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Simulation of extreme precipitation and evaluation of its variability for the flood risk management using the COSMO model

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A necessary requirement for extreme flood events is long-lasting and/or intensive precipitation. The detailed knowledge of the distribution, intensity and spatiotemporal variability of precipitation is a fundamental prerequisite for hydrological flood modelling and subsequent operational flood risk management. For hydrological modelling, temporal and spatial high resolution precipitation data can be provided through meteorological models, where all meteorological scales from synoptical to regional and local scales (catchments of small rivers) are considered simultaneously. In order to determine relevant extreme precipitation events, simulations based on the COSMO model from the German Weather Service (DWD) were carried out. The model domains were set up with different grid resolutions (28, 7 and 2.8 km, respectively), whereas the finer resolution domains were nested into the coarser grids. A crucial meteorological question results from the estimation of the variability of realistic, physically-based extreme precipitation events. Hence, on the basis of the observed Elbe flood events in August 2002 and January 2003, the weather conditions were shifted in four directions with respect to the orography about 28 and 56 km, respectively. The results show that the modelled precipitation has substantially different intensities. The types of the initiating weather conditions play a major role. While Vb weather conditions are quite sensitive to the shifting, spacious precipitation events are more insensible to the shifting. The simulations are used within hydrological models for coupled scenario computations for extreme events in order to evaluate the hazard potential for a 60 km stretch of the Elbe River between Wittenberg and Aken.