A spatial shifting approach to assess localisation errors in LAM quantitative precipitation forecasts forcing hydrological predictions

T. Diomede (1), C. Marsigli (1), F. Nerozzi (1), T. Paccagnella (1), A. Selvini (1)

(1) Regional Hydro-Meteorological Service ARPA-SIM, Bologna, Italy

The one-way atmospheric-hydrological model coupling carried out in this study is designed to assess systematic meteorological model deficiencies related to the predicted rainfall field positioning which directly influence flood forecasts. The system, implemented for the Reno river basin, a medium-sized catchment in northern Italy, exploits the quantitative precipitation forecasts (QPFs) provided by the meteorological model Lokal Modell (LM), a non-hydrostatic Limited Area Model, to drive the distributed rainfall-runoff model TOPKAPI. The proposed methodology consists of a spatial shift approach applied to LM rainfall fields: the precipitation patterns have been shifted in eight different directions by a fixed range and each "shift-adjusted" QPF scenario has been used to drive a hydrological run. A statistical analysis performed in terms of bias and root mean-squared error over the discharge forecasts simulated for the 2003 autumn season shows that the error is reduced when the south, west and south-west shift-adjusted scenarios are involved. The methodology performance is highly dependent on the atmospheric situation characterising the event, the flow direction playing a major role. To fully benefit of this approach, a sensitivity study has been also developed to relate optimal shift directions conditionally to forecasted atmospheric flows. This would enable to account for systematic model deficiencies with regard to QPF over the basin, which are dependent on the model weather type. The analysis repeated by subdividing the sample on the base of the observed atmospheric flow enables to relate QPF errors with the actual weather type.