Geophysical Research Abstracts, Vol. 9, 08177, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08177

Selecting members of an EPS for flood forecasting systems by using atmospheric circulation patterns

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In the recent years Ensemble Prediction Systems (EPS) have been recognised as useful approaches to reduce uncertainties of hydrological forecasting systems. With focus on the reduction of forecast uncertainties particularly in case of extreme flood events EPS are of special interest for the development of suitable and robust prediction tools. However, embedding ensemble predictions (and simulations) into the operational model chain is still a problematic task: Although computer capabilities have become very powerful in the last years, multiple model runs are still time consuming whereas quick forecasts are needed to have sufficient time for action plans in case of flood events. To capture these tasks, a general concept is proposed how to integrate ensembles into the hydrological model for the operational use. As the first step the relation between atmospheric circulation patterns (CP) and extreme discharges is analysed. CPs from daily large-scale sea level pressure fields are classified on the base of fuzzy-rules in order to identify flood related CPs. After this a regression analysis with large-scale atmospheric moisture fluxes is made for further CP specifications. Additionally, daily discharges and daily areal precipitation are analysed to identify precipitation thresholds that indicate flood causing rain quantities. The second step faces the filtering of the EPS runs: The information of the pre-processing in step one is used to select members of the EPS that predict flood producing rainfall. This reduced set of ensemble members serves as input for the runoff model. As test site the mesoscale catchment located in the upper Danube basin is chosen (river Iller). It is mainly dominated by an alpine runoff regime. The method is tested and validated for the period of 1980 - 2005. The proposed strategy outlines the first part of a concept to quantify and disseminate the uncertainty of the flood forecasting model chain.