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Data assimilation of remotely sensed information in operational flood forecast in Southwest Germany

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Floods are the most affecting natural disasters in Europe. Flood damage can be reduced if the runoff is predicted with sufficient accuracy and well enough in time so that technical and precaution measures can be applied. Hydrological models are the tools to simulate runoff and allow flood forecast. Since models are only as good as their input data, one possibility to improve flood forecast is to provide a better spatial characterisation of the watershed and to observe its change with time. Remote sensing methods allow the observation of some of these hydrological relevant watershed properties.

Therefore a project called “InFerno” has been originated to evaluate and demonstrate the capabilities of remote sensing with respect to operational flood forecasting. InFerno (Integration of remote sensing data in operational water balance and flood forecast modelling) is funded by the DLR and coordinated by the operational flood forecast centre of “Baden-Württemberg” (Southwest Germany), responsible for the forecast of the Upper Rhine and Neckar. The project setup is breaking new ground in several ways, i.e. by operationally assimilating remotely sensed data and retrieved information into existing information systems and hydrologic models. The major challenges of the methodology are the implementation of algorithms developed for a multisensoral synergy and the creation of robust, operationally applicable remote sensing products. On the other hand, the operational flood forecast must be adapted to make full use of the new data sources.

Thoroughly processed remote sensing data (optical and microwave) serve as source of information to deliver spatially distributed parameters of snow properties and soil moisture. These highly dynamic land surface characteristics are crucial for the prediction and modeling of floods, since they largely determine the rapidly changing retention and runoff producing capacities of a watershed. Especially in the starting phase of a flood this information is valuable to determine the initial conditions of the model. The flood forecast centres integrate the remote sensing based maps on soil moisture and snow properties in the continuously operated water balance and flood forecast model LARSIM (Large Area Runoff Simulation Model). Results will be presented for the assimilation of snow cover information derived from optical and microwave satellite data. The snow line determined from this synergetic approach is the most valuable related information for the model. Surface soil moisture information and its temporal dynamics retrieved from SAR are used for a parameterisation of the soil properties in the hydrological model.