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Constraining ungauged runoff estimates in northern Australia

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Abstract: Northern Australia is vast, while infrastructure, data and even local knowledge are sparse or difficult to obtain. This is particularly so for the calibration and assessment of river models, where stream gauge data is likewise sparse and often of poor quality. Increased investment in stream gauging would be of great benefit, but even assuming a large and immediate investment, there is a time lag between investment in and availability of data (in the order of decades). Meanwhile, hydrological estimates and more particularly, river models, are required water resource management and policy assessment in northern Australia.

Northern Australia periodically receives great attention as a 'land of opportunity'. Recently, northern Australia was once again the focus of a comprehensive study by CSIRO and state agencies/partners into the viability of agricultural development in the North. Within many study areas, the lack of gauge data provided a serious challenge for hydrologists. In most studies estimates of runoff in ungauged areas are required. Various methods can be used to estimate ungauged runoff, but, post-simulation, how does the hydrologist judge the value of the simulation? Runoff coefficient is a coarse but useful measure of long term runoff generation. Various studies have attempted to correlate runoff coefficient or catchment evapotranspiration with local climate (e.g. Zhang et al. (2001)).

In this study, we attempted to develop relationships between climate and runoff for approximately 100 catchments across Northern Australia. These catchments were selected based of record length and data quality, particularly gauging data quality. Initial models of the catchment response to climate also suggested other factors influenced catchment runoff coefficient. In particular, estimated mean catchment regolith depth was shown to significantly affect (inversely) catchment runoff coefficient using frequentist statistical methods. A linear mixed model approach was also used to test for localised effects, as well as interaction in model terms. Further to this, a Bayesian approach was used to estimate model uncertainty for various models predicting catchment runoff coefficient. Results suggest that climate and regolith information can be used to test the veracity of ungauged area simulated runoff, and posterior distributions of estimated runoff coefficient could be incorporated into the parameter selection process.

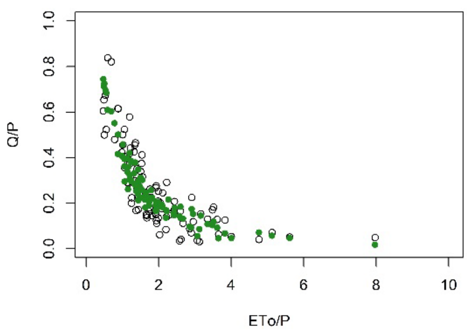

Figure 1. Observed (open symbols) and simulated (closed symbols) catchment runoff coefficient for a given aridity and regolith depth

REFERENCES

Zhang, L., Dawes, W. and Walker, G., 2001. Response of mean annual evaporation to vegetation changes at catchment scale. Water Resources Research 37, 701–708.

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