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Multivariate data assimilation in an integrated hydrological modelling system

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The immensely increasing availability of in-situ and remotely sensed hydrological data has offered new opportunities for monitoring and forecasting water resources by combining observation data with hydrological modelling. Efficient multivariate data assimilation in integrated groundwater - surface water hydrological modelling systems are required to fully utilize and optimally combine the different types of observation data. A particular challenge is the assimilation of observation data of different hydrological variables from different monitoring instruments, representing a wide range of spatial and temporal scales and different levels of uncertainty. A multivariate data assimilation framework has been implemented in the MIKE SHE integrated hydrological modelling system by linking the MIKE SHE code with a generic data assimilation library. The data assimilation library supports different state-of-the-art ensemble-based Kalman filter methods, and includes procedures for localisation, joint state, parameter and model error estimation, and bias-aware filtering. Furthermore, it supports use of different stochastic error models to describe model and measurement errors. Results are presented that demonstrate the use of the data assimilation framework for assimilation of different data types in a catchment-scale MIKE SHE model.