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An empirical approach to evaluate the impact on discharge predictions of the spatial uncertainty associated to LAM quantitative precipitation forecasts

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The capability of meteorological models to forecast correctly local and intense precipitation is still nowadays limited, even at short time-range, despite the high-resolution modelling (1 to 10 km). When quantitative precipitation forecasts (QPFs) are used to force hydrological models within a meteo-hydrological chain for a real-time forecasting system, it is not completely satisfactory just to reproduce precipitating structures, but a correct localisation in space and time is required together with realistic peak values. In the present study it is under evaluation the system implemented for the Reno river basin, a medium-sized catchment in northern Italy. The QPFs provided by the non-hydrostatic meteorological model COSMO - suite LAMI, the Italian implementation of the COSMO model, are used to drive the distributed rainfall-runoff model TOPKAPI. The model is run at 7 km of horizontal resolution, with 40 levels in the vertical, and is nested on the DWD GME global model. As one of the major problems of the operational COSMO model - suite LAMI in forecasting intense precipitation in presence of a mountain range is the tendency to overestimate the rainfall in the upwind areas, with a related drying effect in the downwind regions, an empirical methodology based on the spatial shifting of the predicted rainfall field is proposed in order to take into account localisation errors affecting the precipitation forecast and to investigate their impact on hydrological model simulations. In detail, the forecast precipitation patterns are shifted in eight different directions (north, north-east, east, south-east, south, south-west, west, north-west) by a fixed range and each “shift-adjusted” QPF scenario is used to drive a hydrological simulation. The methodology performance is highly dependent on the atmospheric situation characterising the event, the flow di-

rection playing a major role. To fully benefit of this approach, a statistical analysis has been performed to relate optimal shift directions conditionally to both the observed and forecasted atmospheric flows. This would enable to account for systematic model deficiencies with regard to QPF over the basin, which are dependent on the weather type. The statistical analysis has been carried out in terms of mean error and root mean-squared error considering the hourly discharge forecasts driven by shift-adjusted scenarios of rainfall provided by LAMI for the autumn seasons of the period 2003-2005. The spatial shift approach has been applied also to the rainfall fields forecasted by a different configuration of LAMI, which differs from the operational one by the addition of a prognostic treatment of rain and snow, together with the inclusion of a cloud ice scheme, which would enable to have an advection of the precipitating species. This further study is aimed to test the improvement of the prognostic treatment of rain with respect to hydrological simulations and the usefulness of the spatial shifting approach with respect to a more accurately modelling of the physical processes determining the distribution of the precipitation.