

A Stochastic Filter for Asymmetrically Distributed Streamflow

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Abstract: Filtering is widely used for updating model forecasts in hydrology, by considering the difference between observations and model predicted observations. In the simplest case where the model state is directly observed, a modelled prediction can be simply adjusted to the observed value. Such filtering does not account for the variance of those distributions and reflects only the 1st moment of the model prediction and observations. Such an approach is called a Stochastic Filter of Level 1 (SF1). The next generation of filters reflect also the uncertainty of those distributions, and allow adjustment to model predictions based on the relative uncertainty of the model prediction and observation. As this approach uses both the 1st and the 2nd moments, it is called a Stochastic Filters of Level 2 (SF2). This is the most commonly used approach and includes the well known Kalman Filter (KF) that recursively update estimates of system states by sequential use of observations. However, this approach is based on the restrictive assumptions that error distributions are Gaussian, which limits application to non-asymmetrical distributions. To resolve this limitation, Stochastic Filters of Level 3 (SF3) which use the first 3 moments have been developed for relatively stable asymmetric distributions. This paper demonstrates the applicability of SF3 for streamflow forecasting.