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A sub-regional climate cluster analysis over Italy from regional climate model simulation and weather station observations

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High resolution Regional Climate Models (RCMs) are a key tools in producing downscaled and calibrated outputs for impact studies where local scale climate information are needed. Recent studies suggest that in the processing chain that goes from the global scale climate projection to the local scale information, the use of an intermediate scale RCM increases the quality of the climate information produced at the local scale.

We propose a direct assessment of the type of improvements achieved by using RCMs for producing the intermediate scale climate information required for example in impact studies.

We use relatively long (50 years) daily climate records of 64 weather stations in Italy the evaluate how the ENEA-PROTHEUS system reconstruct the sub-regional climate clusters emerging from observation at a spatial scale finer than the one of the global driver.

Specifically, on one side we tested the capability of ENEA-PROTHEUS regional coupled model, run in a 'perfect boundaries' mode using ERA-40, to capture the pattern of sub-regional climate spatial clusters relative to maximum/minimum temperature and rainfall. On the other hand, we considered the spatial averages of these parameters on the sub-regional climate spatial clusters. We compare the model output and the weather station data in terms of their representation of the mean seasonal cycle, the corresponding interannual variability and large deviations.

We find a close agreement between model and observations. In particular, although biases in the modelled seasonal cycle are present, the model is able to reproduce the frequency and the seasonality of intense events for all seasons, including hot and cold spells and intense rainfalls, especially for alpine regions.