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Evaluating the impact of spatial uncertainty of rainfall numerical forecasts in the hydrological predictions

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Nowadays, with the recent developments in the numerical weather prediction field and the availability of very high-resolution models, the scale compatibility between atmospheric and hydrological models does not seem to represent any longer a serious problem for successful model coupling, at least in catchments showing scales that enable such. Despite these improvements, reliable quantitative rainfall forecasts are not yet provided to be used directly as input to hydrological models with satisfactory outcomes. In this work, different configurations of the non-hydrostatic meteorological model Lokal Modell (LM) have been adopted, trying to improve the description of the phenomena related to the precipitation. These quantitative precipitation forecasts have been coupled with the distributed rainfall-runoff model TOPKAPI to evaluate the results in terms of discharge forecast. To take into account the spatial uncertainty affecting the precipitation forecast an experiment has been attempted building an ensemble of future rainfall scenarios. A member is represented by the forecast proper to the area of interest, the others are obtained assigning to the area of interest the forecast provided for eight spatial domains defined shifting the area investigated in eight different directions by a fixed range. Coupling these rain time-series with the hydrological model, an ensemble of discharge forecasts is so generated. The methodology has been tested over three case studies employing the forecasts provided by the different configurations of LM. Then, a statistical analysis has been performed, only for the operational version of LM, to define in terms of the number of LM grid points the spatial shift more suitable to convey a quantification of uncertainty about the precipitation forecast. Moreover, the analysis investigates which shift directions are preferable to improve the forecast over the area of interest. This investigation, aiming to understand and overcome systematic model deficiencies related to the flow direction, can be considered as a validation tool for the meteorological model. The study pertains to the

activities of the INTERREG IIIB RISK AWARE (RISK-Advanced Weather forecast system to Advise on Risk Events and management) project, which main goal is to add value to the meteorological information providing the prediction of possible ground effects from a civil protection point of view.