A flood forecasting system for the river Inn – case studies of successful and failure applications

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Flood forecasting in alpine catchments is challenging due to the spatial variability of topography which in consequence may cause high spatial variability of meteorological processes, e.g. precipitation, temperature or solar radiation. The snow cover plays a key role for runoff generation and the storage or release of water. Although headwater areas often are remote and sparsely populated, downstream areas with higher population density and infrastructure are affected by runoff processes in alpine catchments. In addition, hydropower production in alpine catchments influences (and is influenced by) runoff processes. Hence, accurate flood forecasting with as little predictive uncertainty as possible is required in water management of catchments with multiple users.

This study presents the flood forecasting system "HoPI" which was developed for the Tyrolean part of the Inn catchment in Austria. The catchment is characterized by mountain areas which are partly glacierized, but also by urban and densely settled areas in the valley floor. The HoPI system comprises a snow and glacier model simulating discharge from glacierized catchments, a hydrological model covering non-glacierized catchments, and finally a 1D-hydraulic model simulating discharge in the river Inn itself. The system is run with a 48 h forecast horizon. Driving force to the models during the forecast period is the metrological forecast model INCA (Integrated Nowcasting through Comprehensive Analysis). The data set consists of all required input parameters. The meteorological forecast data is already provided as spatially distributed data set to a 1 km grid. The forecast period of +48 hours consists of a nowcasting part (first 6 hours) and a numerical weather modeling part.

The HoPi system is currently run in a test mode and is under further development. Given the topographic complexity of the catchment and the anthropogenic impact through hydropower production, the simulation results are promising. However, improvements regarding interpolation of meteorological input data, snow modelling and the representation of catchment characteristics is currently under development. This work will present case studies of flood forecast simulations with the HoPI system and discuss the reasons for successful or failure applications.