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Improving river model predictions via structural modifications and simple state adjustments

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Abstract:

One of the biggest challenges in hydrology is to produce reliable predictions in non-stationary environments. One obvious strategy is to improve model structures utilising advancements in process knowledge and observations. Another approach from a statistical angle is to develop better error models so that the uncertainty of the predictions can be more reliably estimated. These two approaches are obviously not mutually exclusive and, in fact, can complement each other. The river bed/bank storage (RBS) model allows better representation of transmission loss processes in basin-scale river system models, and provides additional states and fluxes that can be calibrated or validated (Kim et al., 2022). For example, the RBS riparian zone evapotranspiration can be calibrated against CMRSET, which is a remotely sensed actual evapotranspiration product (Guerschman et al., 2009). The introduction of the river bed/bank store allows the use of state adjustment techniques that generally provide more reliable predictions. For this, the State and Parameter Uncertainty Estimation (SPUE) (Kim et al., 2021) was used. Marked improvements in reliability were seen when the RBS model was combined with SPUE. The presentation will demonstrate that improving model structures combined with better state error characterisation can alleviate issues of non-stationarity.

References

- GUERSCHMAN, J. P., VAN DIJK, A. I., MATTERS DORF, G., BERINGER, J., HUTLEY, L. B., LEUNING, R., PIPUNIC, R. C. & SHERMAN, B. S. 2009. Scaling of potential evapotranspiration with MODIS data reproduces flux observations and catchment water balance observations across Australia. *Journal of hydrology*, 369, 107-119.
- KIM, S., MARSHALL, L., HUGHES, J., SHARMA, A. & VAZE, J. 2021. Jointly calibrating hydrologic model parameters and state adjustments. *Water Resources Research*, 57, e2020WR028499.
- KIM, S. S., HUGHES, J. D., MARSHALL, L. A., PETHERAM, C., SHARMA, A., VAZE, J. & CROSBIE, R. S. 2022. Modelling daily transmission losses in basin-scale river system models under changing hydrological regimes. *Hydrological Processes*, 36, e14625.