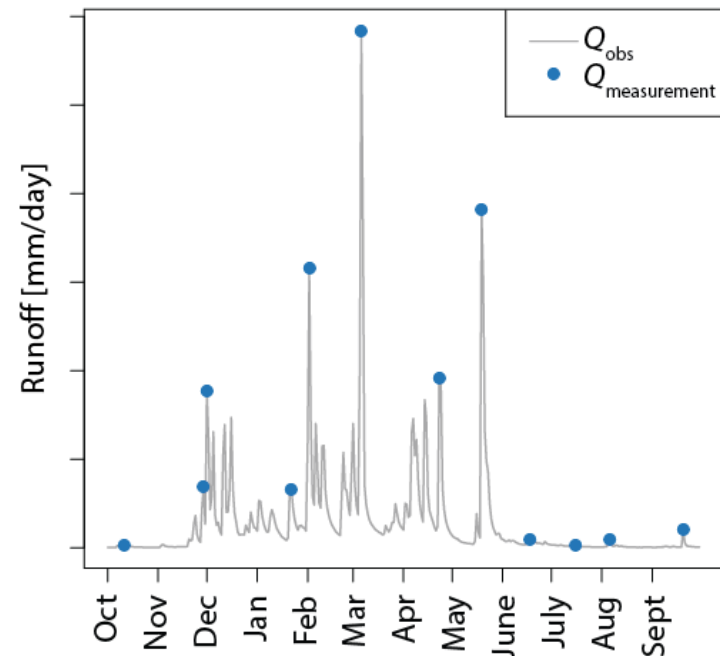


Prediction in almost ungauged catchments:

Which runoff measurements are most informative for constraining a bucket-type hydrological model?

Sandra Pool
Daniel Viviroli
Jan Seibert

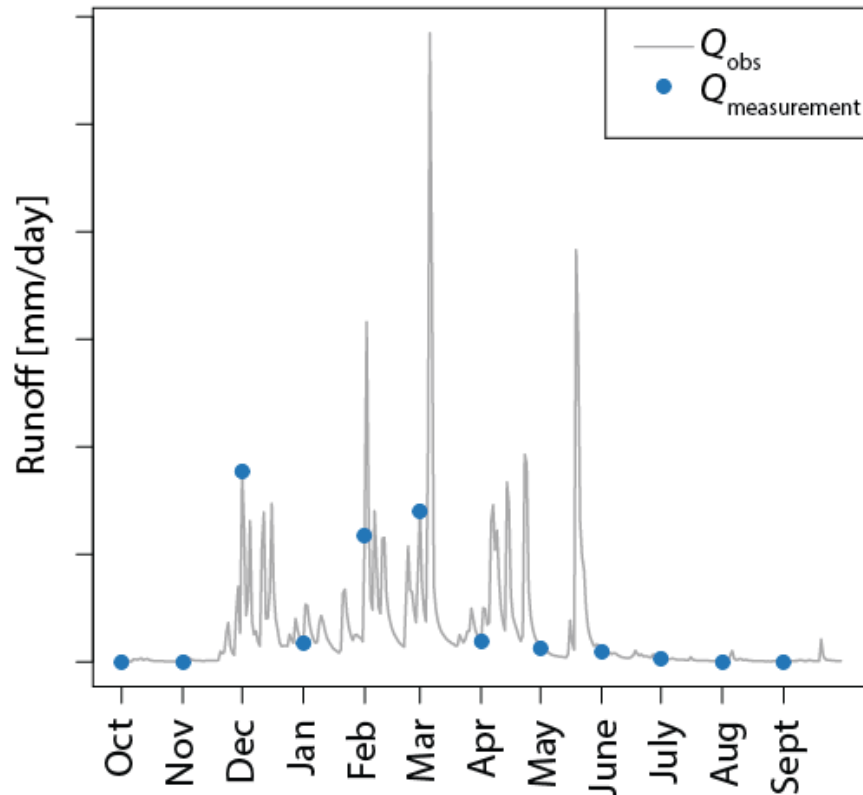
Contact: sandra.pool@geo.uzh.ch



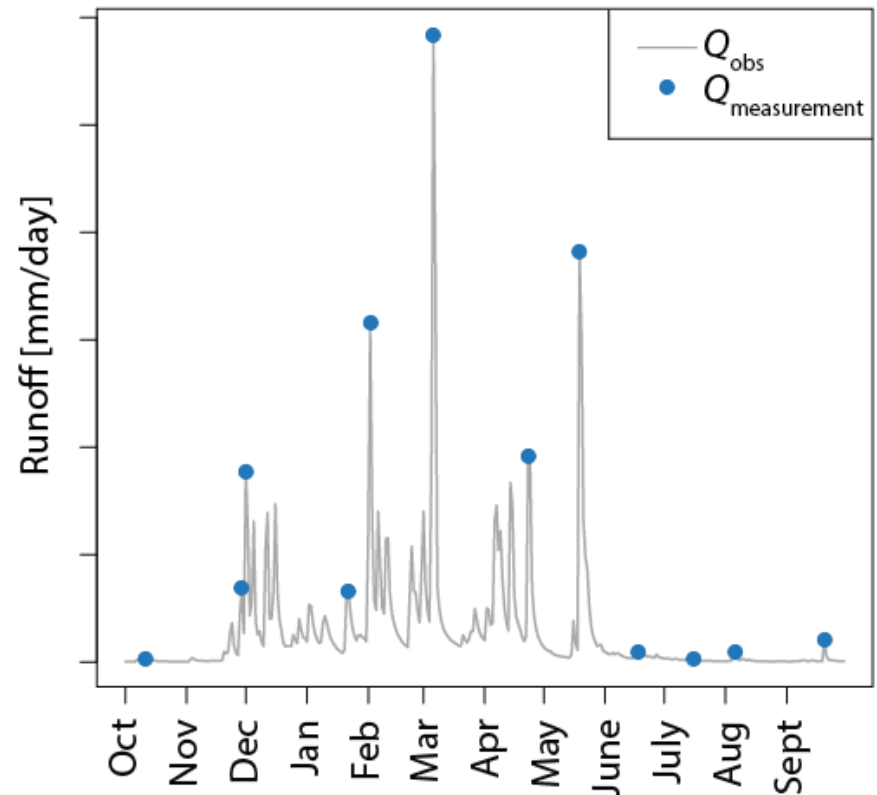
Prediction in almost ungauged catchments:

... when would you measure runoff?

Practical aspect:

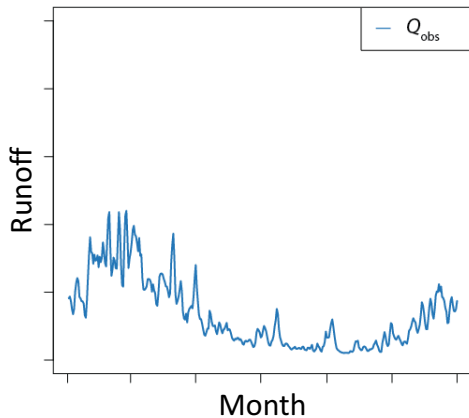
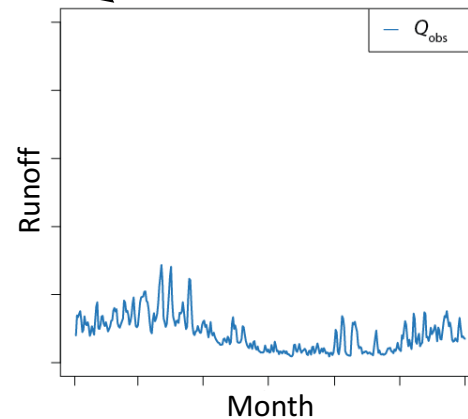
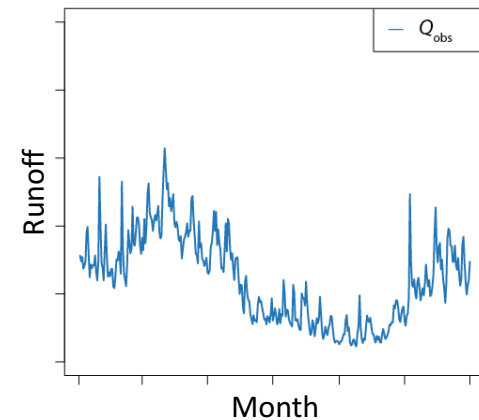
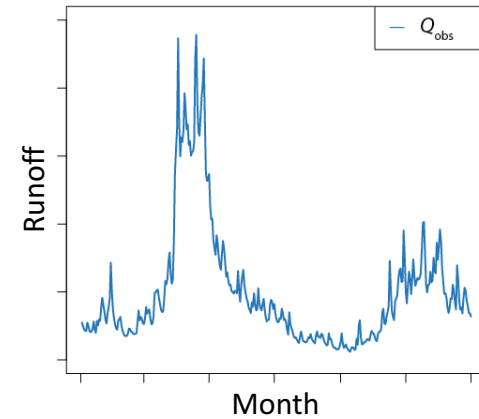
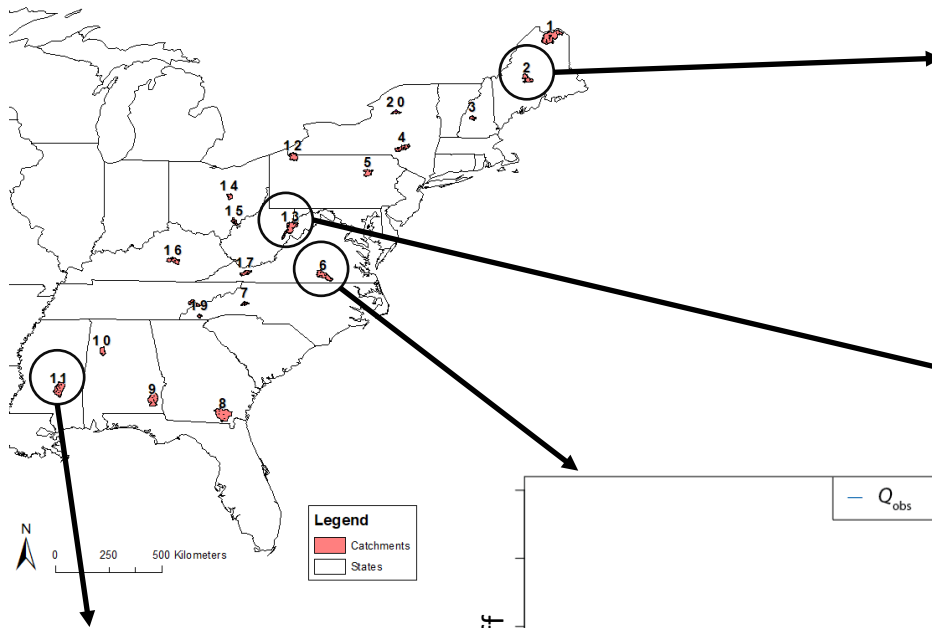


Use of hydrological knowledge:



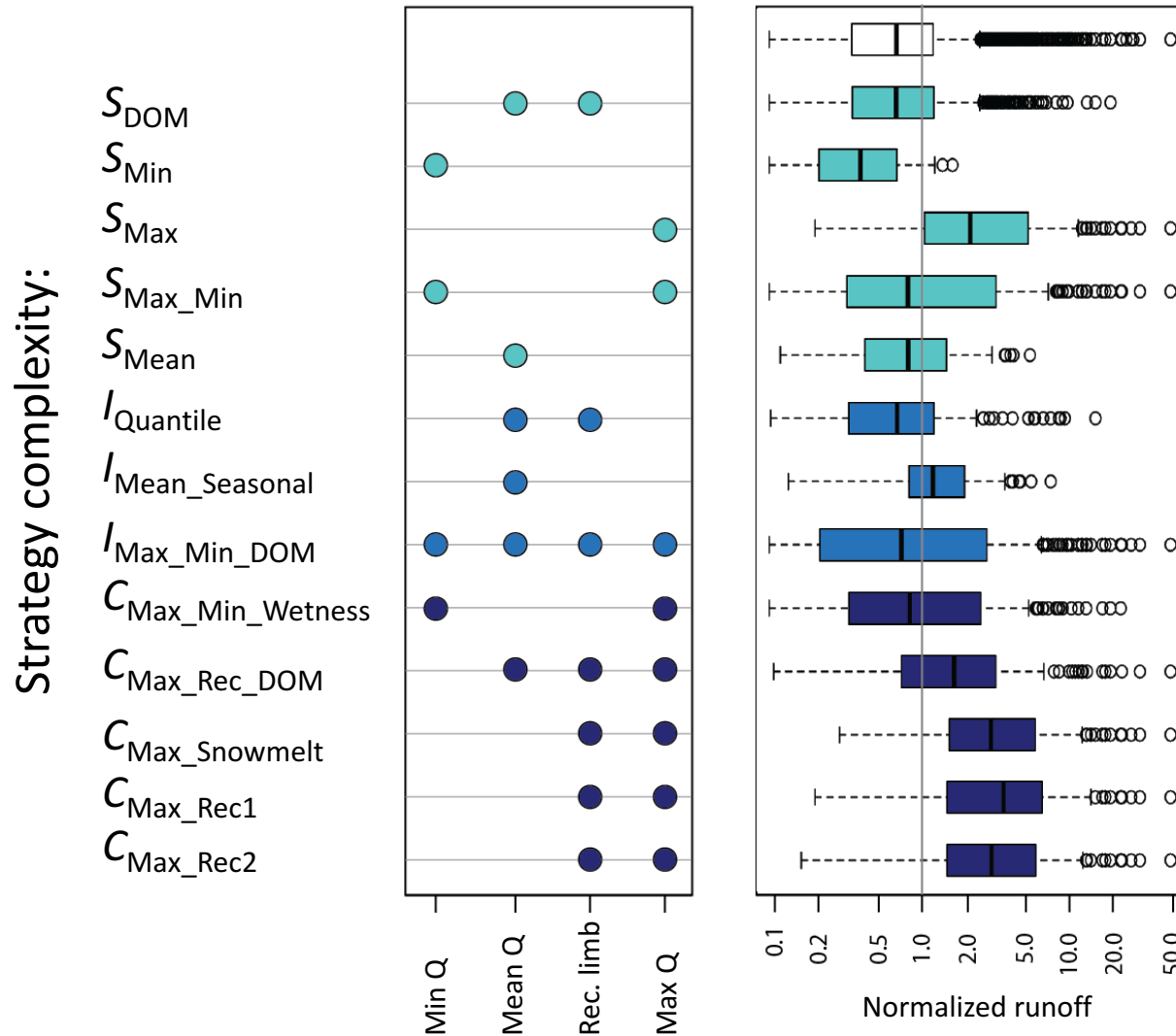
20 catchments across Eastern USA:

Runoff, precipitation and potential evaporation
for the period 1980-2010



13 measurement strategies:

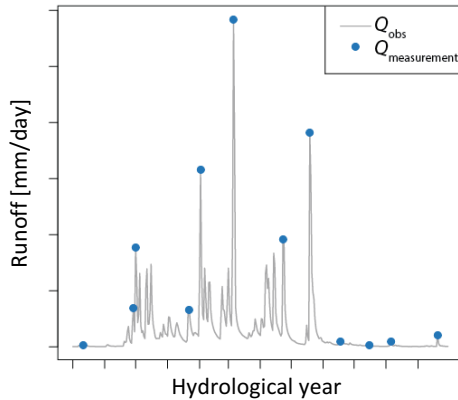
Runoff magnitudes:



**12 runoff
measurements
per year**

Modelling framework:

① Measurement strategy



② Upper benchmark

Continuous daily
runoff of 14 years

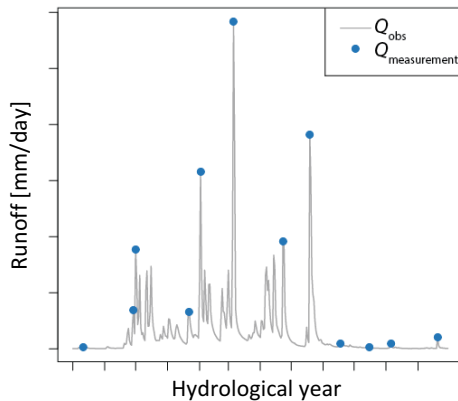
③ Lower benchmark

1 000 random
parameter sets

HBV runoff model

Modelling framework:

① Measurement strategy



② Upper benchmark

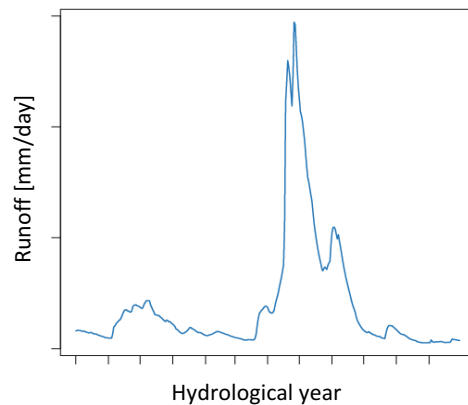
Continuous daily
runoff of 14 years

③ Lower benchmark

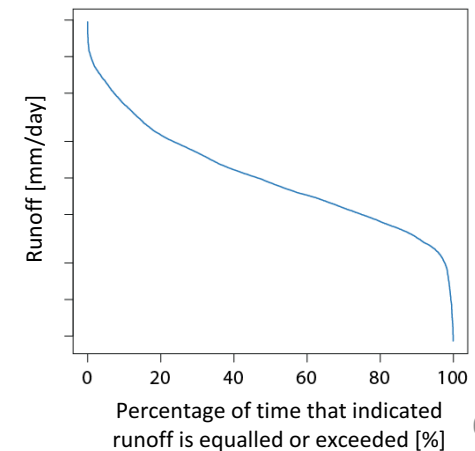
1 000 random
parameter sets

HBV runoff model

① Hydrograph



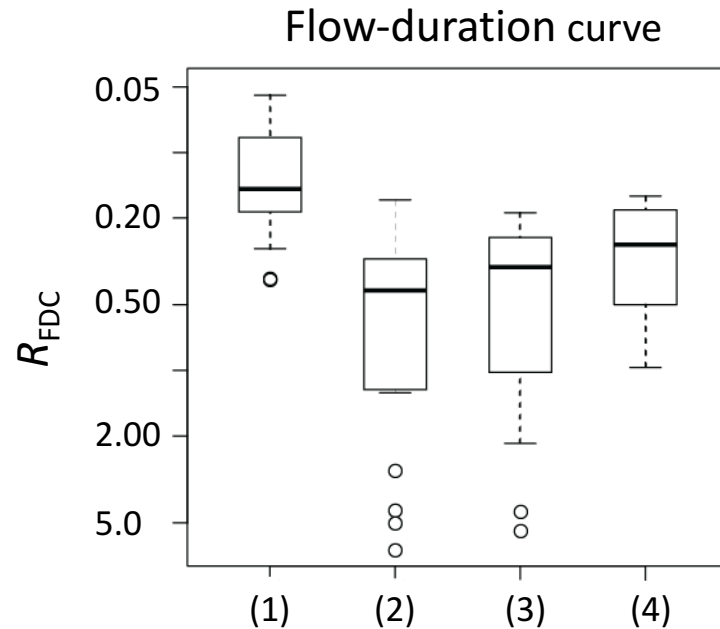
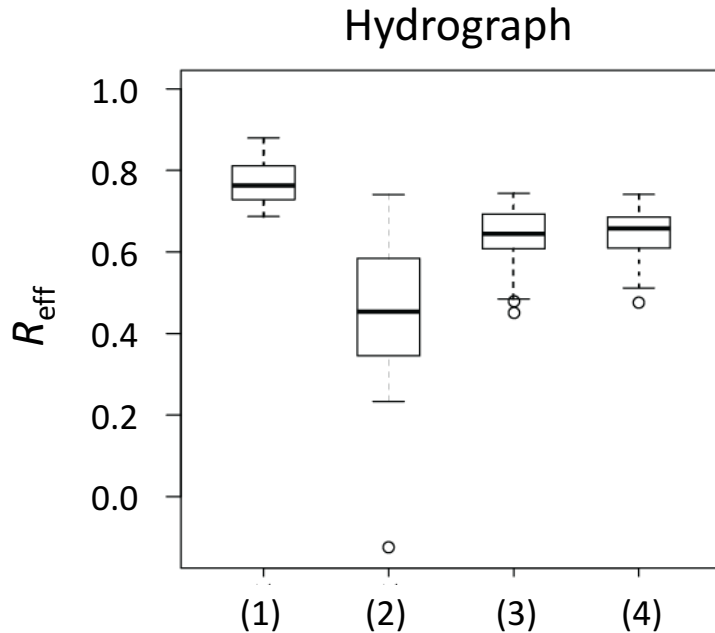
② Flow-duration curve



$$R^* = \frac{R_{ss} - R_{lb}}{R_{ub} - R_{lb}}$$

Results:

How does the model perform when calibrated with...?

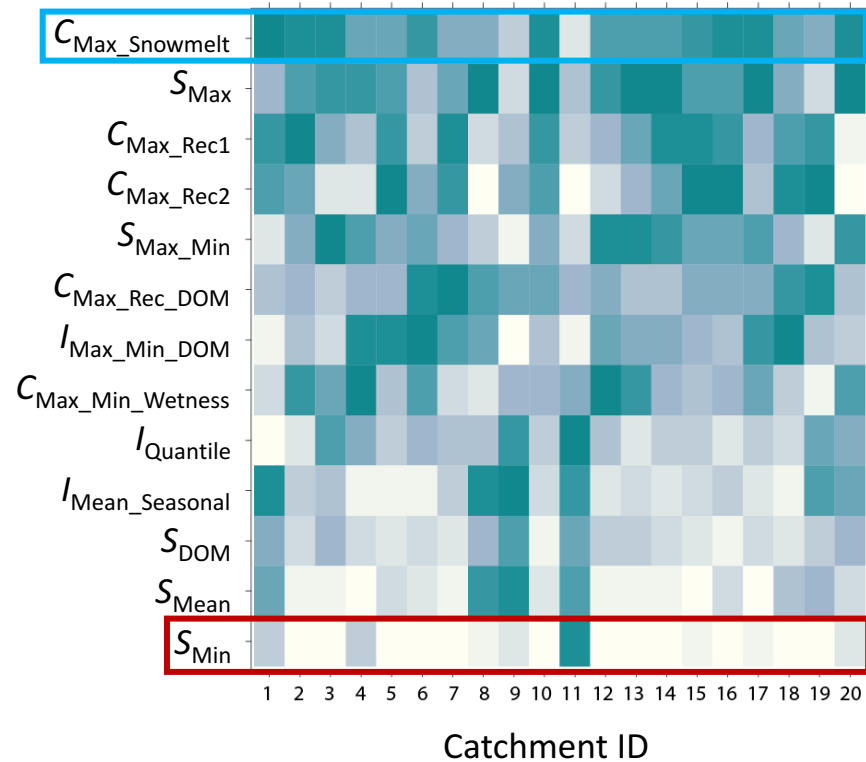


- Upper benchmark (1)
- Lower benchmark (2)
- Measurement strategies using R_{eff} for calibration (3)
- Measurement strategies using $R_{\text{eff_logQ}}$ for calibration (4)

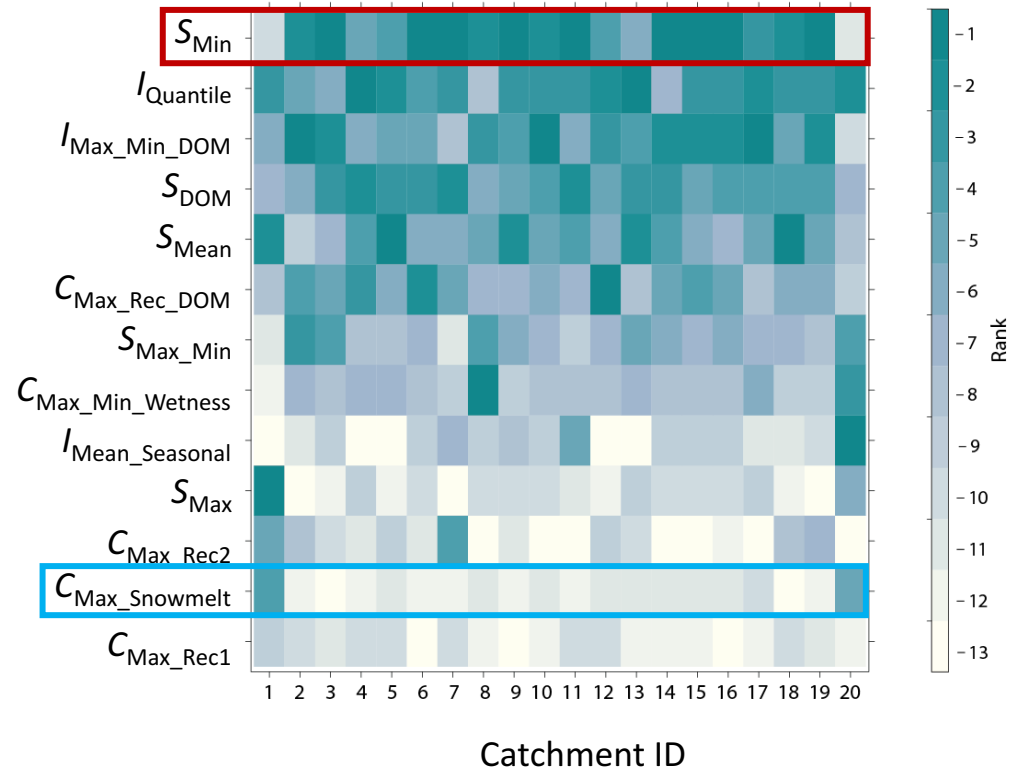
Results:

Which is the best measurement strategy?

Hydrograph



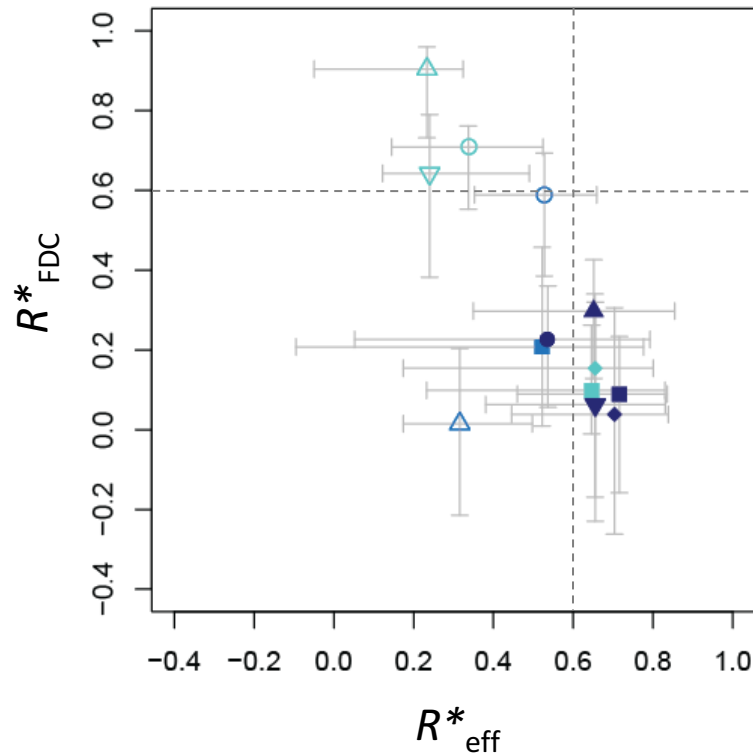
Flow-duration curve



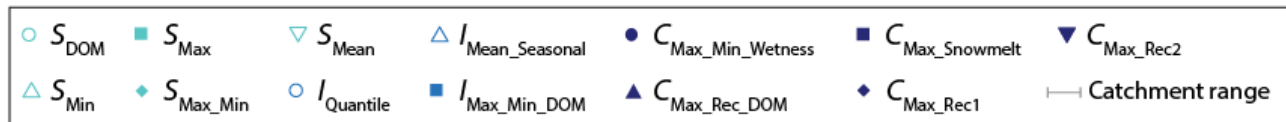
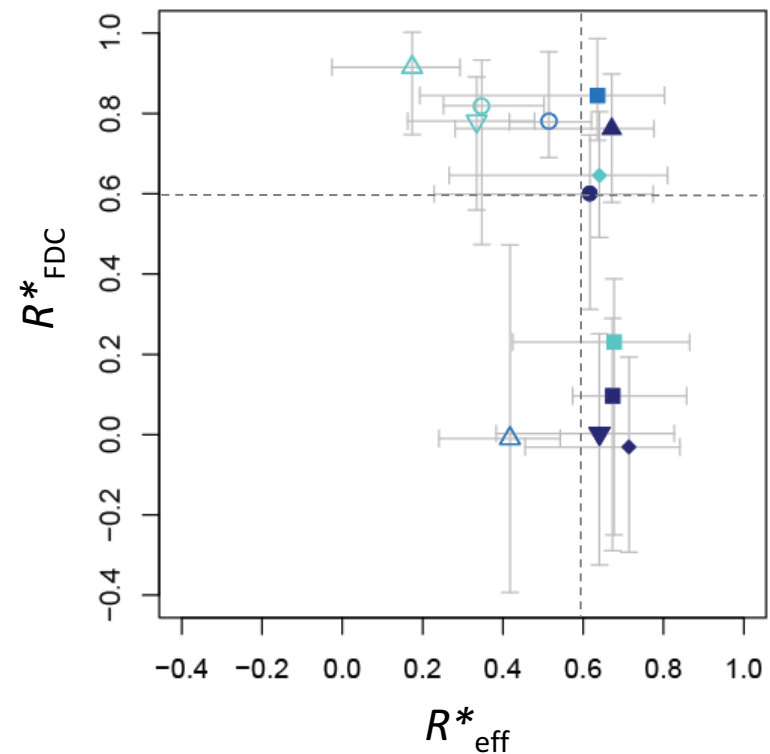
Results:

How does the objective function influence the ranking of measurement strategies?

Calibration with R_{eff}



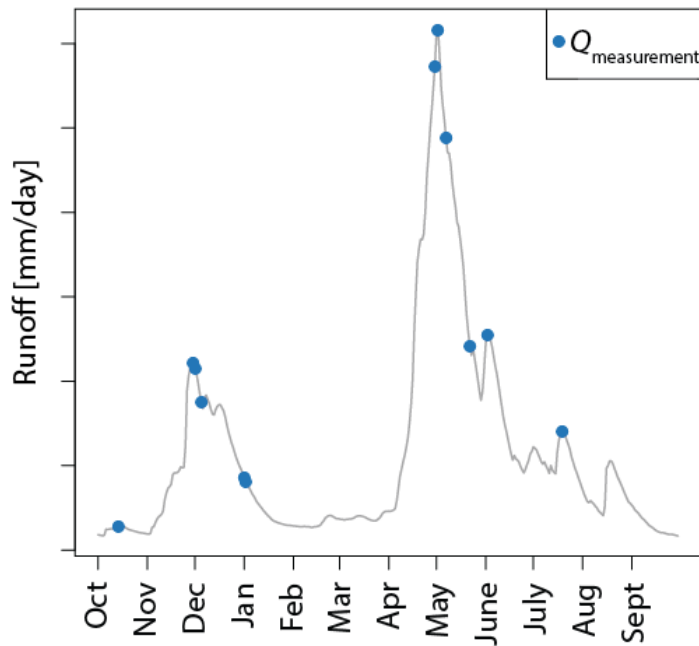
Calibration with $R_{\text{eff_logQ}}$



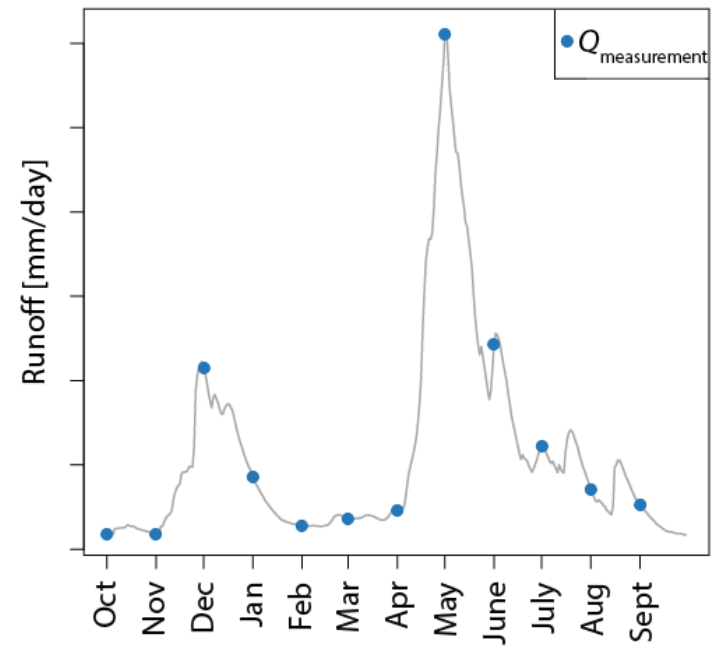
Take home message:

... when would you measure runoff?

Hydrograph



Flow-duration curve

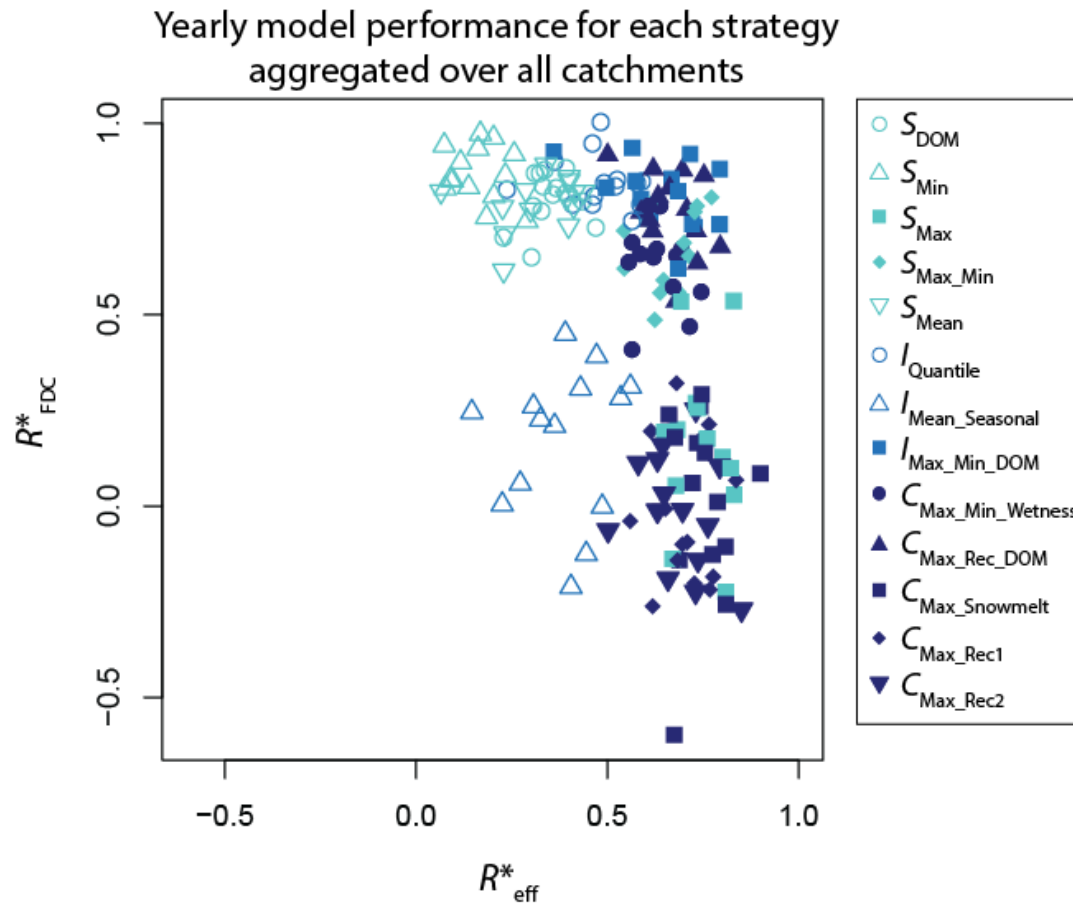


➡ High magnitude with recession data

➡ Low and mean flow conditions

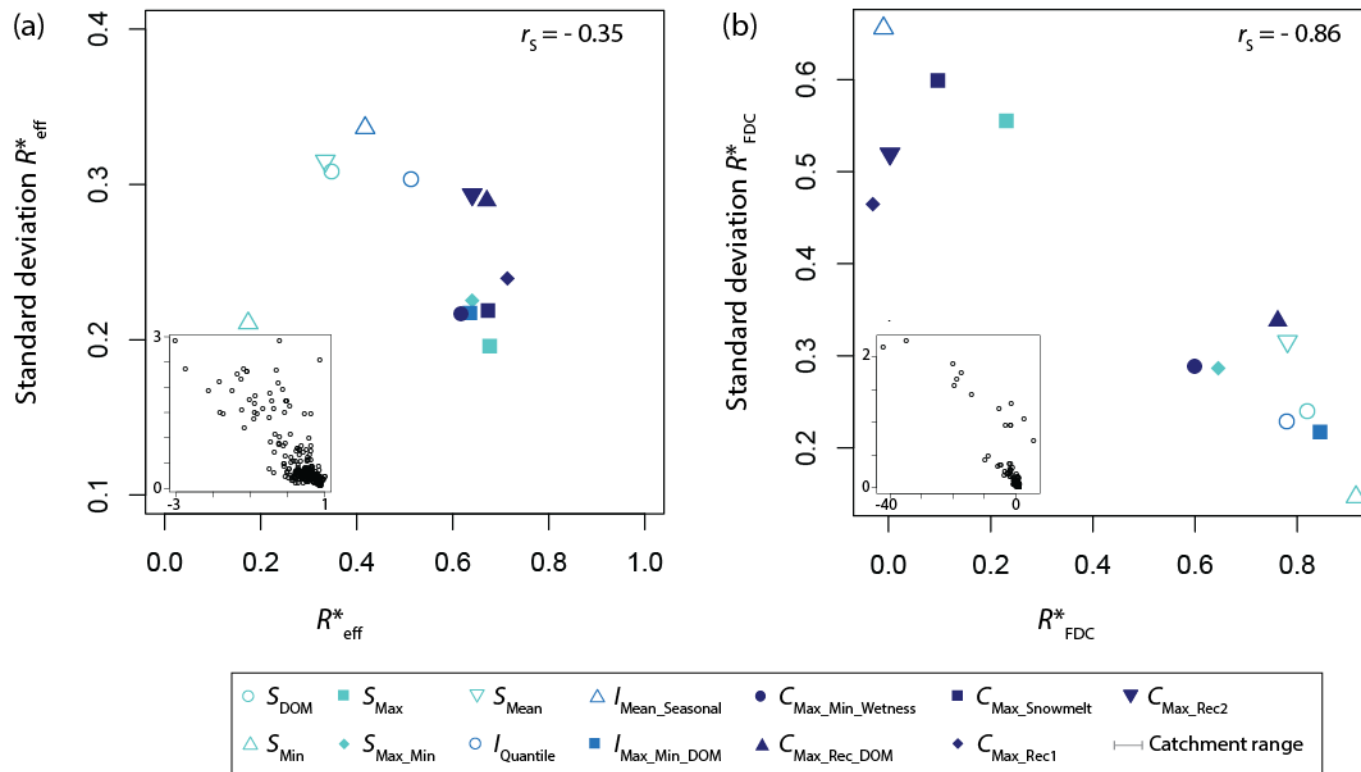
Results:

How consistent is the model performance over the 14 single calibration years?



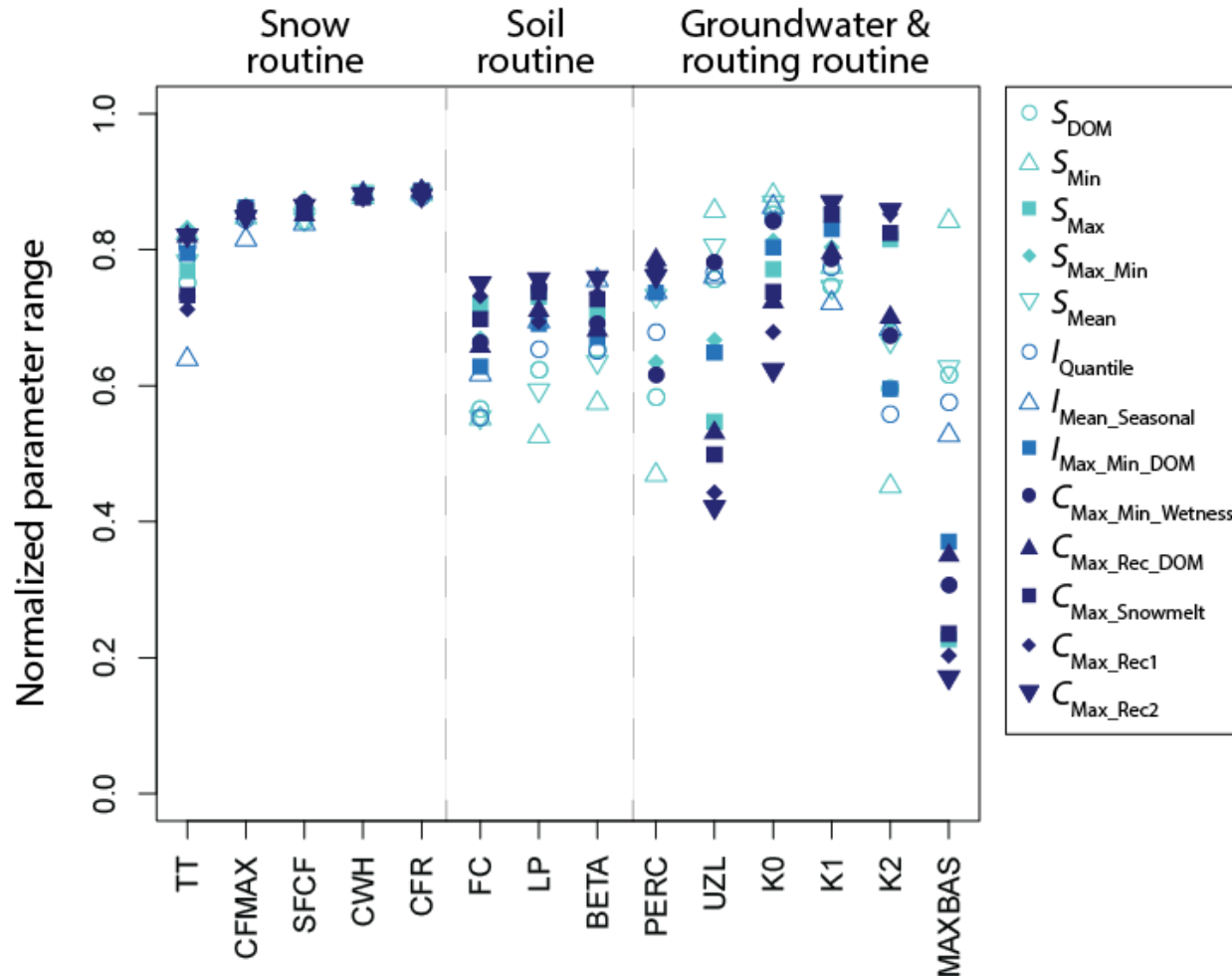
Results:

Robustness of the sampling strategies.

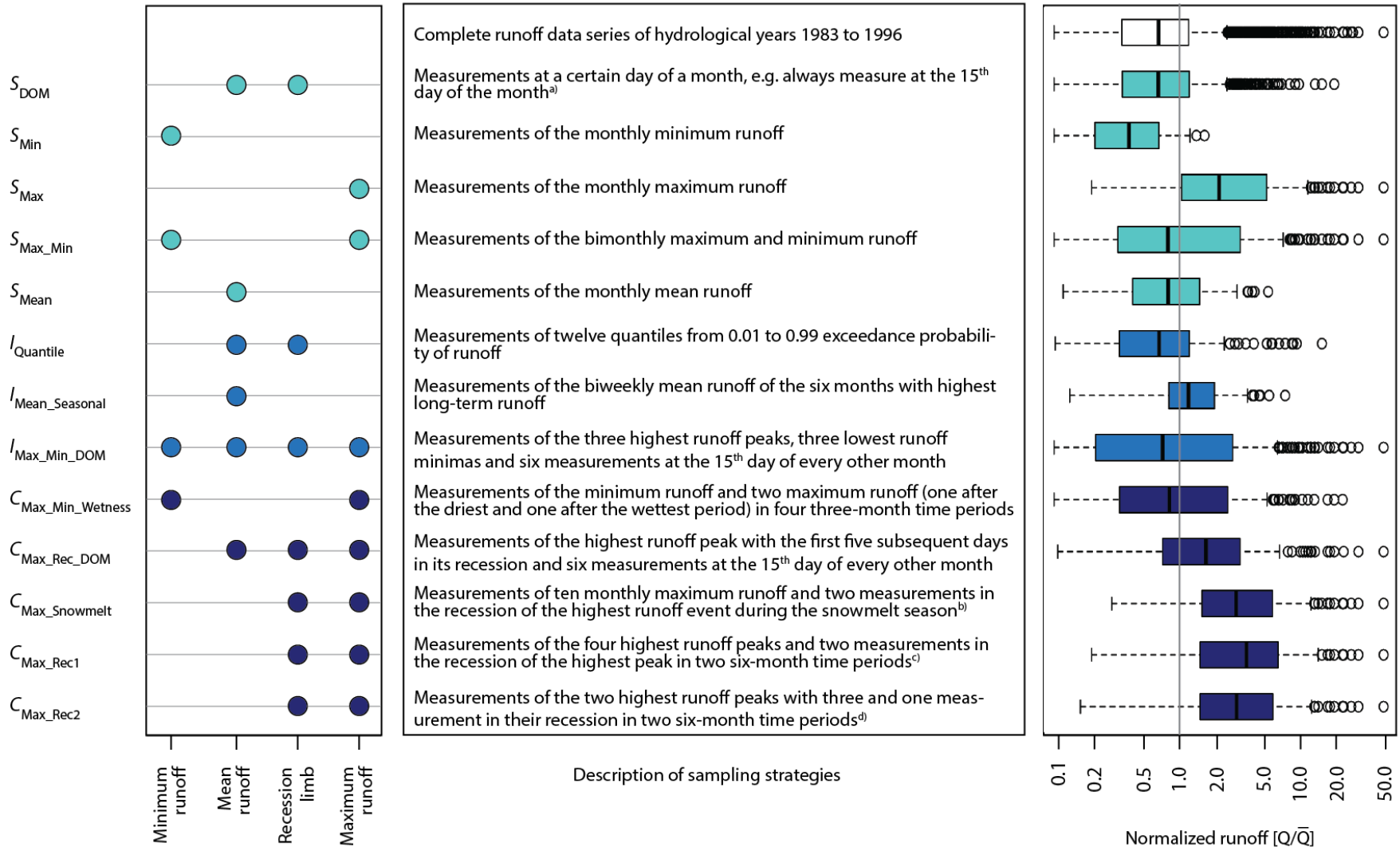


Results:

How do sampling strategies constrain model parameters?



13 sampling strategies:



Information:

References

Newman, A. J., Clark, M. P., Sampson, K., Wood, A., Hay, L. E., Bock, A., Viger, R. J., Blodgett, D., Brekke, L., Arnold, J. R., Hopson, T., Duan, Q., 2015. Development of a large-sample watershed-scale hydrometeorological data set for the contiguous USA: Data set characteristics and assessment of regional variability in hydrologic model performance. Hydrol. Earth Syst. Sci. 19, 209–223, <http://dx.doi.org/10.5194/hess-19-209-2015>