Data assimilation for operational flood forecasting in the Kamp catchment, Austria

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In this paper we present the data assimilation method that is used in the Kamp flood forecasting system. The main idea is to assimilate observed river discharges to update the simulated catchment states. The updated catchment states are used as the initial conditions of the flood forecasts.

The hydrological model consists of a spatially distributed soil moisture accounting scheme and a flood routing component. The spatial and temporal resolutions of the model are 1 x 1 km^2 and 15 minutes. The total catchment size is 1550 km^2 with a number of internal forecasting points.

The assimilation routine is based on the Ensemble Kalman Filter (EnKF) technique. The largest source of uncertainty are the model inputs (rainfall, evaporation). The model errors are hence formulated as the errors of the inputs. The observation errors are formulated as the errors of the discharge measurement. In the EnKF, the perturbed rainfall/evaporation inputs are obtained by superposing measured rainfall/evaporation by stochastic errors with a predefined variance. The forward application of the hydro-logical model gives an ensemble of n realisations of simulated discharges and related system states. The updated discharge estimate is then obtained by combining the en-semble of simulated discharges with the discharge observations perturbed by the ob-servation error. The system states associated with the updated discharge estimate are found from the realisation that is most similar to the updated discharge. Most of the model is formulated in a state-space notation, but some parts (such as reservoir man-agement scheme) are not. The adopted implementation of the EnKF allows us to run parts of the model in non state-space notations. 50 ensemble members were found to give robust estimates.

Comparisons between flood simulations with the same model input and parameters but different initial system states (with and without EnKF assimilation) indicate that the assimilation procedure improves the flood forecasts in most cases. The method has been used by the flood managers of the Kamp catchment on an operational basis since January 2006.