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A statistical framework for evaluating EURO-CORDEX simulations and derived drought characteristics

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Regional climate models (RCMs) are commonly used for assessing, at proper spatial resolutions, future impacts of climate change on hydrological events. In this study, we propose a statistical methodological framework to assess the quality of the EURO-CORDEX RCMs concerning their ability to simulate historic observed climate (temperature and precipitation). We specifically focus on the models' performance in reproducing drought characteristics (duration, accumulated deficit, intensity, and return period) determined by the theory of runs at seasonal and annual timescales, by comparison with high-density and high-quality ground-based observational datasets. In particular, the proposed methodology is applied to the Sicily and Calabria regions (Southern Italy), where long historical precipitation and temperature series were recorded by the ground-based monitoring networks operated by the former Regional Hydrographic Offices. The density of the measurements is considerably greater than observational gridded datasets available at the European level, such as E-OBS or CRU-TS. Results show that among the models based on the combination of the HadGEM2 global circulation model (GCM) with the CLM-Community RCMs are the most skillful in reproducing precipitation and temperature variability as well as drought characteristics. Nevertheless, the ranking of the models may slightly change depending on the specific variable analysed, as well as the temporal and spatial scale of interest. From this point of view, the proposed methodology highlights the skills and weaknesses of the different configurations, aiding on the selection of the most suitable climate model for assessing climate change impacts on drought processes and the underlying variables.