# Linked Multi-Model Ensemble Disaggregation Framework: Application to the Upper Colorado River Basin

The following figures show the streamflow predictions of the linked multi-model disaggregation (LMED) framework. Seasonal (Apr-Jul) predictions were made at an index (I) gage. The I gage is a sum of the seasonal flows at four main gages in the Upper Colorado River Basin (Lees Ferry, Cisco, Bluff and Green River). The framework consists of

1. Identifying large-scale climate predictors using climate diagnostics [Grantz et al. 2005],
2. Generating multi-model ensemble (probabilistic) forecasts [Regonda et al. 2006],
3. Spatial disaggregation of the I gage predictions to the four sites [Prairie et al. 2007].

The flow at the I gage is is a function of various climate predictors and antecedant land conditions. The model has the form

$$\text{I gage seasonal flow} = f(\text{climate predictors})$$

where f is obtained using local polynomial regression. The climate predictors included here were 500 mb geopotential height, zonal winds, meridonal winds, sea surface temperature and the Palmer drought severity index.

The predictions were made using retroactive (i.e. realistic) forecasting where only data from previous years were used in the forecasting of any given year (1990-2005). The skill of the forecast is measured using the ranked probability skill score (RPSS) and the median correlation (MC). The RPSS is a categorical measure of forecast skill which has a value in the interval $(-\infty, 1]$. An RPSS value is calculated for every year and the median value is shown. For example the April 1 prediction is 87% better than the climatological prediction (i.e. 1/3 probability of wet/middle/dry year). The median correlation is the correlation between the median ensemble forecast and the observed flow value.

The predictions shown here are the result of the disaggregation of the I gage flow to the four sites. The forecasts are of natural flow. In April and January the LMED forecasts are compared to the CBRFC forecast (which has been converted to natural flow).

## References


Katrina Grantz, Balaji Rajagopalan, Martyn Clark, and Edith Zagona. A technique for incorporating large-scale climate information in basin-scale ensemble streamflow forecasts. *Water Resources Research*, 41, 2005.

James Prairie, Balaji Rajagopalan, Upmanu Lall, and Terrance Fulp. A stochastic nonparametric technique for space-time disaggregation of streamflows. *Water Resources Research*, 2007.

Satish Kumar Regonda, Balaji Rajagopalan, Martyn Clark, , and Edith Zagona. A multimodel ensemble forecast framework: Application to spring seasonal flows in the gunnison river basin. *Water Resources Research*, 42, 2006.

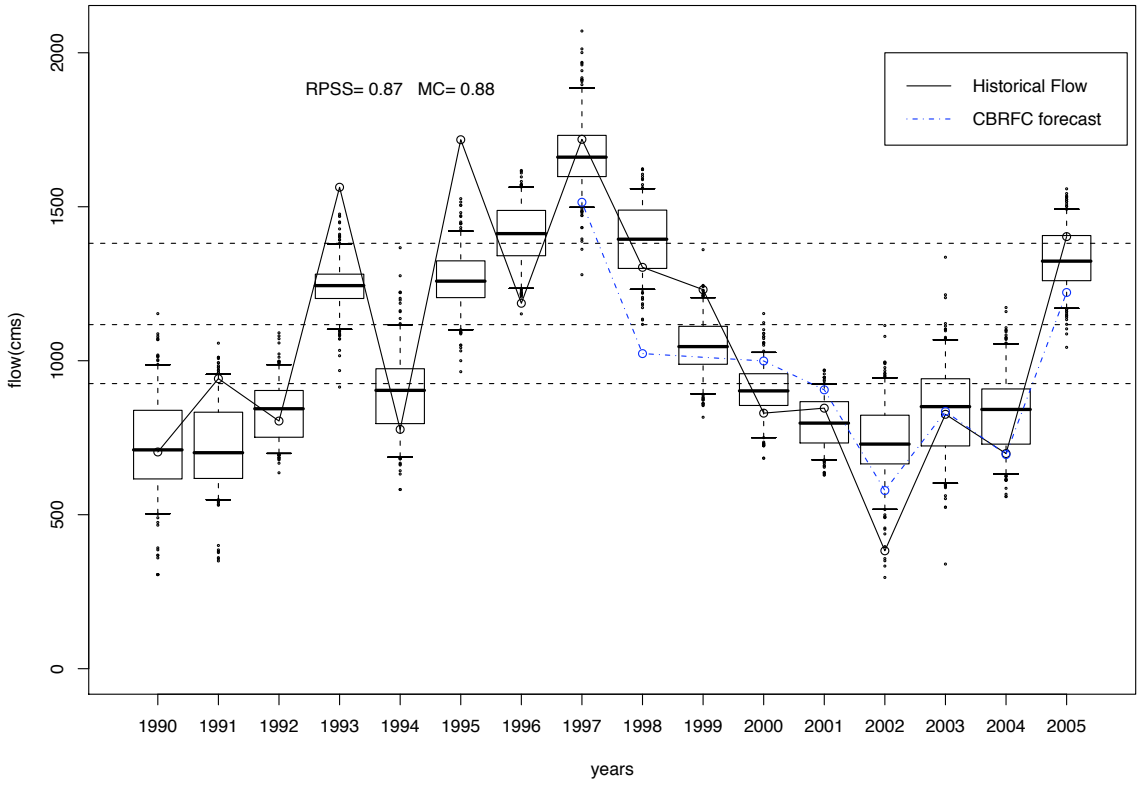


Figure 1: April 1 Lees Ferry disaggregation retroactive forecast

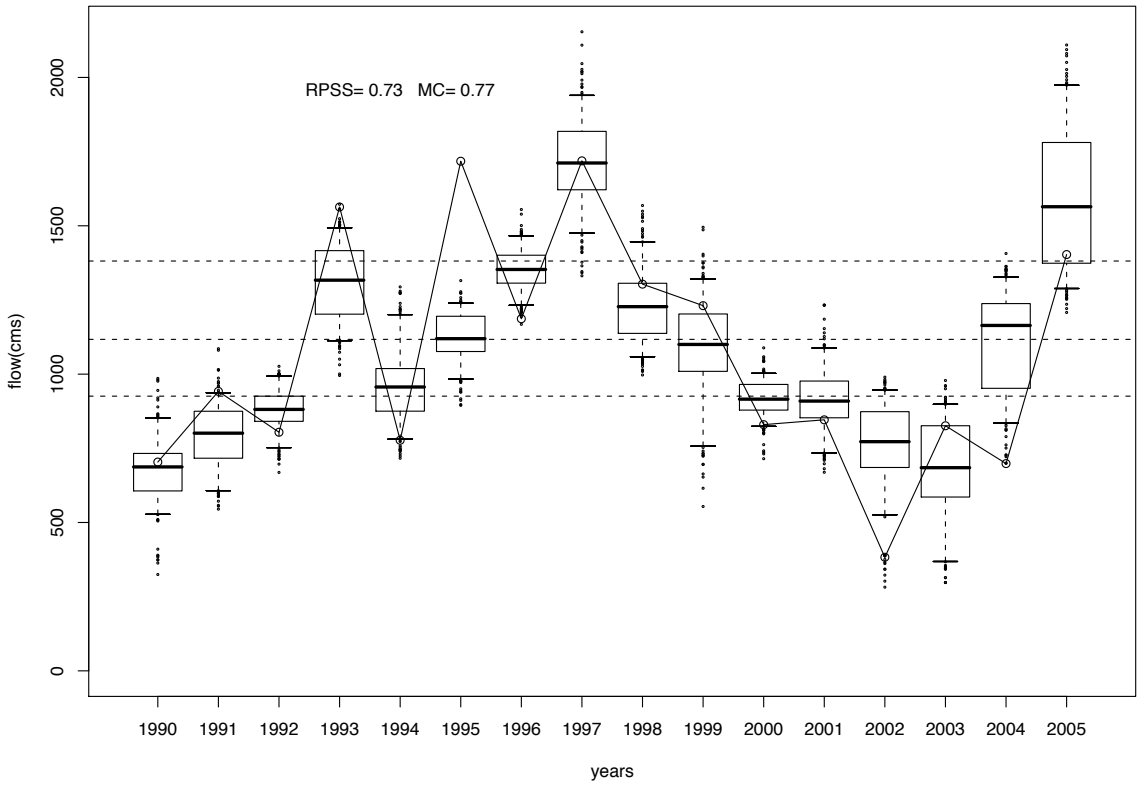


Figure 2: February 1 Lees Ferry disaggregation retroactive forecast

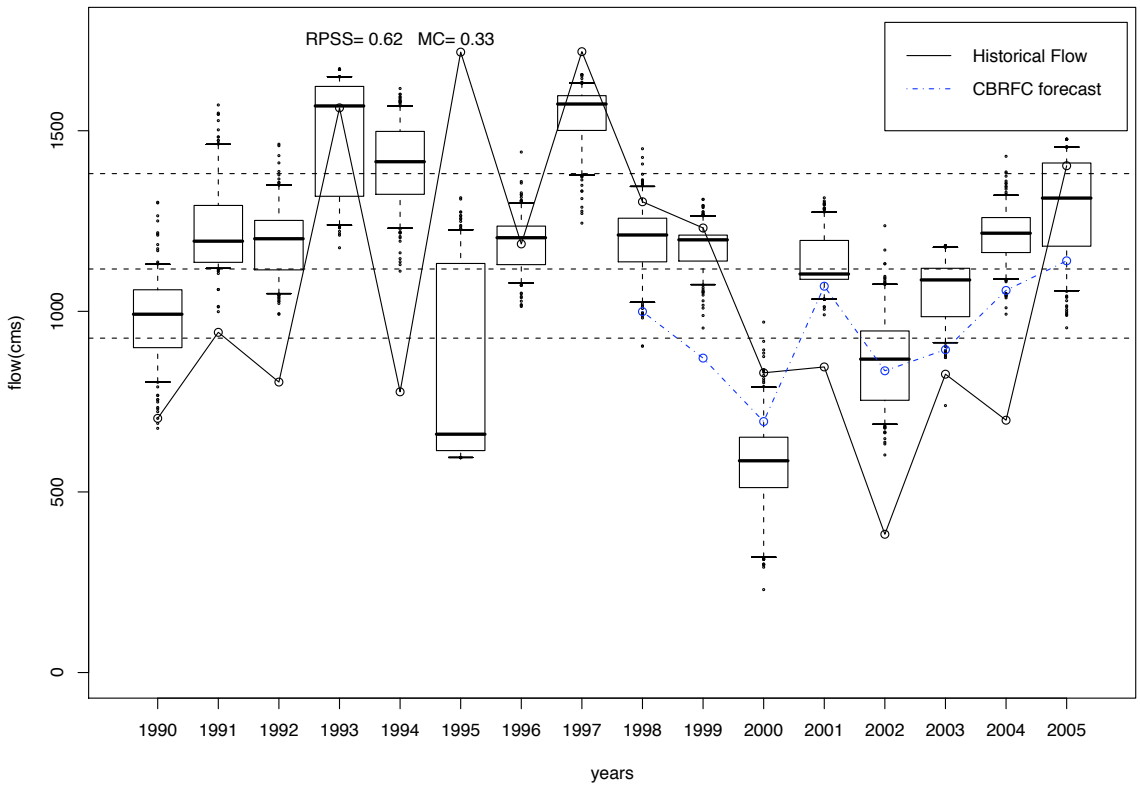


Figure 3: January 1 Lees Ferry disaggregation retroactive forecast

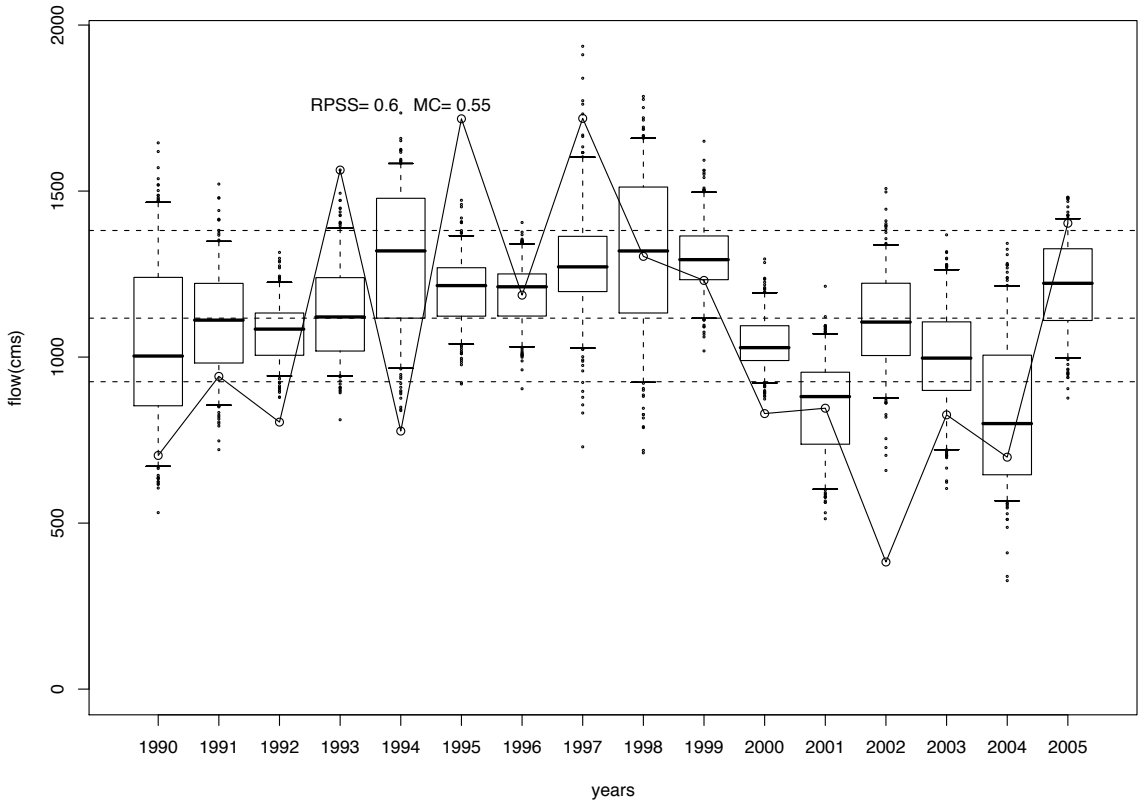


Figure 4: November 1 Lees Ferry disaggregation retroactive forecast