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Importance of Spatial Precipitation for Calibrating a Flood Forecasting System?

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This paper presents the role of regionalized precipitation as input data for hydrological model calibration in a flood forecasting system. Simulation results out of two differently calibrated hydrological models are compared during the flood event from 21 to 25 July 2012 for the Mur watershed in Austria that is about 10000 km^2 until the border to Slovenia. The original calibration done in 2005 uses regionalized station precipitation. For calibration purpose hourly precipitation values have been calculated for 40 sub-catchments using the simple Thiessen Polygon method from 1995 to 2002. This simple method has the huge advantage to be very fast so that it can be used in operational system like for the Mur watershed. The modified calibration uses precipitation prepared from the Austrian meteorological institute (ZAMG) mixing information from stations, radars and satellites.
Since 2009 hourly quasi real time flood forecasting simulations are made using these precipitation data until time of forecast and results from different meteorological models for 8 days ahead. Thus, implicitly it is considered that ZAMG delivers "regionalized measured precipitation" until time of forecast. That's the reason why in May 2010 it was decided to save these data in a special "grid based" database with an hourly precipitation values per cell with a resolution of 1*1 km. These data have been retrieved for the 40 sub-catchments from the Mur flood forecasting system for the new calibration period extending from May 2010 to April 2012. Simulations compared at the gauging stations on the Mur river are much better using the modified parameters. This is true for all stations except the station Zeltweg with a drained area of 2960 km^2. The reasons for this specific behavior could not be clearly identified until now. Nevertheless it can be clearly demonstrated that the modified calibration gives much better simulation results for the mid-July flood as the original system. This is true even if the modified calibration covers only a two years period compared to the seven years used in the original calibration.
This example shows that the simulation quality for the Mur river flood forecasting system depends very much on the precipitation data used during both calibration and operational application. The apparent detriment of a short calibration period seems to be compensated with the benefit of calibrated parameters in "harmony" with spatial precipitation delivered during operational applications. Following the results from the present analysis it can be concluded that apparently the same precipitation type should be used for both modeling phases: calibration and operational application. Such a finding, if applicable to other flood forecasting systems, means (1) that collaboration between meteorologists and hydrologists must be strengthen and (2) that many hydrological models implemented in flood forecasting systems must be re-calibrated.