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Improvement of hydrological flood forecasting through an event based output correction method

Daniel Klotz and Hans Peter Nachtnebel
University of Natural Resources and Life Sciences, Vienna

This contribution presents an output correction method for hydrological models. A conceptualisation of the method is presented and tested in an alpine basin in Salzburg, Austria. The aim is to develop a method which is not prone to the drawbacks of autoregressive models.
Output correction methods are an attractive option for improving hydrological predictions. They are complementary to the main modelling process and do not interfere with the modelling process itself. In general, output correction models estimate the future error of a prediction and use the estimation to improve the given prediction. Different estimation techniques are available dependent on the utilized information and the estimation procedure itself.
Autoregressive error models are widely used for such corrections. Autoregressive models with exogenous inputs (ARX) allow the use of additional information for the error modelling, e.g. measurements from upper basins or predicted input-signals. Autoregressive models do however exhibit deficiencies, since the errors of hydrological models do generally not behave in an autoregressive manner. The decay of the error is usually different from an autoregressive function and furthermore the residuals exhibit different patterns under different circumstances. As for an example, one might consider different error-propagation behaviours under high- and low-flow situations or snow melt driven conditions.
This contribution presents a conceptualisation of an event-based correction model and focuses on flood events only. The correction model uses information about the history of the residuals and exogenous variables to give an error-estimation. The structure and parameters of the correction models can be adapted to given event classes. An event-class is a set of flood events that exhibit a similar pattern for the residuals or the hydrological conditions. In total, four different event-classes have been identified in this study. Each of them represents a different hydrological state, which is associated with different error sources and behaviours. Within each event-class, a set of ARX models are applied to simulate the behaviour of the error. This approach makes the correction model highly adaptable and allows for the representation of different behavioural patterns of the error.
The procedure is tested and compared with an auto regressive model of first order. It is shown that the event-based correction method can improve the prediction significantly, given that an event is classified correctly.