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Bayesian inference of flow in large drainage networks

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This contribution deals with estimating flow in large drainage networks, accounting for the effect of uncertainty in local runoff and noisy river flow data on accuracy of the resulting flow estimates. This problem can be formulated as a Bayesian inference task: compute the individual (marginal) posterior distributions for each flow variable, constrained by imperfect knowledge of local runoff and by noisy flow measurements (from gauging stations), while honoring local water balance constraints. The resulting model is represented as a probabilistic graph, which allows for efficient inference by exploiting the tree-like structure of the drainage network. The approach is illustrated by applying it to flow estimation in drainage networks, derived from gridded elevation data (DEM), containing millions of variables. The analysis yields full posteriors (best estimates and uncertainty) for all flow variables in the model.