The effects of post-processing on the performance of reservoir inflow at Itaipu (Brazil / Paraguay)

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General aims of our research:
- To develop a system for making seasonal hydrological forecasts for South America
- To optimize the forecasts for stations in South-east Brazil with post-processing
- To analyse the skill and the components of the skill of the system

Post-processing:
- Aim: to minimize the bias and to minimize dispersion errors
- Method: ensemble model output statistics (EMOS) – Gneiting et al. (2005)
- separation of training and test data: leave-one-year-out

System:
- WUSHP: Wageningen University Seamless Hydrological Prediction system
- Domain: South America; resolution 0.5 x 0.5 degrees
- Forcing from ECMWF SEAS5: starts each month, 25 members, 7 months forecast time, 1981 -2015
- No bias correction to forcing
- Hydrological model: VIC
- Initial conditions from historical simulation (with WFDEI forcing)

Skill of inflow Itaipu reservoir before and after post-processing

Lead month 1

Lead months 1 (red), 2 (blue), 3 (green) 4 (red), 5 (blue), 6 (green)

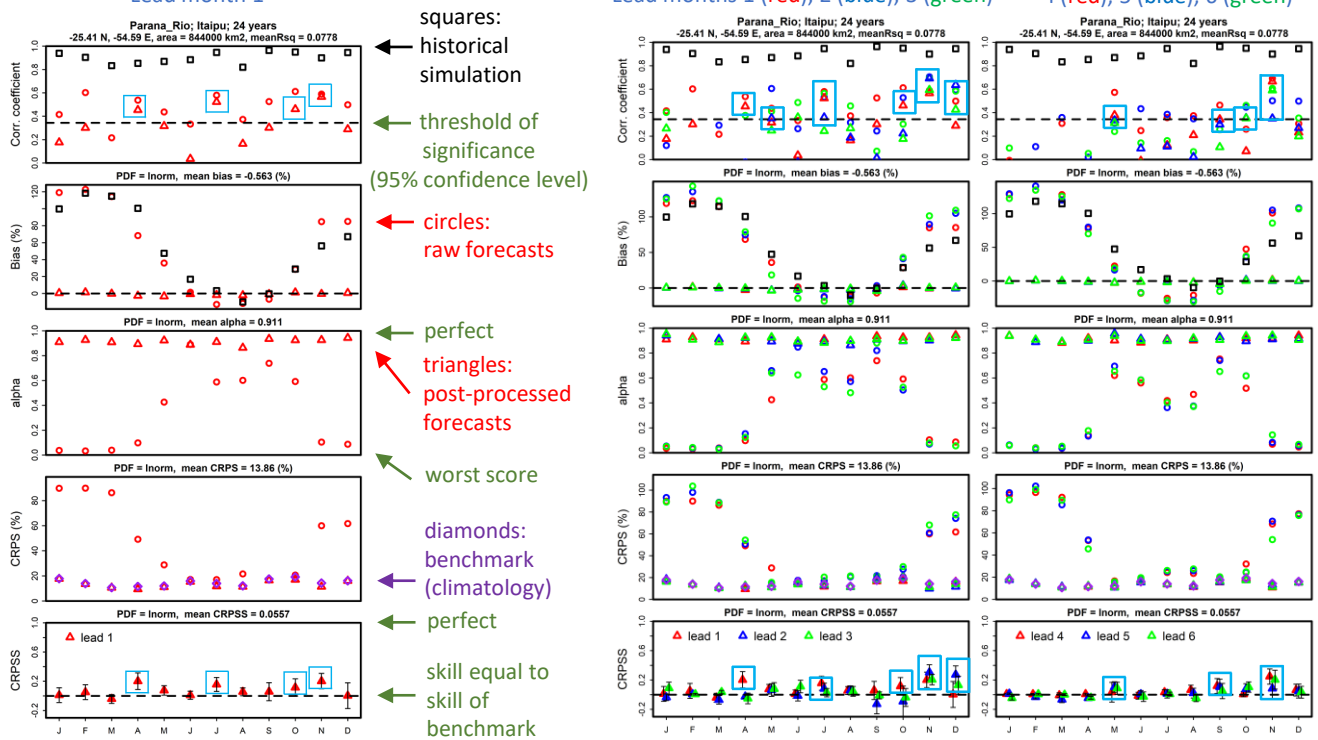
Correlation coefficient [discrimination skill]

Bias

Alpha from PIT diagram [reliability = bias + spread]

CRPS [discrimination + reliability]

CRPSS



squares: historical simulation

threshold of significance (95% confidence level)

circles: raw forecasts

perfect

triangles: post-processed forecasts

worst score

diamonds: benchmark (climatology)

perfect

skill equal to skill of benchmark

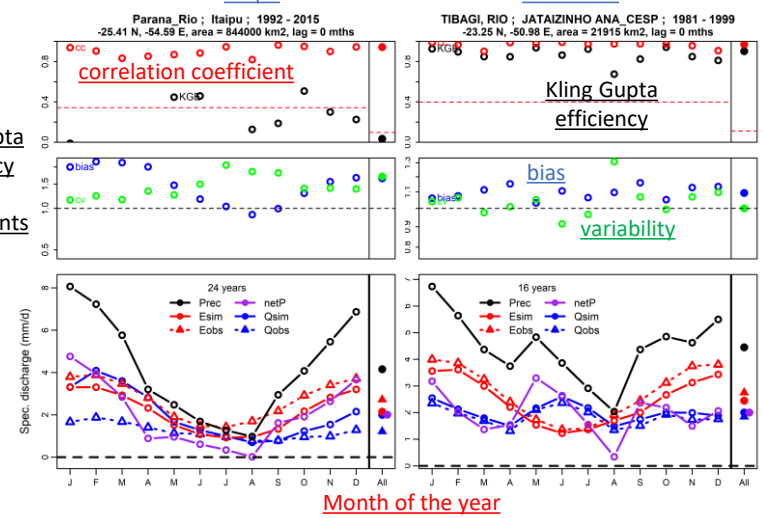
Conclusions
- At Itaipu seasonal forecasts of streamflow have significant skill for a large number of combinations of lead and target months (blue boxes)
- Not shown here: this is essentially due to skill in the forecasts of the meteorological forcing and not to the initial conditions
- Post-processing is essential for providing useable forecasts
- Post-processing is successful in reducing biases and in adjusting the spread of the ensembles

Evaluation of the historical simulation

Itaipu Jataizinho

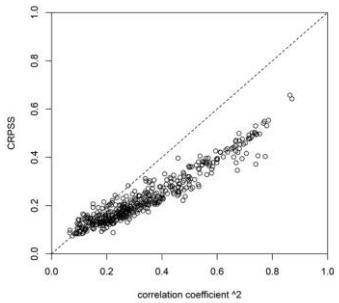
Kling Gupta Efficiency and its components

Mean annual cycles of (net) precipitation, ET and discharge



Conclusions:
- In the catchment of Itaipu precipitation seems to be overestimated
- For some stations WUSHP provides excellent simulations

Relation between correlation coefficient and CRPSS



Each symbol:
- Monthly mean
- One of ~40 stations in the catchments of the Párana and the Sao Francisco
- One of the 12 target months and one of the 7 lead months

Conclusion:
- After post-processing the relation between CRPSS and the correlation coefficient is not far from being unique
- We also found that the CRPSS is related to other discrimination skill metrics (ROC, RPS, 2AFC) but there is more spread around a unique relation