



Towards reliable assessments of climate change impacts on droughts in Southern Italy: Evaluation of Euro-Cordex historical simulations by high-quality observational datasets

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Many recent studies indicate climate change as a phenomenon that can potentially alter the water cycle, also implying new challenges in drought risk management. Impacts of drought are difficult to study, as this phenomenon is usually characterized by multiannual evolution scales, meaning that few occurrences may take place in a climatologic period of 30-years. Hence, it is of key importance to assess the quality of Regional climate models (RCMs), which are commonly used for assessing future impacts of climate change on hydrological events. To this end, a common approach consists in evaluating models' capability to simulate historic climate by comparing models' simulations to observational gridded datasets, available at global or continental spatial scales. Regardless of the specific methods used to assess the differences between simulated and observed data, a main limitation in this approach is that the considered spatial resolution is too coarse for reliable climate change impact studies at hydrologically relevant scales, especially in areas of complex topography. From this point of view, large scale observational gridded datasets are of poor applicability, since they are built upon low-density hydro-meteorological networks.

The Coordinated Regional Climate Downscaling Experiment (CORDEX) initiative provides climate data simulated by RCMs developed by several research centers all over the world. In the present study we use climate data for the Euro-Mediterranean area, known as EURO-CORDEX (www.euro-cordex.net). In particular, simulations for an historic reference period (baseline) and for future projections up to 2100, with a 12.5 km grid resolution, are available for four different greenhouse gas concentration trajectories (Representative Concentration Pathways).

We propose a statistical methodological framework to assess the quality of the EURO-CORDEX RCMs with respect to their ability to simulate historic climate by a comparison with high-density and high-quality ground-based observational datasets. In particular, the focus of this study is on observed thermometric and pluviometric regimes in Southern Italy at time scales from monthly to annual, which are particularly useful for drought analyses. To this aim, performances indicators relevant for assessing the accuracy of assessments are also considered. The proposed methodology is applied to Sicily and Calabria regions, where long historical precipitation and temperature series have been recorded by the ground-based networks operated by the formerly Regional Hydrographic Offices, whose density is considerably greater than observational gridded datasets available at European level, such as E-OBS.

Results show that the proposed methodology is capable to highlight clearly skills and weaknesses of different RCMs and can help to properly select the models for climate projections in the investigated areas, with respect to the examined hydrologic processes.