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Aiming towards improved flood forecasting: Identification of an adequate model structure for a semi-arid and data-scarce region

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A lot of effort has already been put into the development of forecasting systems to warn people of approaching flood events. Such systems, however, are influenced by various sources of uncertainty which constrain the skill of forecasts. The main goal of this study is the identification, quantification and reduction of uncertainties to provide improved early warnings with adequate lead times in a data-scarce region with strong seasonality of the hydrological regime. This includes the setup of hydrological models and post-processing of simulation results by mathematical means such as data assimilation.
The focus area is the Jaguaribe watershed in northeastern Brazil. The region is characterized by a seasonal climate with strong inter-annual variation and recurrent droughts. To ensure a secure water supply also during the dry season several thousand small and some large reservoirs have been constructed. On the other hand, floods caused by heavy rain events are an issue as well. This topic, however, so far has hardly been considered by the scientific community and until today no flood forecasting system exists for that region.
To identify the most appropriate model structure for the catchment the process-based hydrological model for semi-arid environments WASA was implemented into the eco-hydrological simulation environment ECHSE. The environment consists of a generic part providing data types and simulation methods, and a problem-specific part where the user can implement different model formulations. This provides the possibility to test various process realisations under consistent input and output data structures. The most appropriate model structure can then be determined by statistical means such as Bayesian model averaging. Subsequently, forecast results may be updated by post-processing and/or data assimilation. Furthermore, methods of data fusion can be used to combine measurements of different quality and resolution, such as in-situ and remotely sensed data, and reduce uncertainties in input data and boundary conditions of the model and in the data assimilation procedure.
In this contribution the setup of the simulation environment and identification of an appropriate model structure for a meso-scale and data-scarce region in a semi-arid environment is presented.