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Sensitivity analysis of data assimilation strategies on flow prediction using a conceptual rainfall-runoff model for hydrological forecasting

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The aim of this study is to investigate the impact on flow predictions of different strategies for the assimilation of discharge and precipitation data in a conceptual rainfall-runoff model. The analysis focuses on hypothetical situations that can possibly occur during operational forecasting. Two scenarios are studied to assess the sensitivity of data availability and of data quality on flow predictions. We consider degradation on data availability by simulating situations where the forecaster may or may not have information on real-time observed discharges and precipitation at successive time steps previous to the forecast date. The impact of data quality is assessed by introducing realistic random errors to observed data used in the assimilation procedure. An auto-regressive model on natural and logarithmic transformed values is applied for data assimilation and error correction. The hydrological model used is the lumped reservoir-based GR model, developed by Cemagref. The analysis is performed on a database of about 400 catchments in France, representative of a wide range of upstream areas and different hydro-meteorological conditions. Long-term time series of discharge, precipitation and potential evapotranspiration are used in model calibration and prediction. Half of the available data is used in the model setup. The other half is used to imitate a "perfect" forecasting mode: the model is run using observed precipitation data as "perfect" forecasts, so that any bias or deviations in the analysis are primarily due to hydrological modelling and updating. Results on model performance are shown as a function of catchment area and forecast range. The study is a preliminary investigation of the links between data assimilation strategies and the quality

of flow predictions from the GR model applied to hydrological forecasting in French catchments. It contributes to give insights into making decisions during real-time operational forecasting.