

Ensemble forecast of monthly drought indices in South Carolina

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PDSI & SPI

- Station scale drought indices used
- PDSI and 3-month SPI (SPI-3)
- 1971 to 2000 history is used

Conditional Residual Resampling

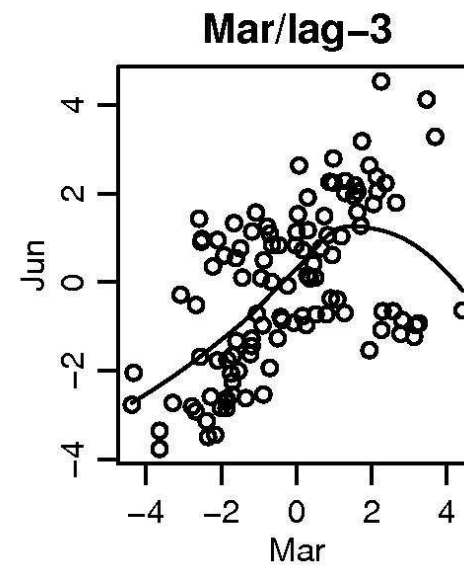
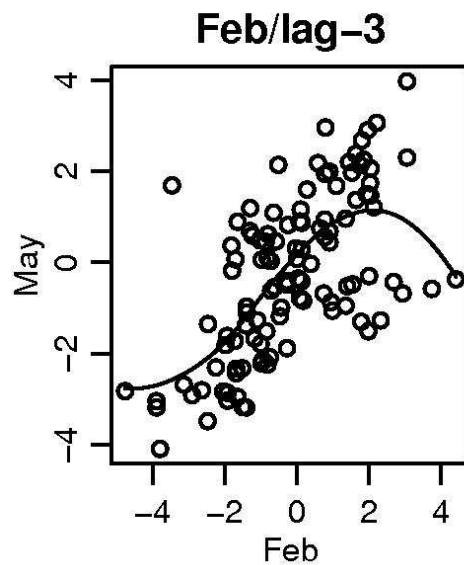
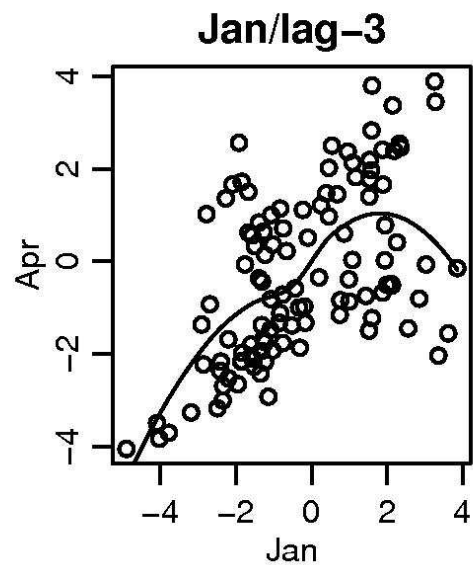
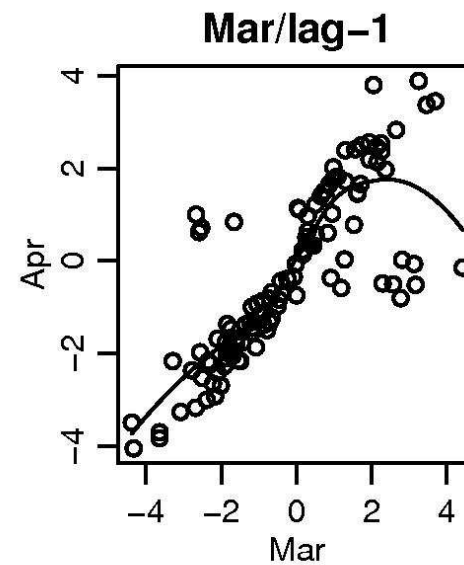
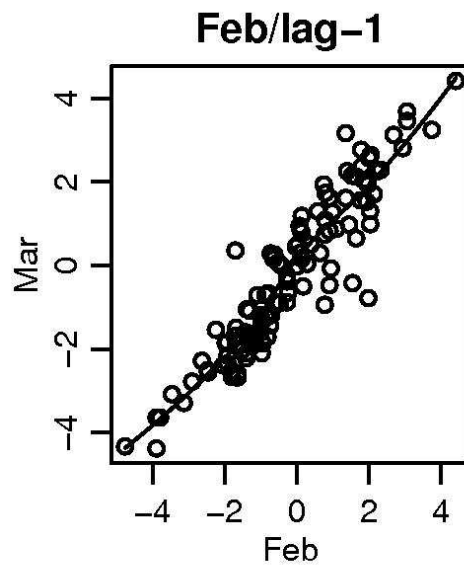
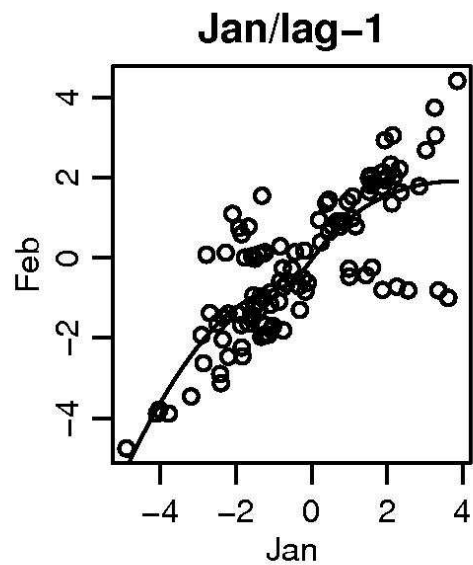
Conditional Resampling

- Ensemble forecast using history
- Use categorical climate forecast (CPC)
- Resample historical record similar to the current climate condition (temperature & precipitation)

Carbone and Dow (2005)

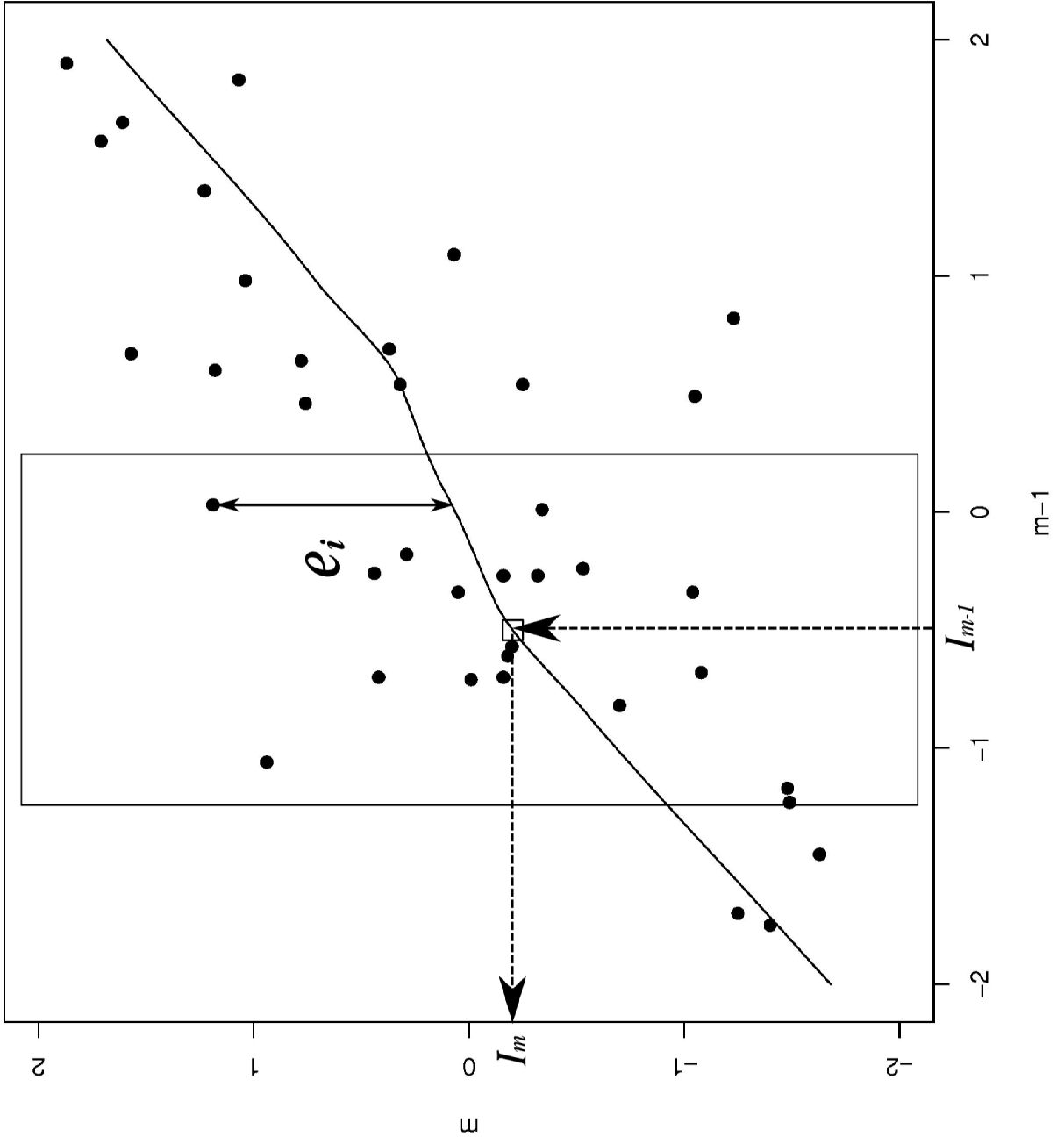
J. Amer. Water Resour. Assoc., 41

“PDSI is basically an autoregressive process of first order while SPI is a moving average process, and the two indices are known to be linearly related” (Guttman 1998)

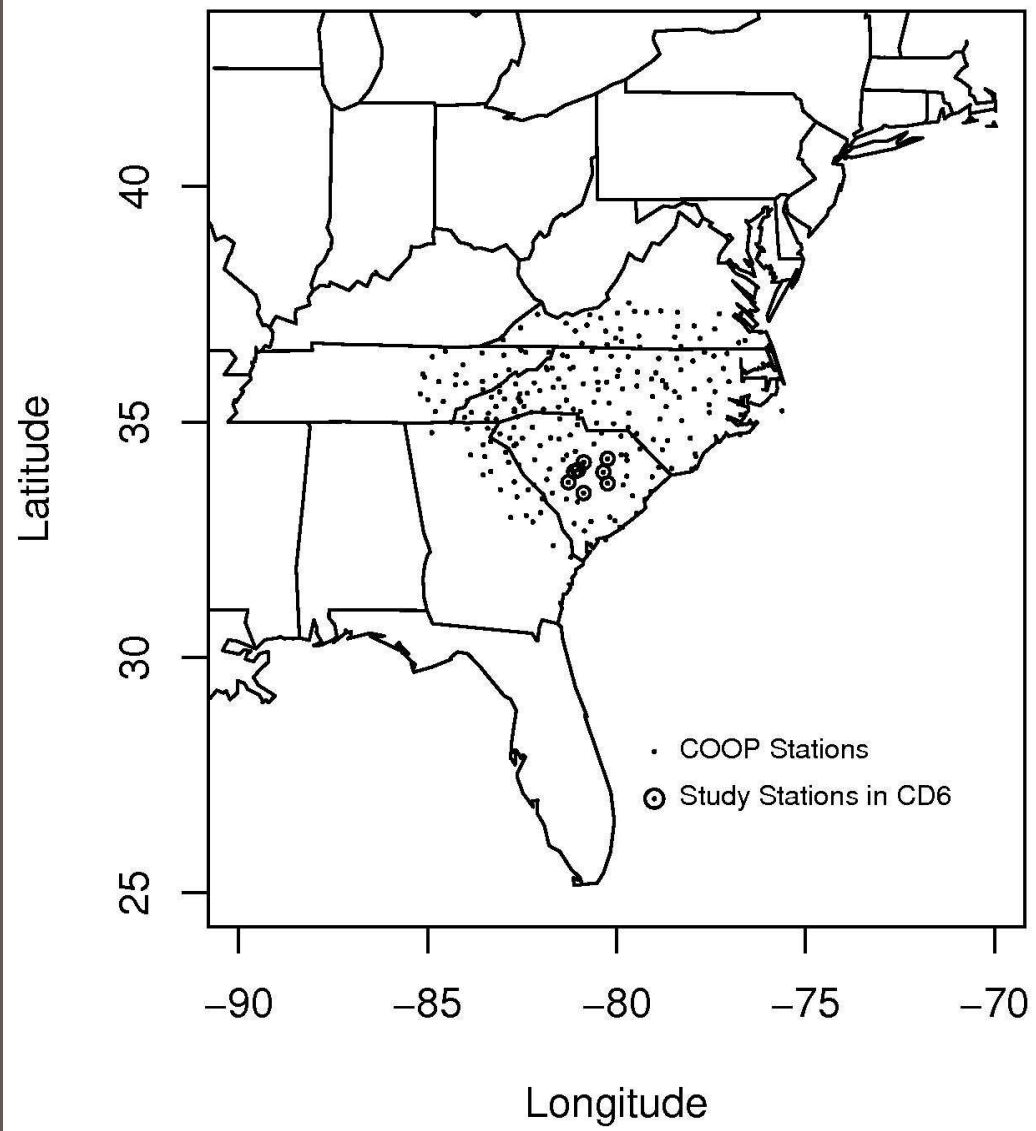


Residual Resampling

- Modified approach to K-NN technique
- Using Non-parametric regression
- Applied in ensemble streamflow forecasts, Prairie et al. (2006) *J. Hydrol. Eng.*, 11
- Ensemble can be generated beyond history

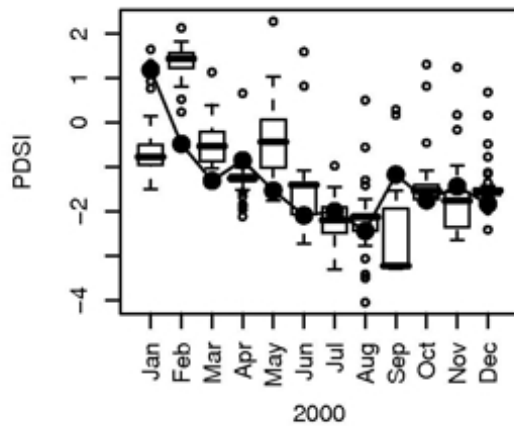


Central SC Region

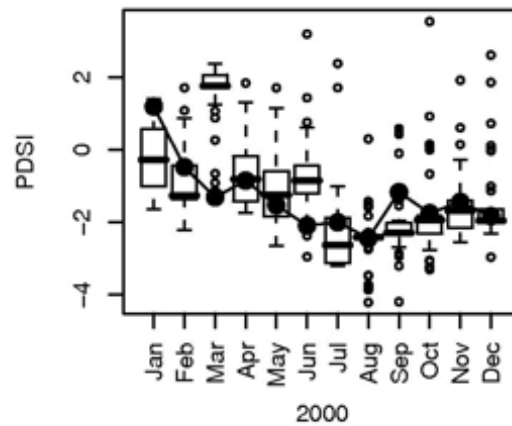


1-3 month lead PDSI forecast

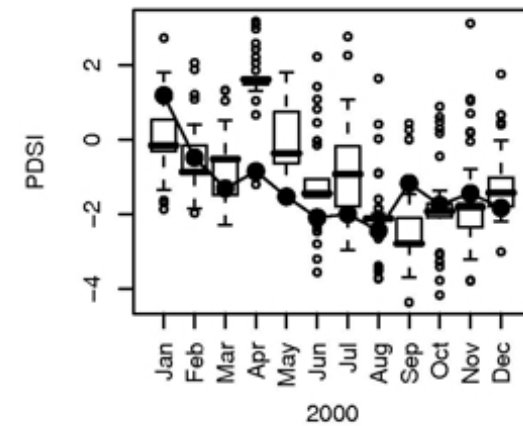
Lag-1 Forecast PDSI



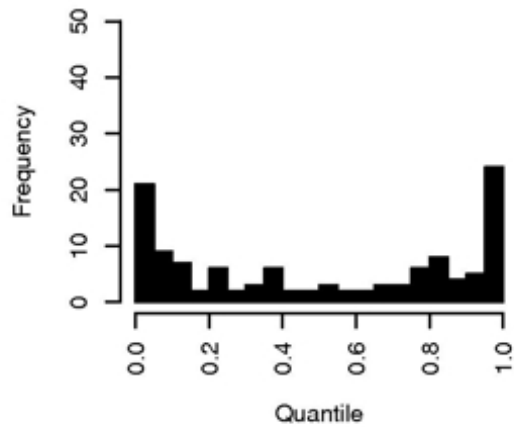
Lag-2 Forecast PDSI



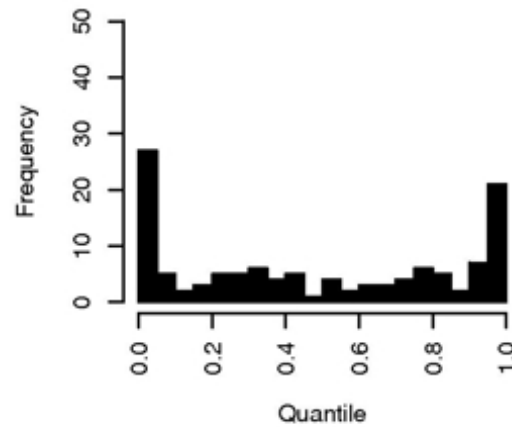
Lag-3 Forecast PDSI



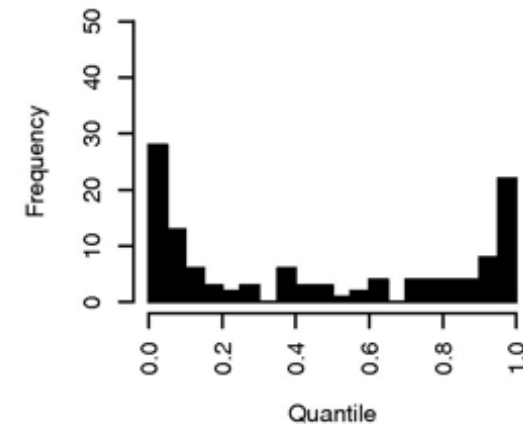
Lag-1 Rank Histogram



Lag-2 Rank Histogram

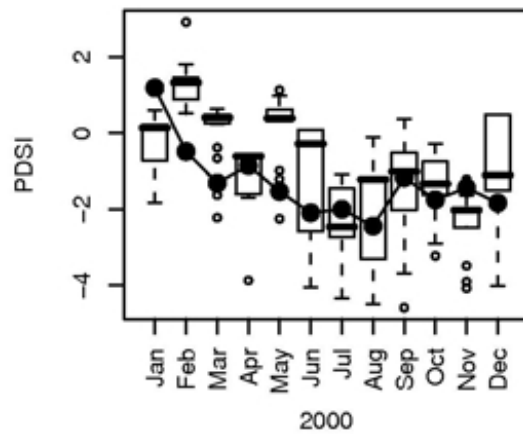


Lag-3 Rank Histogram

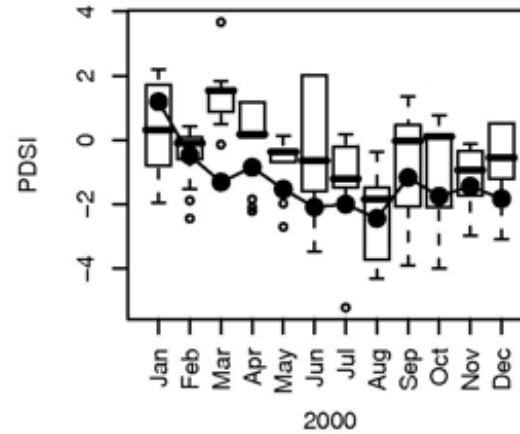


PDSI with CPC forecast

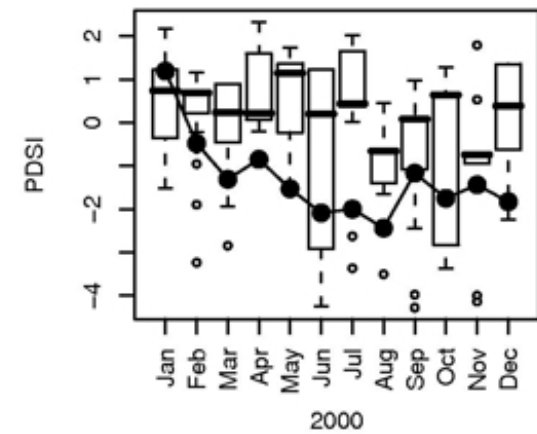
Lag-1 Forecast PDSI



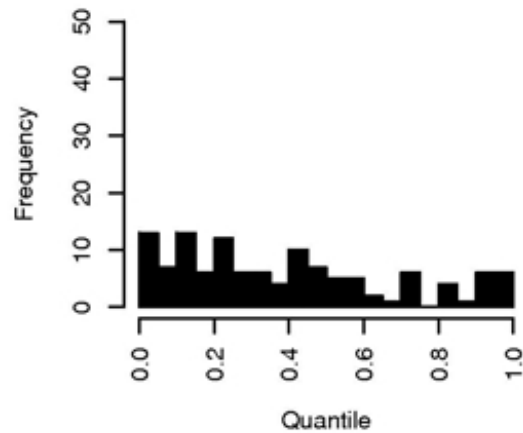
Lag-2 Forecast PDSI



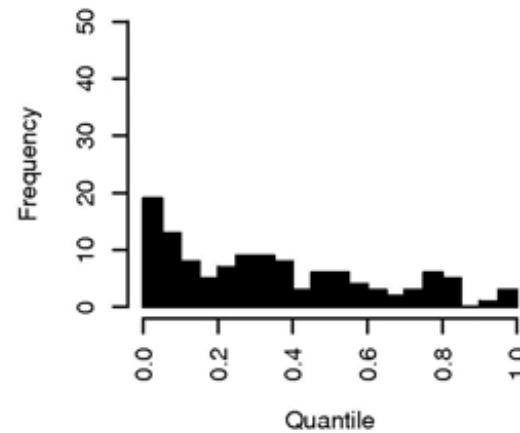
Lag-3 Forecast PDSI



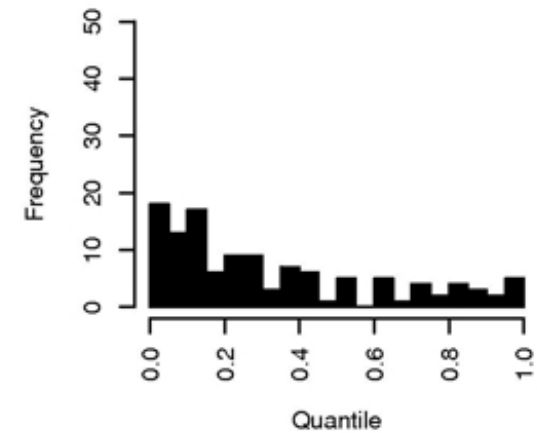
Lag-1 Rank Histogram



Lag-2 Rank Histogram

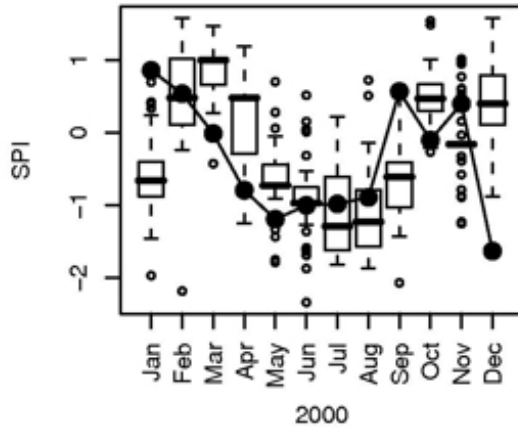


Lag-3 Rank Histogram

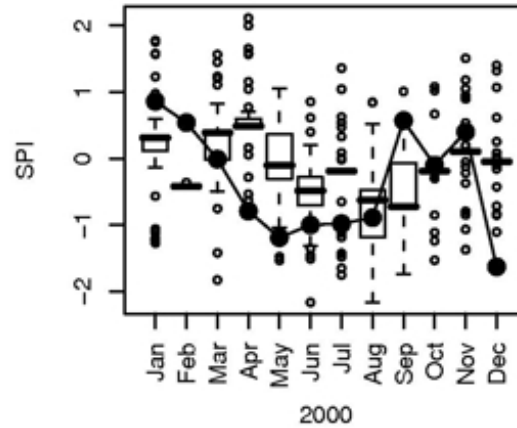


SPI forecast

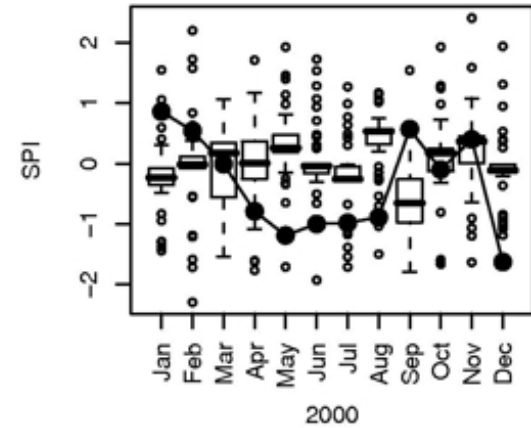
Lag-1 Forecast SPI-3



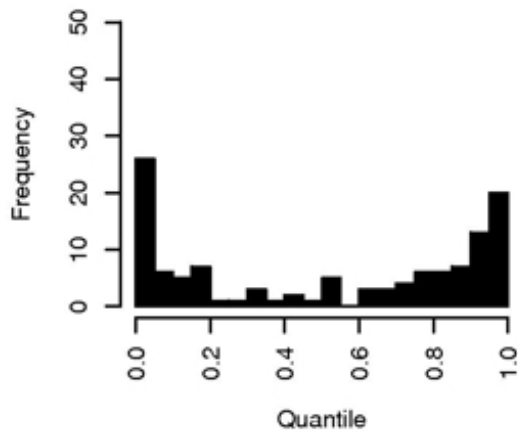
Lag-2 Forecast SPI-3



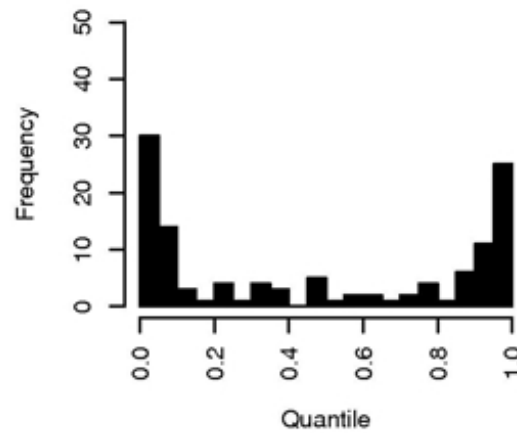
Lag-3 Forecast SPI-3



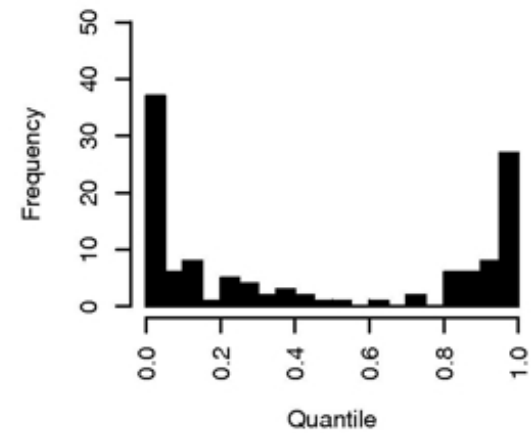
Lag-1 Rank Histogram



Lag-2 Rank Histogram

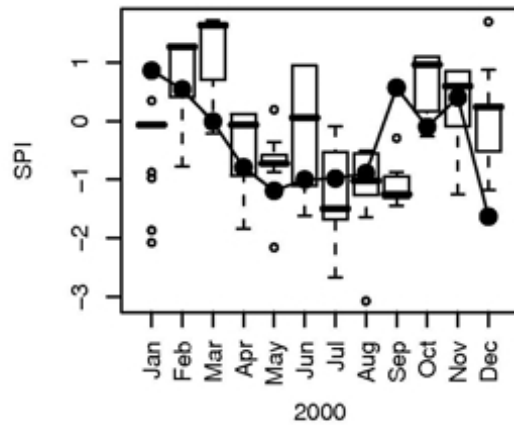


Lag-3 Rank Histogram

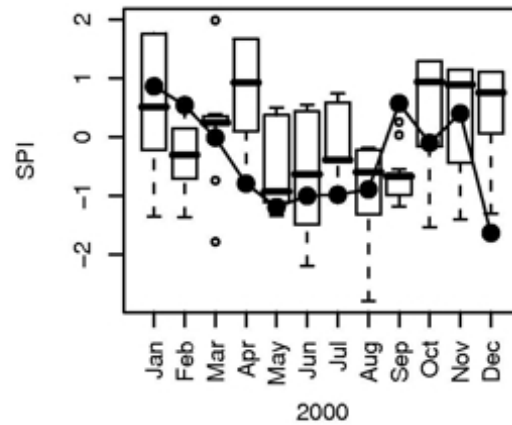


SPI with CPC forecast

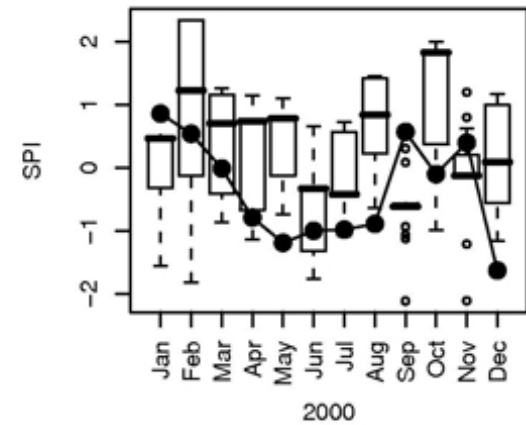
Lag-1 Forecast SPI-3



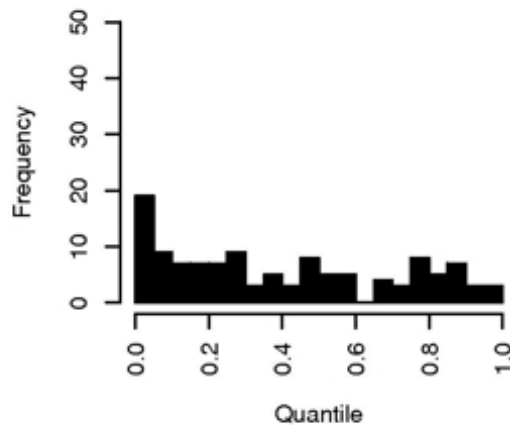
Lag-2 Forecast SPI-3



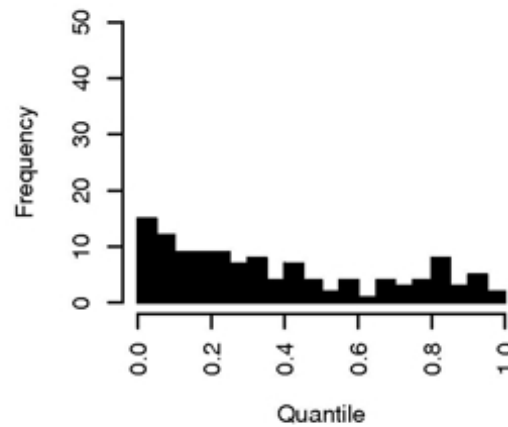
Lag-3 Forecast SPI-3



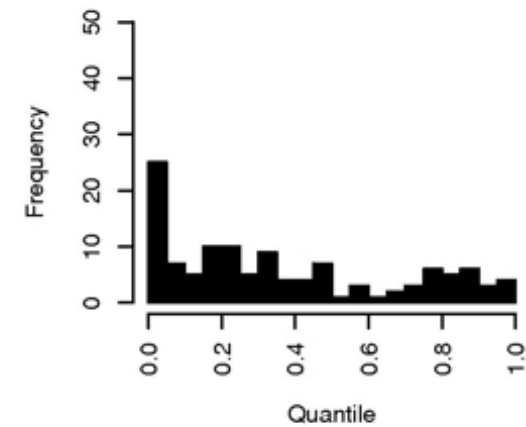
Lag-1 Rank Histogram



Lag-2 Rank Histogram



Lag-3 Rank Histogram



Mixed
improvements in
ensemble forecasts
with CPC outlook

1996-2004

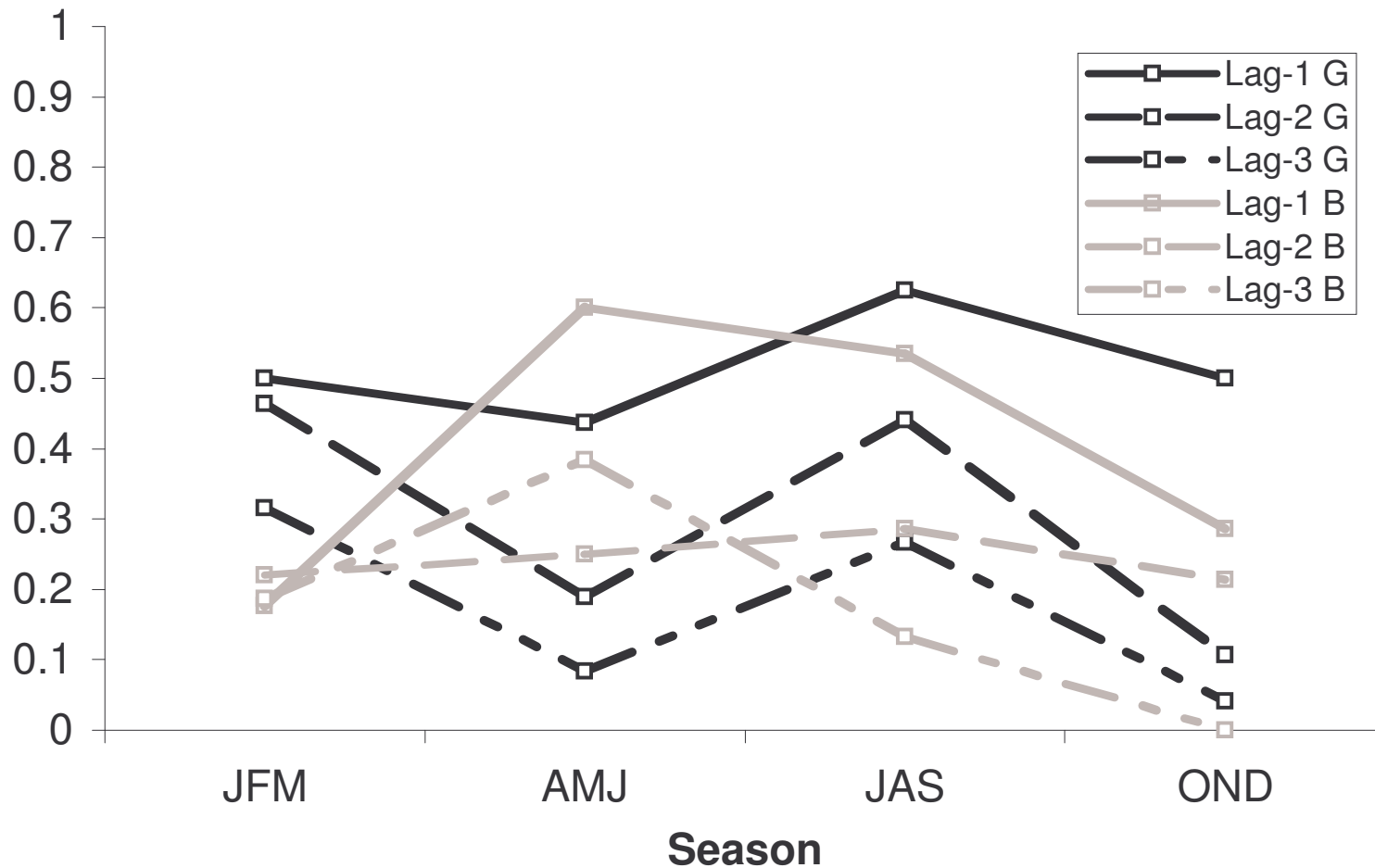
KSS of CPC Outlook ranges

-0.27~0.66 (temperature)

-0.16~0.43 (precipitation)

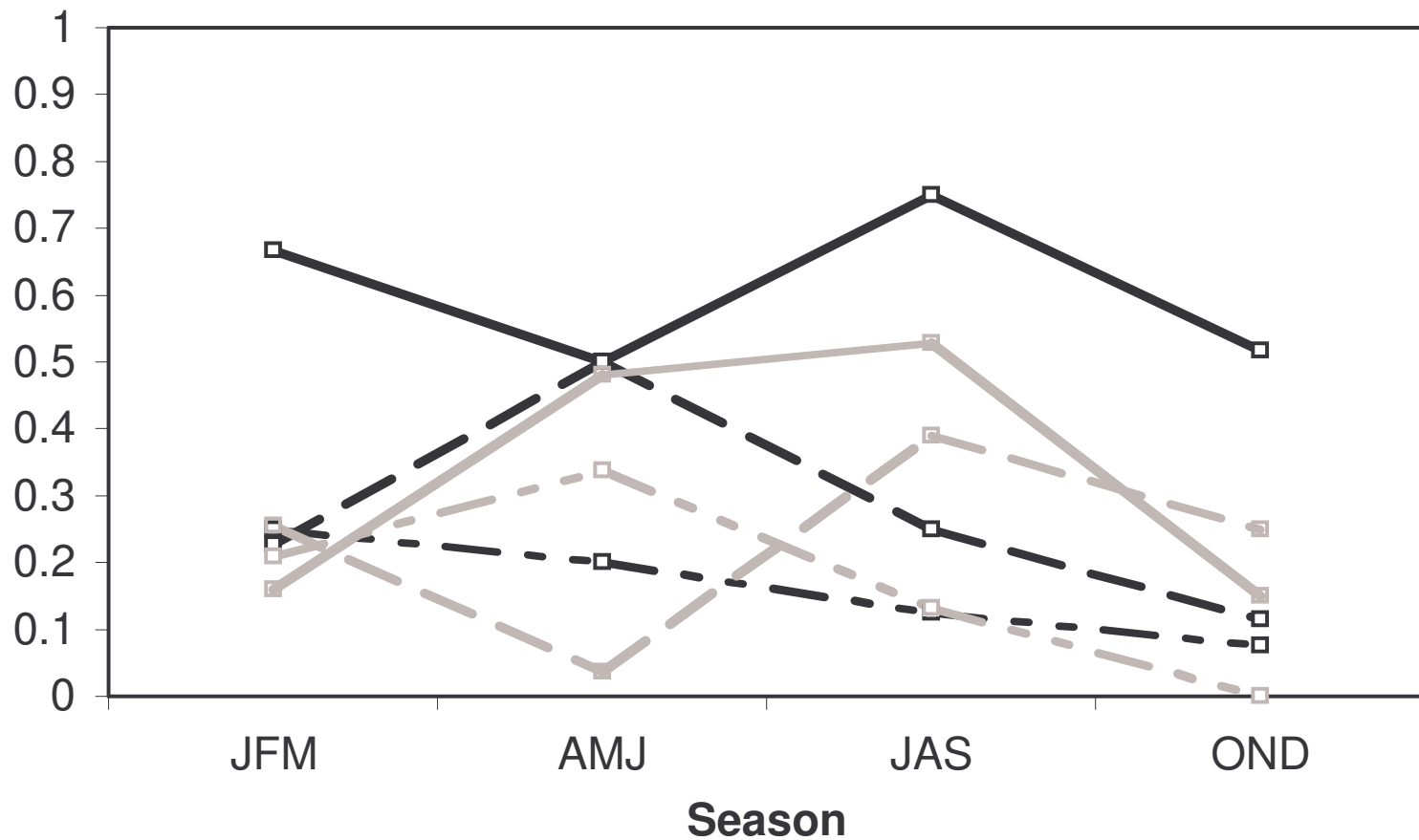
Mean forecast skills with different temperature outlook quality

(a)



Mean forecast skills with different precipitation outlook quality

(b)



Findings

- Auto-correlation confirmed in drought indices
- Conditional residual resampling for PDSI and SPI
- Ensemble forecast provide confidence interval for various stakeholders up to 3 month lead time
- Forecast skills vary with the quality of temperature and precipitation outlook

Further Research

- Physical connections with climate outlook quality
- Other climate outlooks for sampling (different time scale, spatial scale, etc)

Support from: NOAA Climate
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