Quantifying uncertainties in streamflow predictions through signature based inference of hydrological model parameters

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The calibration of hydrological models based on signatures (e.g. Flow Duration Curves - FDCs) is often advocated as an alternative to model calibration based on the full time series of system responses (e.g. hydrographs). We propose an approach where the likelihood function for the signatures is derived from the likelihood for streamflow (rather than using an "ad-hoc" likelihood for the signatures as done in previous approaches). This likelihood is not easily tractable analytically and we therefore cannot apply "simple" MCMC methods. This numerical problem is solved using Approximate Bayesian Computation (ABC). Our result indicate that the proposed approach is suitable for producing reliable streamflow predictive distributions based on calibration to signature data. Moreover, our results provide indications on which signatures are more appropriate to represent the information content of the hydrograph.