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A simplified approach to produce probabilistic hydrological model predictions

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A simplified approach to produce probabilistic hydrological model 1 predictions 2 David McInerney⁽¹⁾, Mark Thyer⁽¹⁾, Dmitri Kavetski⁽¹⁾, 3 Bree Bennett⁽¹⁾, Julien Lerat⁽²⁾, Matthew Gibbs⁽³⁾ and George Kuczera⁽⁴⁾ 4 5 (1) School of Civil, Environmental and Mining Engineering, University of Adelaide, SA, Australia 6 (2) Bureau of Meteorology, Canberra, ACT, Australia 7 (3) Department of Environment, Water and Natural Resources, Government of South Australia, Australia 8 (4) School of Engineering, University of Newcastle, Callaghan, NSW, Australia 9 10

11 Abstract

12 Probabilistic predictions from hydrological models, including rainfall-runoff models, provide valuable 13 information for water and environmental resource risk management. However, traditional 14 "deterministic" usage of rainfall-runoff models remains prevalent in practical applications, in many 15 cases because probabilistic predictions are perceived to be difficult to generate. This paper introduces a 16 simplified approach for hydrological model inference and prediction that bridges the practical gap 17 between "deterministic" and "probabilistic" techniques. This approach combines the Least Squares 18 (LS) technique for calibrating hydrological model parameters with a simple method-of-moments 19 (MoM) estimator of error model parameters (here, the variance and lag-1 autocorrelation of residual 20 errors). A case study using two conceptual hydrological models shows that the LS-MoM approach 21 achieves probabilistic predictions with similar predictive performance to classical maximum-22 likelihood and Bayesian approaches, but is simpler to implement using common hydrological software 23 and has a lower computational cost. A public web-app to help users implement the simplified approach 24 is available.

Keywords: probabilistic prediction, rainfall-runoff modelling, method of moments, maximum
likelihood

27 Highlights

- New simplified approach for producing probabilistic hydrological predictions
- Similar performance to maximum-likelihood approach, at lower computational cost
- Web-app available to facilitate uptake of probabilistic predictions
- 31

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