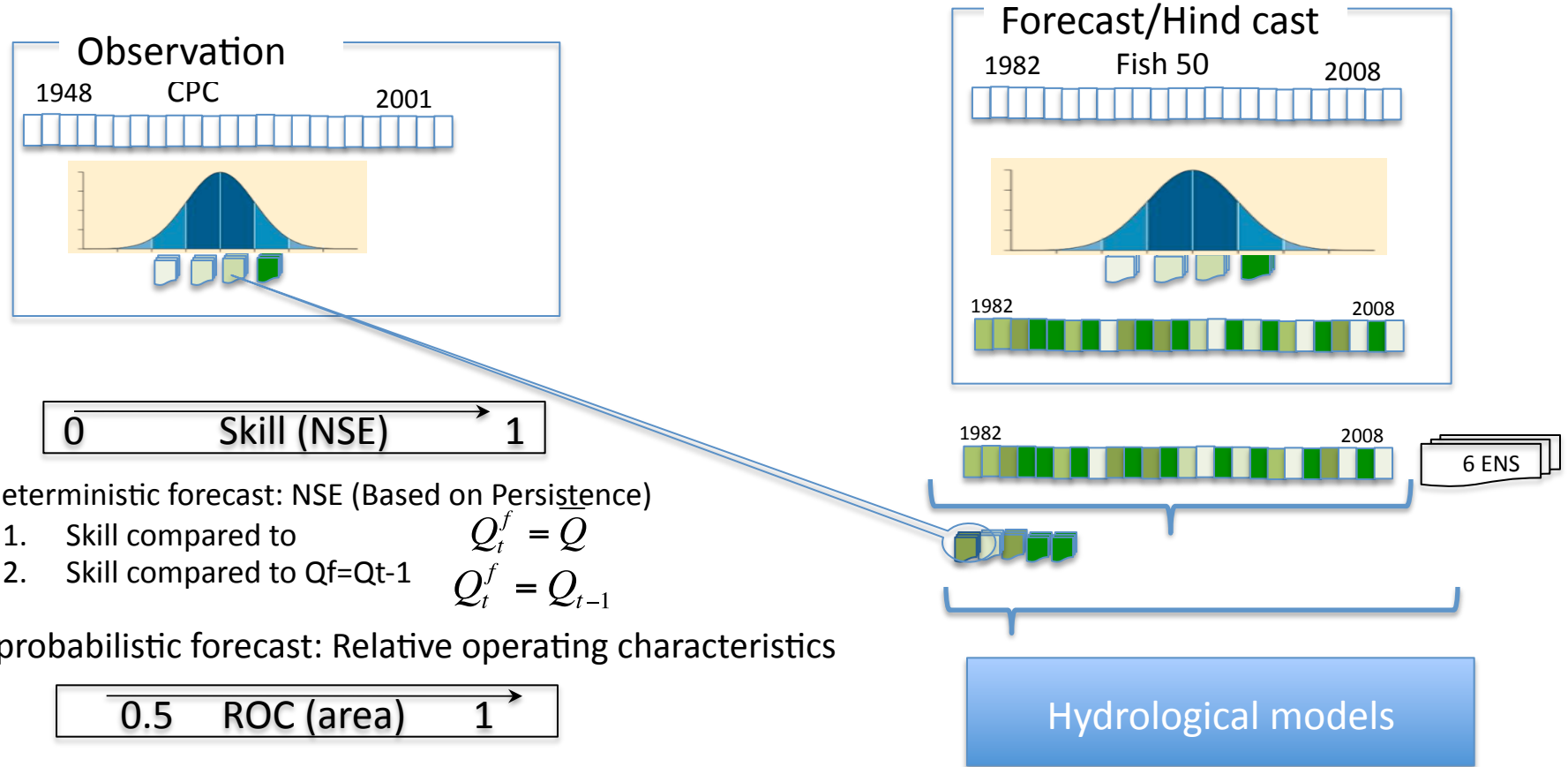


- Seasonal run with 6 month lead and initialized in month of June (June-Nov)
- Predicted SST to forecast the global Climate
- Ensembles of 6 run are produced with the same predicted SST but initialized with varying atmospheric condition.

Seasonal hydrologic Forecast

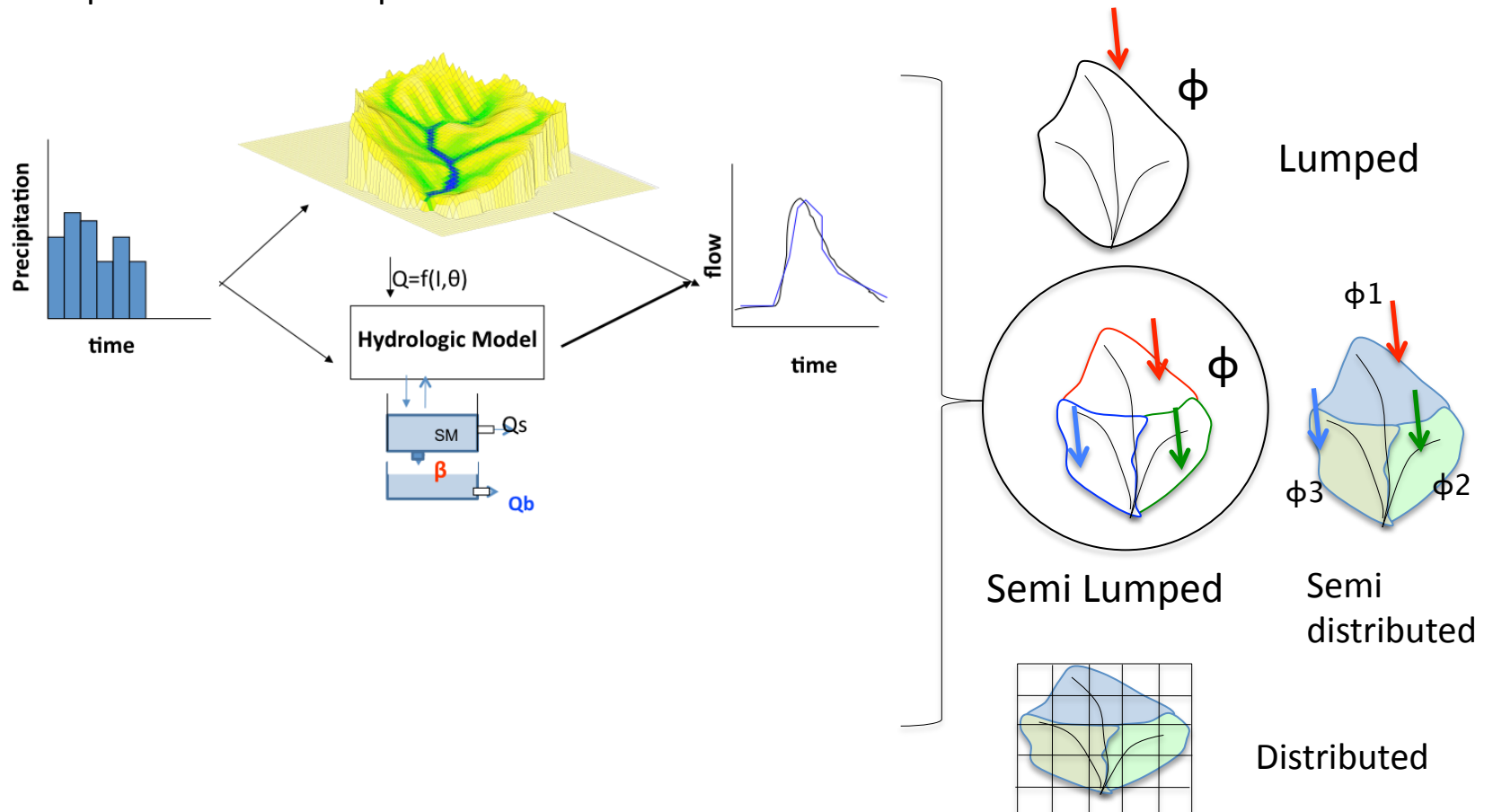


Data and Methods contd...: Ensemble Prediction System

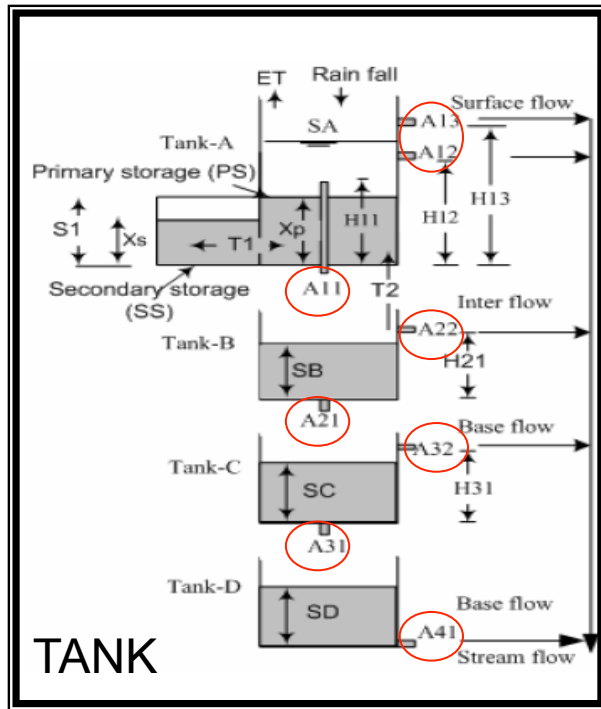


Hydrological modeling

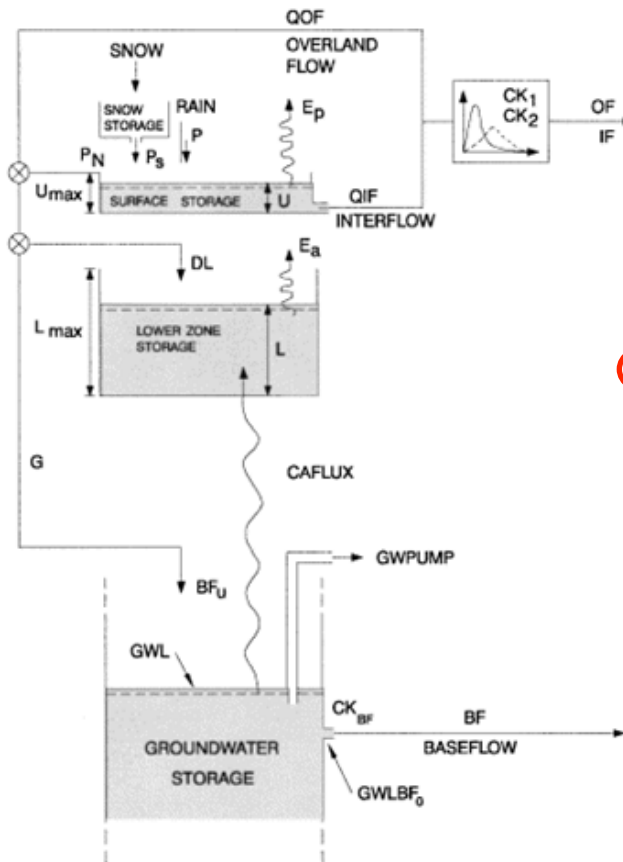
- Semi distributed Lump modeling
 - Based on subdivision of watershed into number of sub basin in order to account for the spatial variability in precipitation
 - The parameter are lumped over the whole watershed.



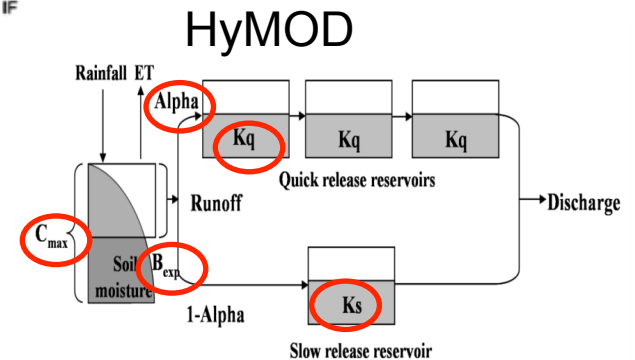
Conceptual models



Non Linear Tank and linear tank
Spatially Lumped



Linear Tank
Spatially lumped

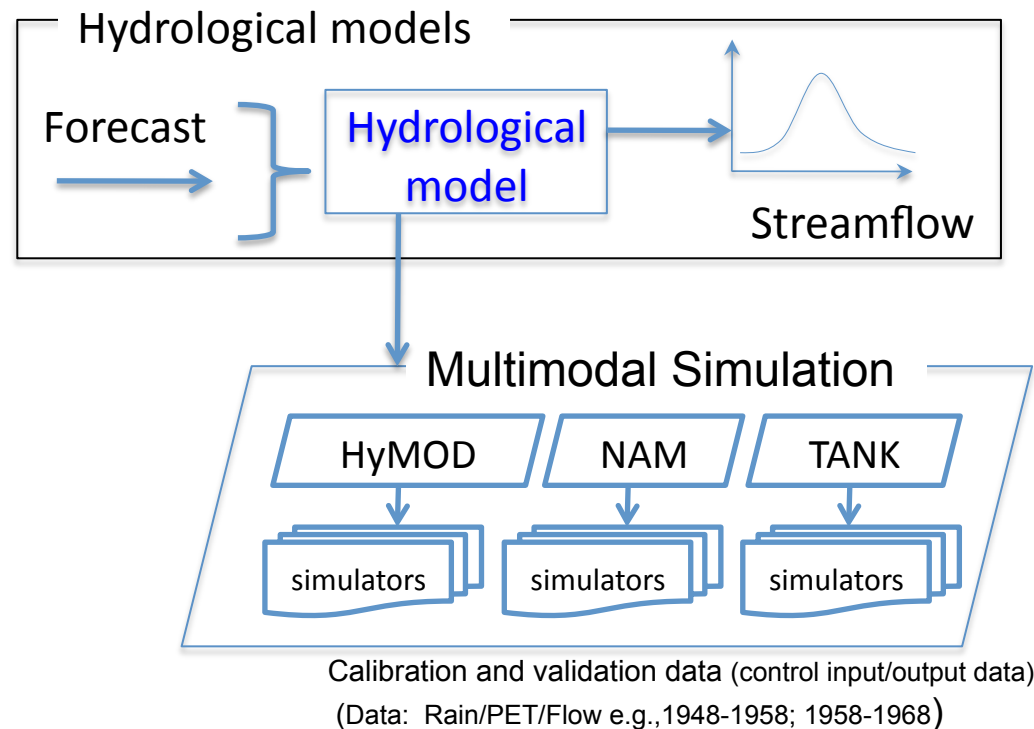
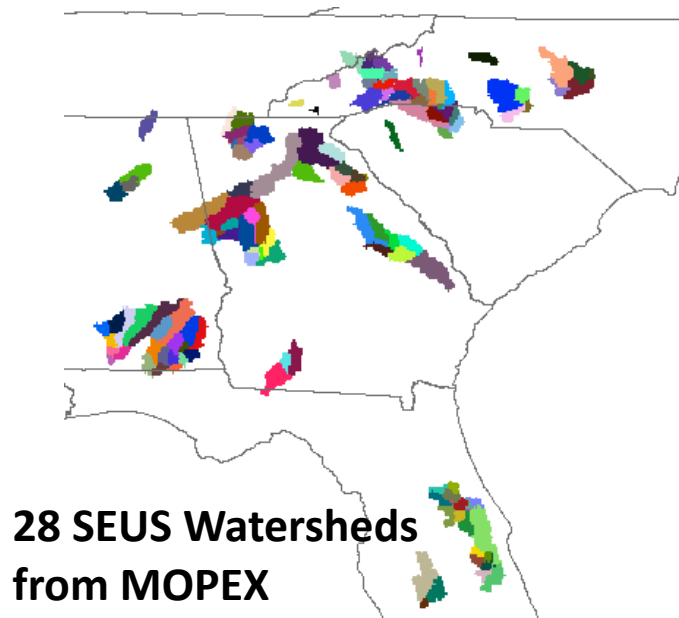


Nonlinear and linear tank
Spatial variability accounted for using statistical distribution

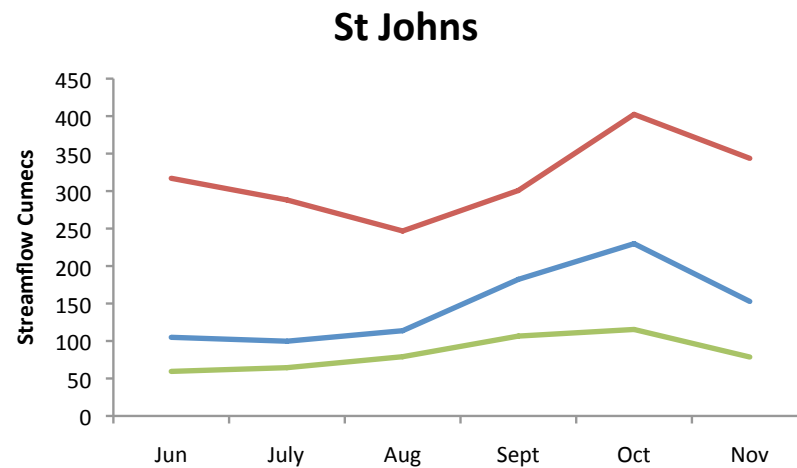
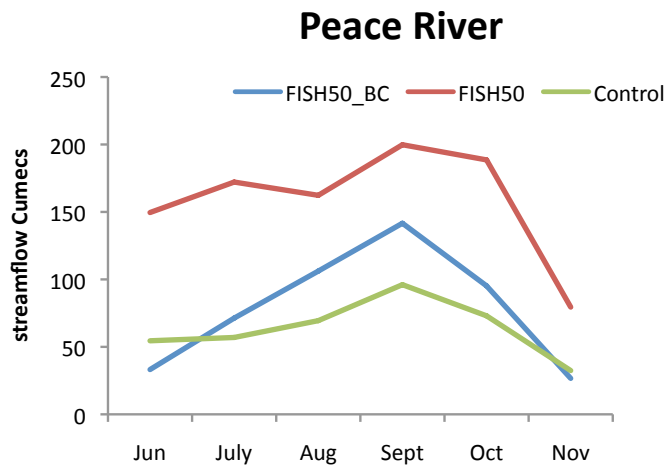
No of parameter

Hydrological modeling

- 28 SEUS MOPEX watersheds
- Simple conceptual model; the streamflow at basin outlet
- Uncertainty associated with hydrological model prediction
 - Suite of model (varying in complexity)
 - Large number of model parameter can result in comparable model simulation (GLUE methodology).



Flow simulated with FISH50 and Bias corrected FISH50



High Bias and poor Skill

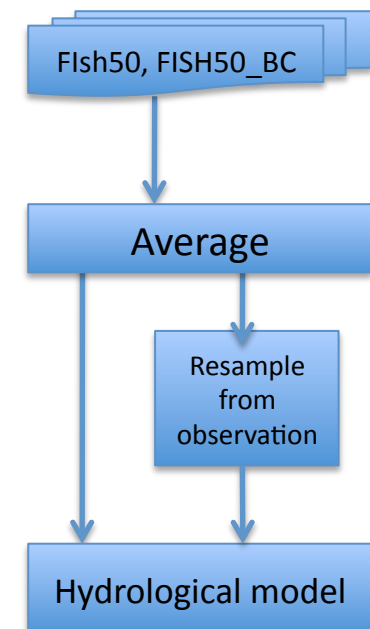
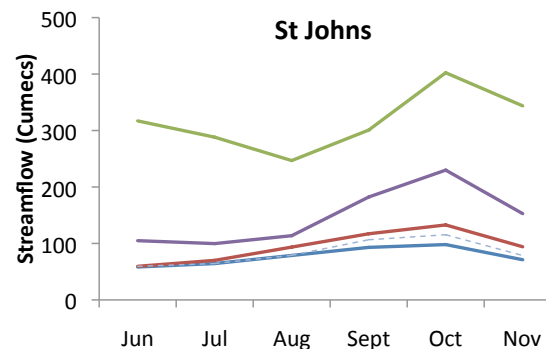
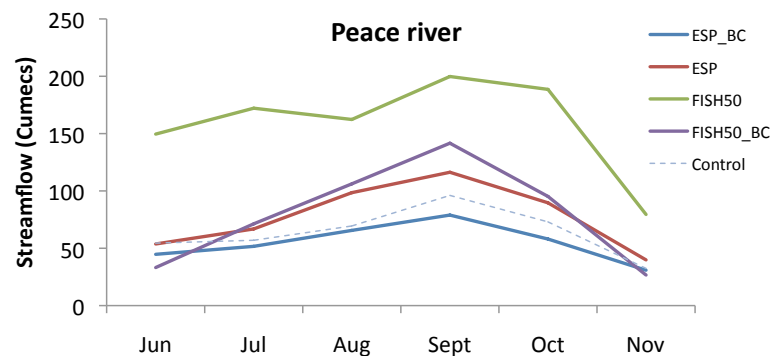


Hydrological simulation with model forcing re sampled from observation based on climate information from FISH50

Ensemble streamflow prediction

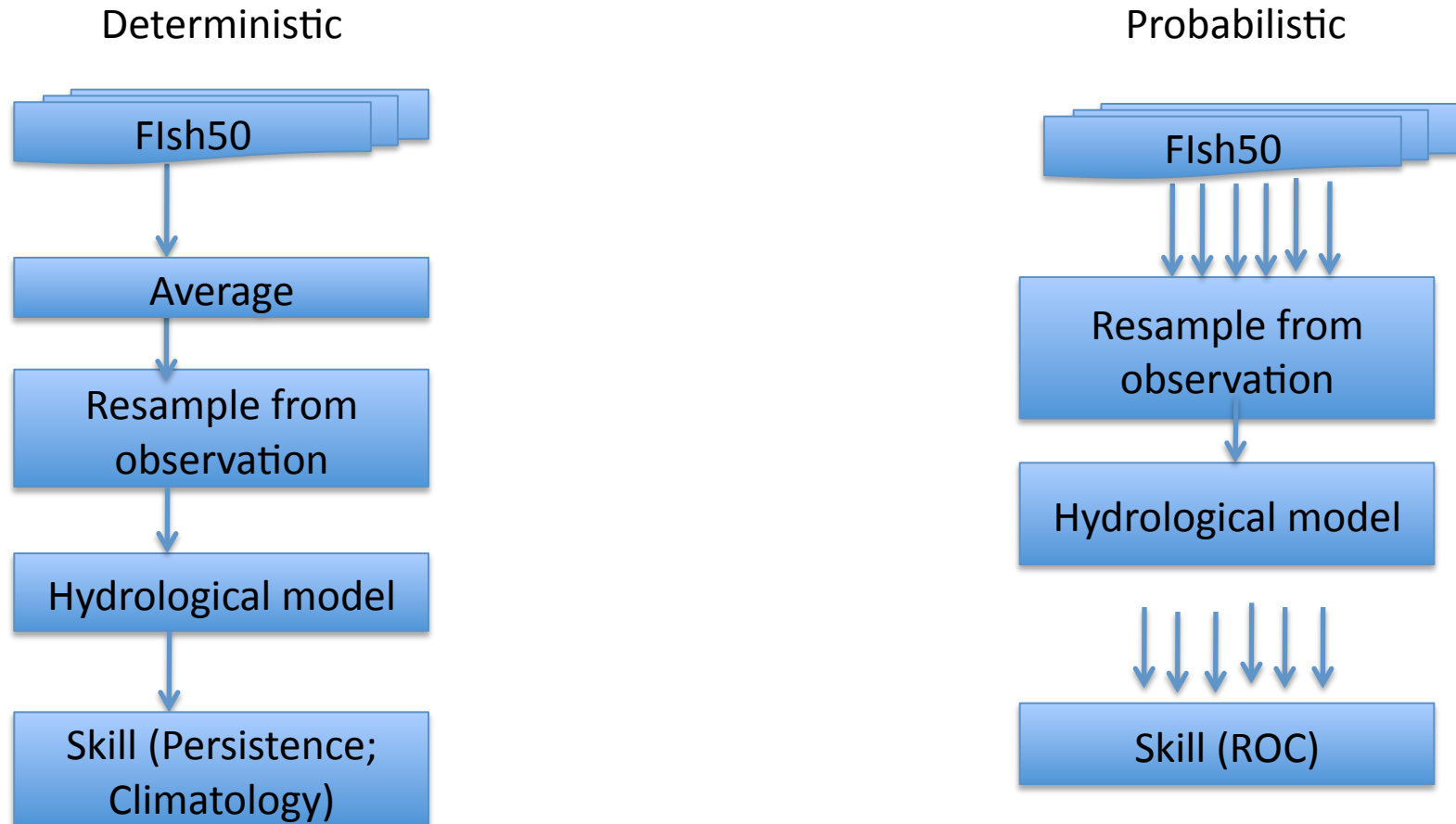
- Climate information from FISH50 , FISH50 Bias corrected
- Re sampling with replacement from CPC (1948-2001).
- Suit of hydrological model and their plausible parameters (obtained through model calibration).
- Skill evaluation
 - Deterministic approach: based on climatological value and simple persistence model
 - Probabilistic approach: based on ROC (relative operating characteristics) curve

Flow simulated with ESP approach (FISH50 and Bias corrected FISH50)



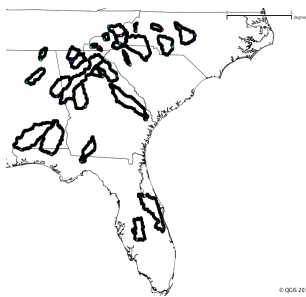
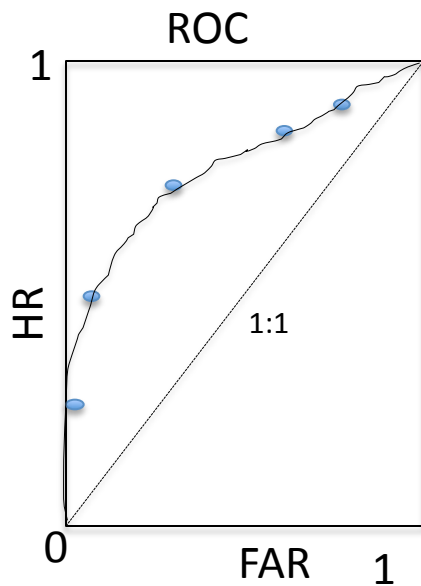
Compared to biases associated with RAW and Bias corrected FISH 50, Biases associated with ESP is small.

Skill scores: Deterministic/Probabilistic

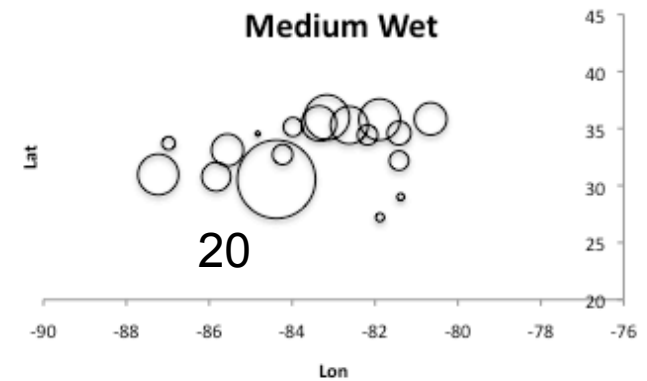
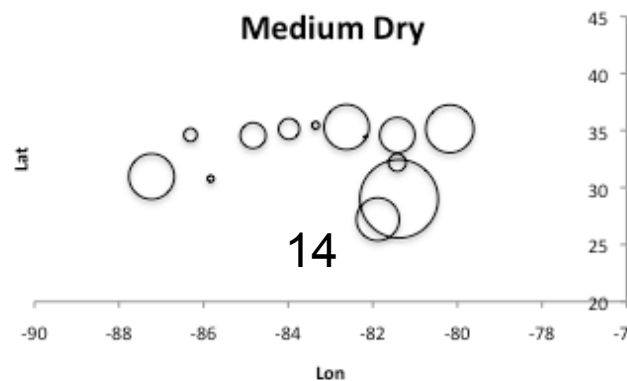
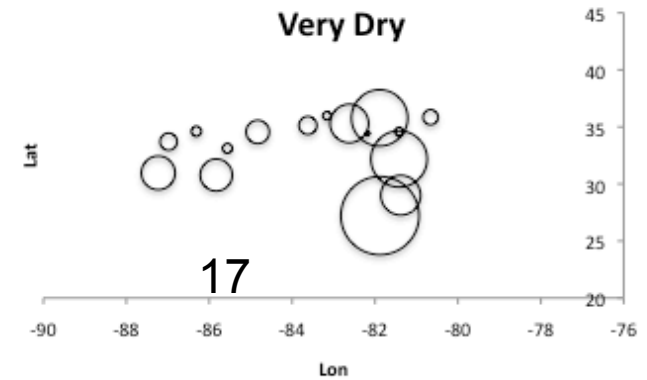
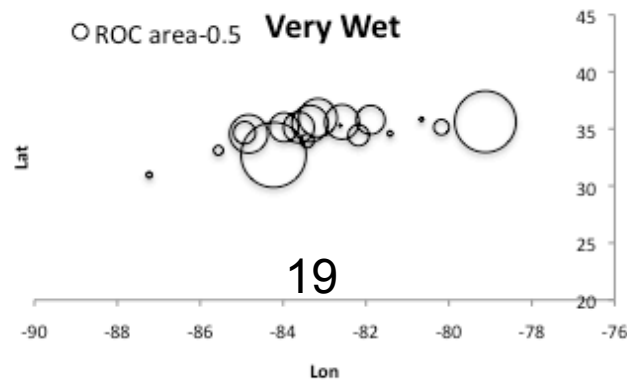


Hydrological simulation scheme
(ESP)

Area of ROC above 0.5: Skill of climate information



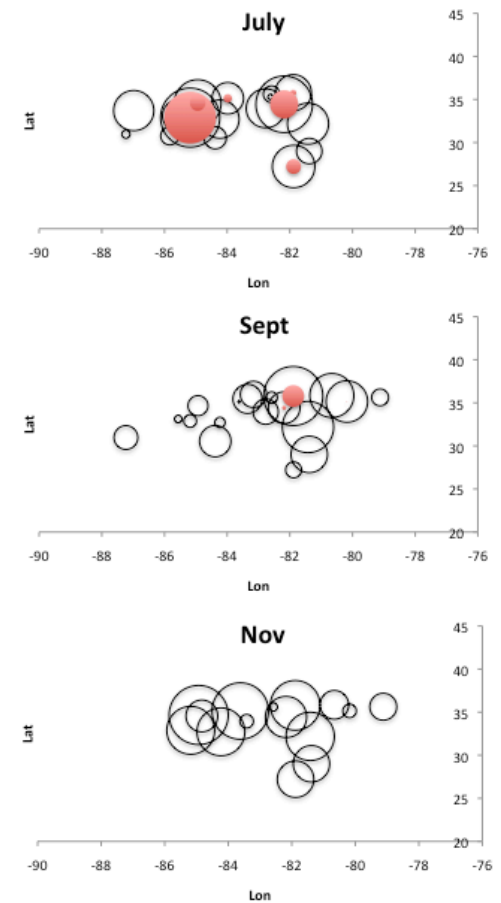
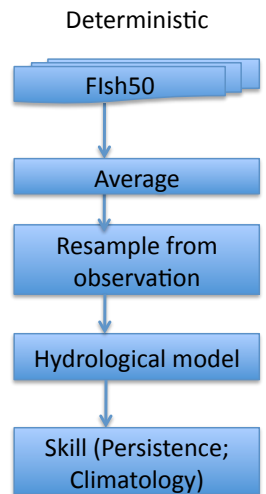
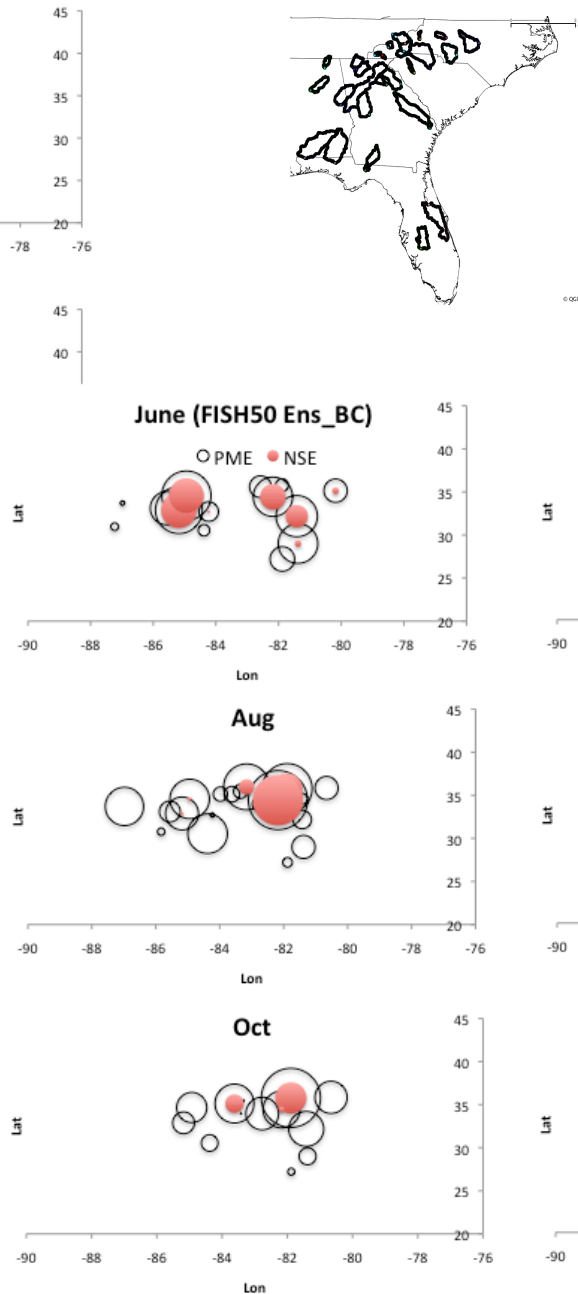
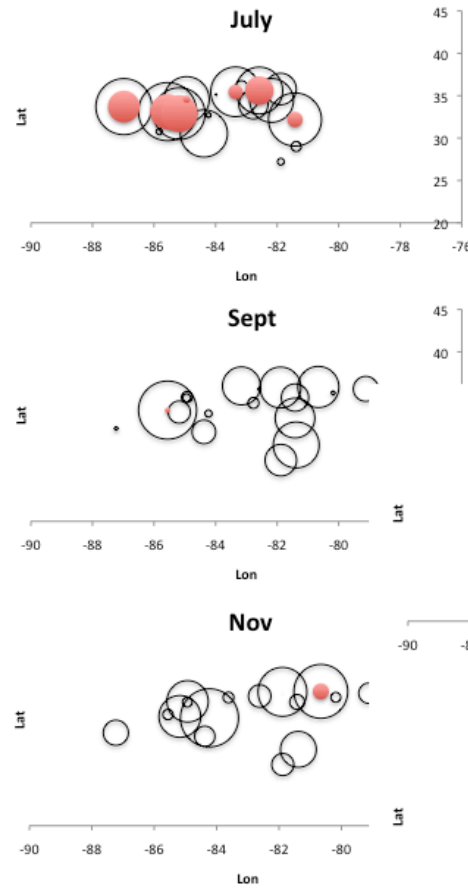
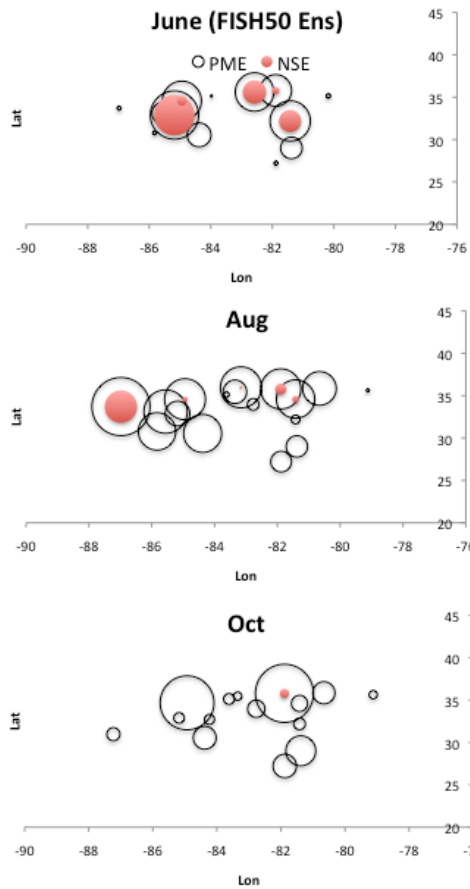
Based on: Six ensembles from FISH50 (28 watersheds of SEUS); Based on four category; and based on six month total rainfall (Jun-Nov)



Watersheds in NC: FISH50 show some skill for very wet and medium wet quartiles

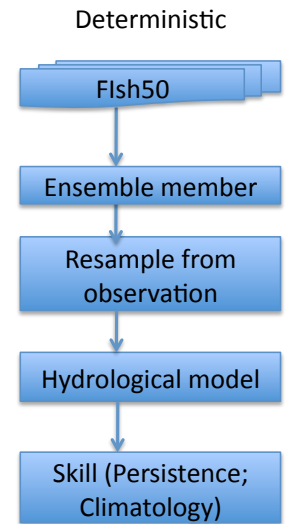
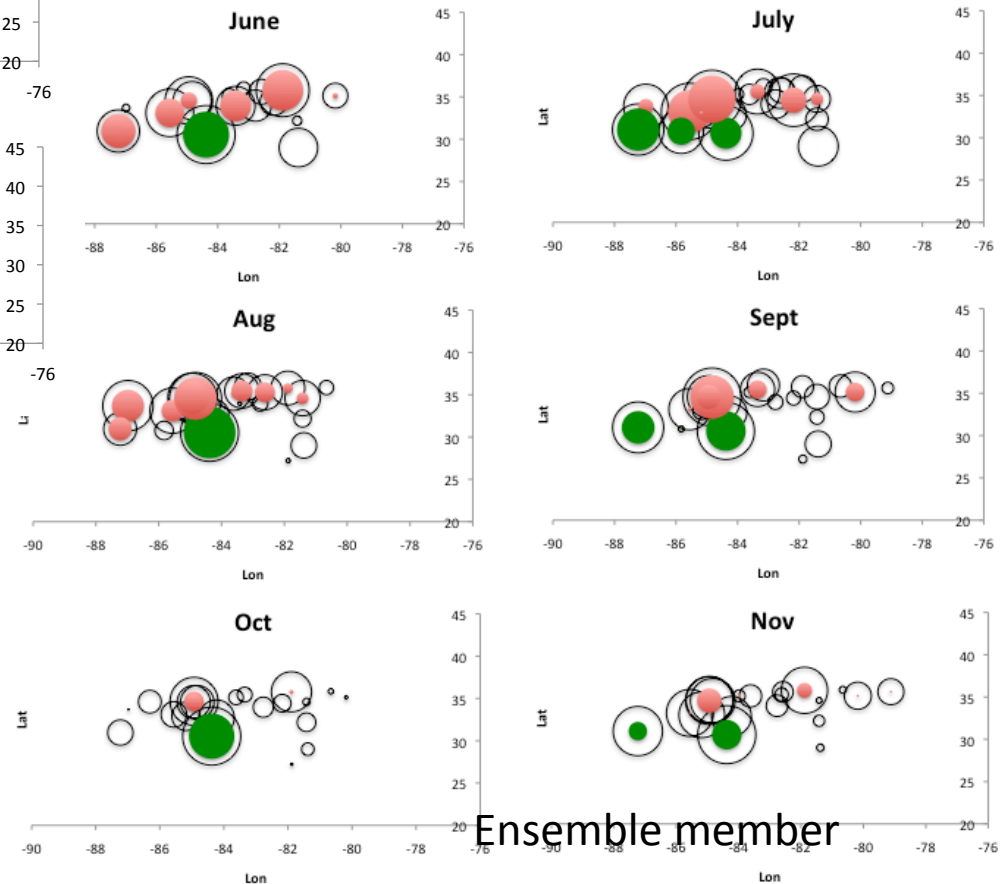
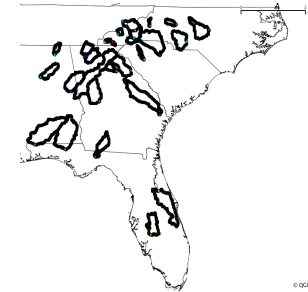
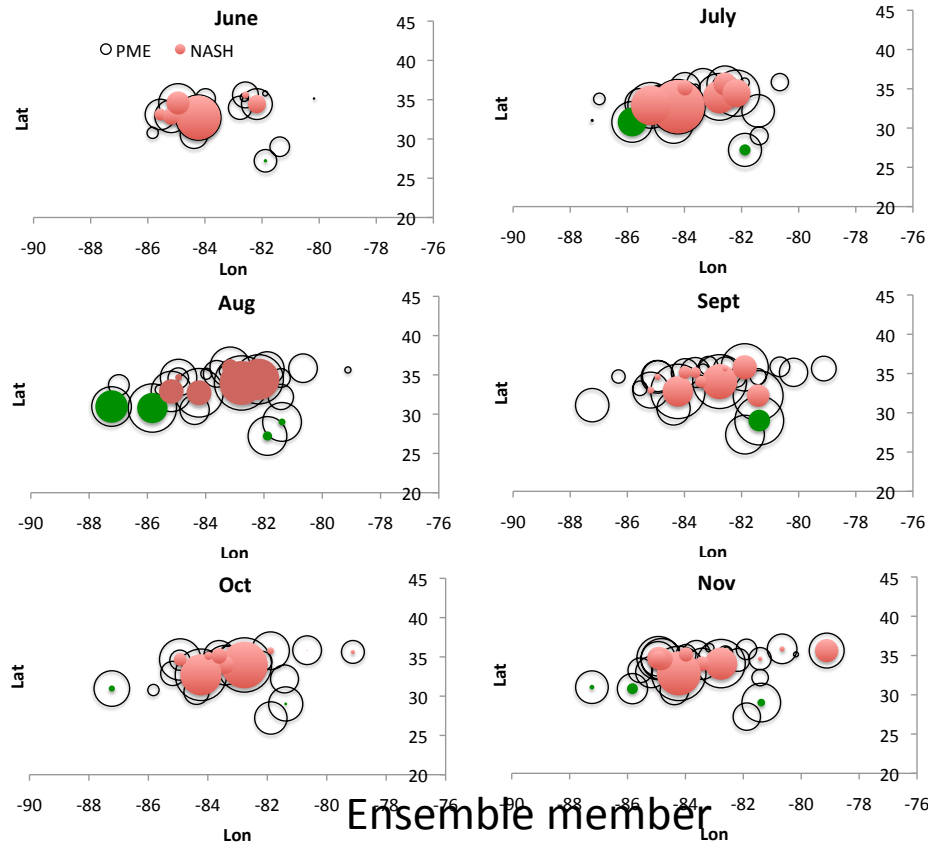
Watersheds in South Florida: FISH50 show some skill in very dry, Medium dry quartile

Skill of Hydrologic forecast: Ensemble averaged FISH50 and FISH50_BC



- Improvement in skill over persistence forecast is apparent across watershed
- Improvement in skill against climatological forecast (Solid sphere) varied among watershed and season.

Skill of Hydrologic forecast: Ensemble Member

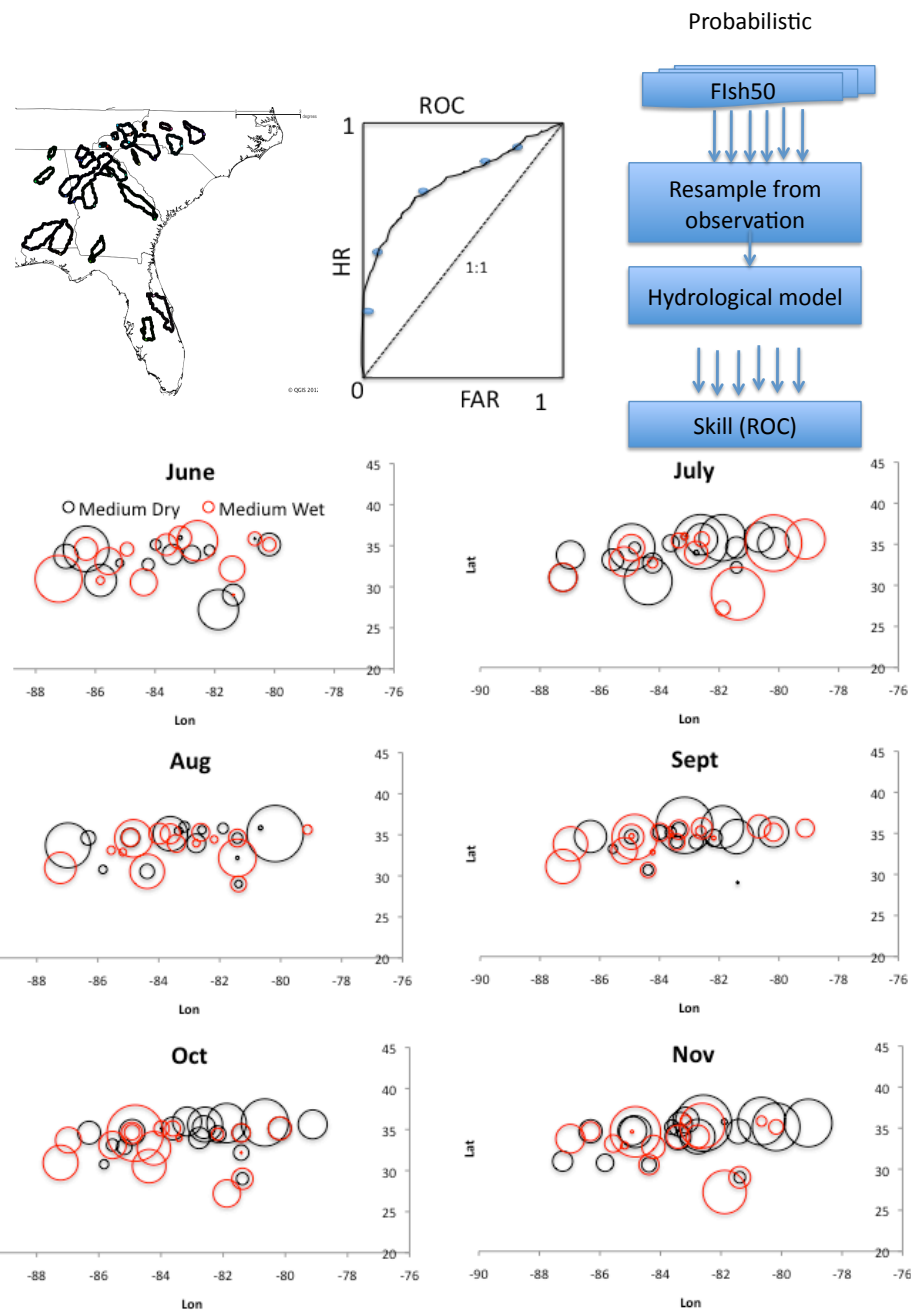
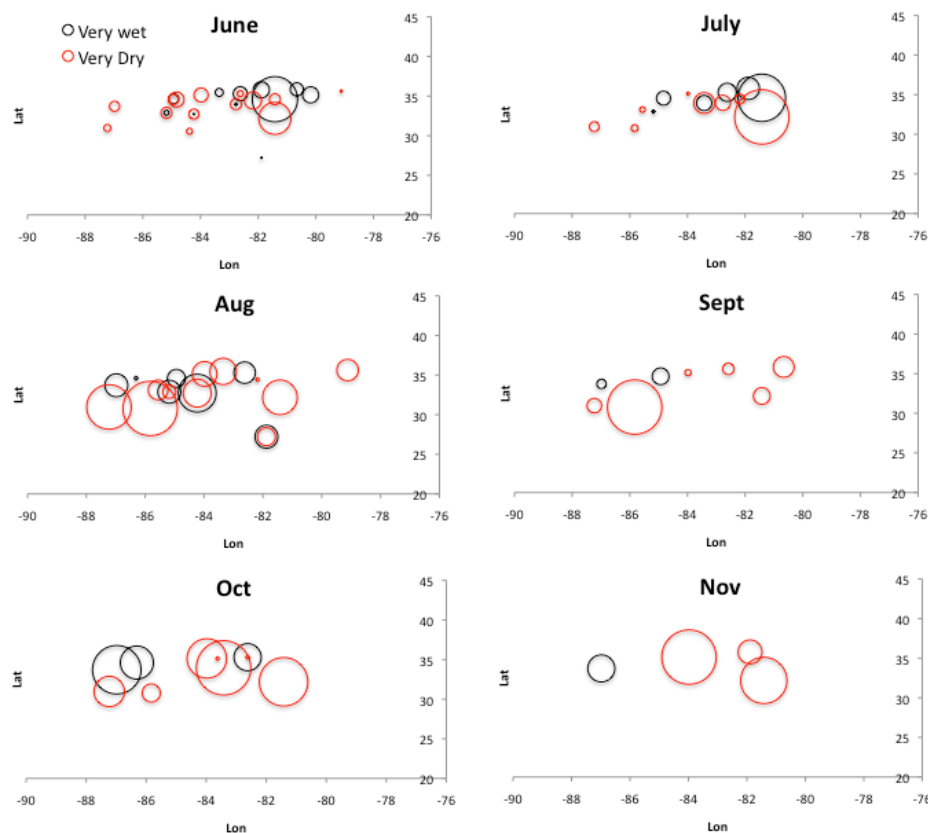


Skill: **Climatology**/persistence

Skill for two ensemble member show that the skill

In most of the watershed, the skill of some of the ensemble member is better than the Ensemble average

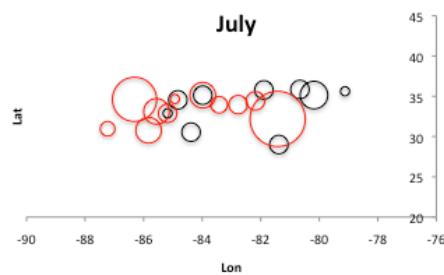
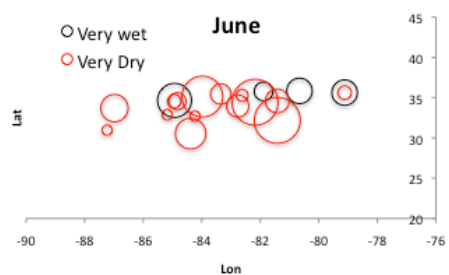
Probabilistic skill of seasonal hydrologic forecast (Area under ROC curve) :FISH50



Watersheds in NC: FISH50 show some skill for very wet quartile (June-July)

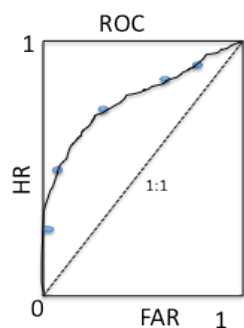
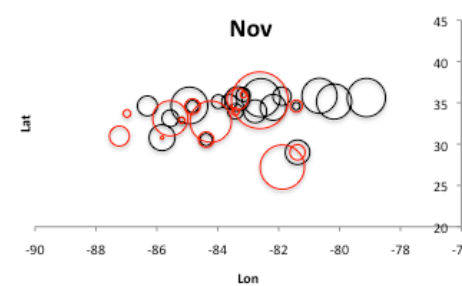
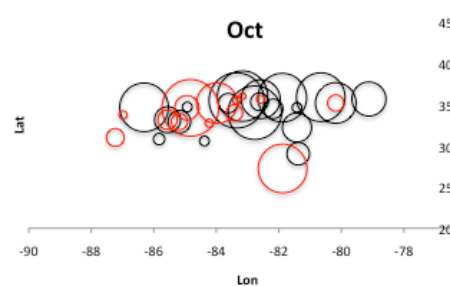
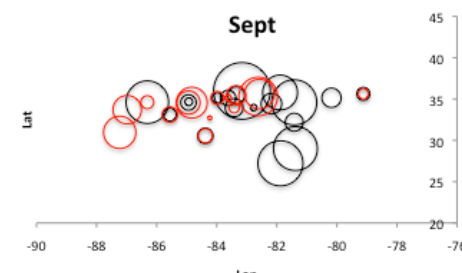
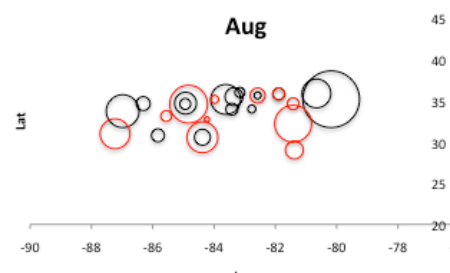
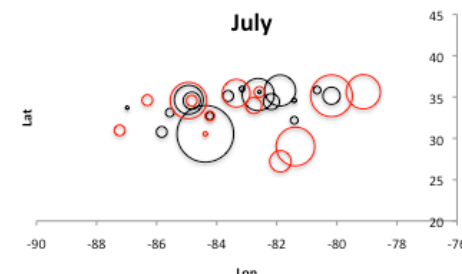
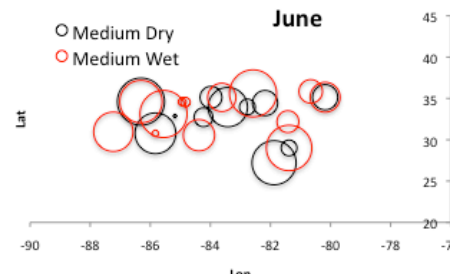
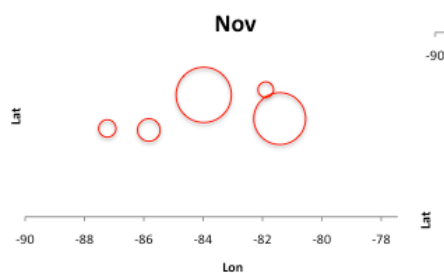
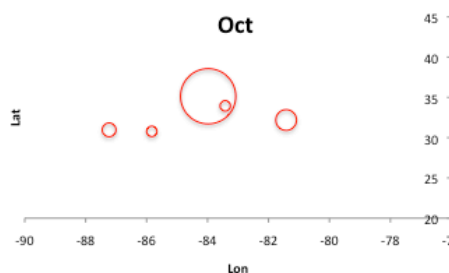
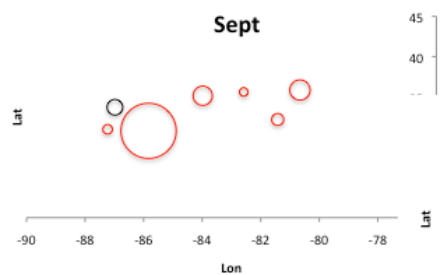
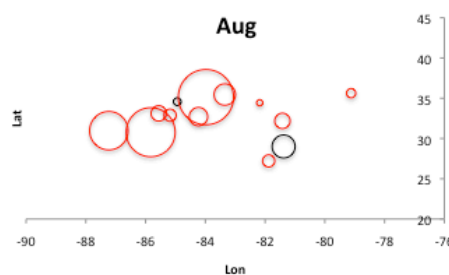
Watersheds in SEUS: Show some skill for medium dry/wet quartile

Probabilistic skill of seasonal hydrologic forecast (Area under ROC curve) :FISH50



Very Wet/Dry Events: Discriminative ability of forecast is higher in the month of June and July

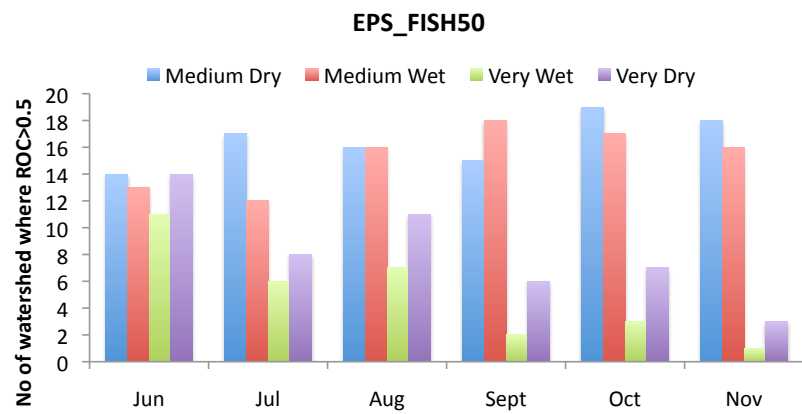
Medium dry/Wet Events: Discriminative ability of forecast is greater for medium wet/medium dry events



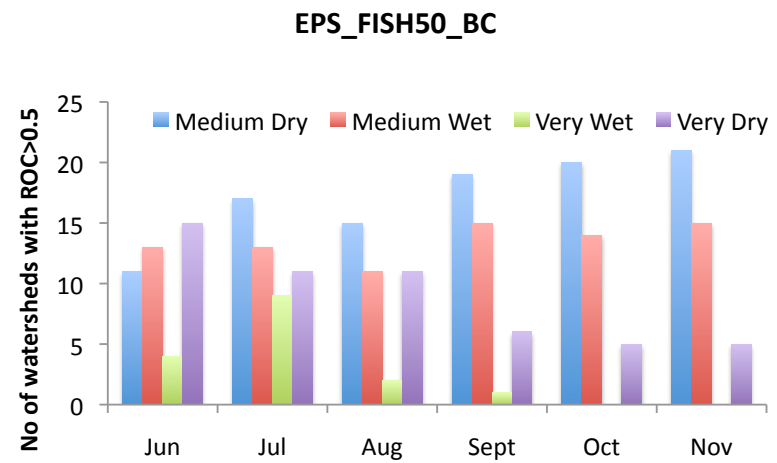
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Summary

- Assessment of FISH50, an experiment retrospective climate forecast, for seasonal hydrologic forecast is made using ensemble streamflow prediction.
- The direct use of FISH50 for hydrological simulation is detrimental as the biases are huge.
- Ensemble streamflow prediction using climate information derived from FISH50 (from resampling observations) showed improvement over direct use of FISH50 data.
- In most of the watershed, the skill of some of the ensemble member is found superior to the Ensemble average.
- The hydrologic forecast based on FISH50 is more skillful than forecast based on persistence.
- Persistence is a poorer forecast than climatology for majority of the SEUS watersheds.
- Discriminative ability of hydrologic forecast over climatological forecast is greater for medium wet/medium dry events.



Streamflow



Streamflow

