Statistical Downscaling of EURO-CORDEX future climate scenarios: Projections of droughts, heavy precipitations, heat waves and cold spells

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Abstract

Extreme weather events (e.g. persistent droughts, heavy precipitation, heat waves, severe convective storms and violent cyclonic windstorms) are responsible for most of the nature-related economic costs and human losses in many regions of Europe, including the Mediterranean zone. In the context of climate change it is likely that extreme precipitation events -and concomitant floods or flash floods- might become more intense over the mid-latitude continents while droughts might last longer by the end of the century. In many dry regions as southern Europe, soils are predicted to dry out as temperatures rise and rain-bearing atmospheric circulations become less frequent.
Prospects on the future of these extreme hydrological events are here derived by using observed and model projected daily meteorological data. Specifically, E-OBS high resolution gridded data sets of daily observed precipitation and surface minimum and maximum temperatures have been used as the regional observed baseline. For projections, the same meteorological variables have been obtained from a set of regional climate models (RCMs) integrated in the EURO-CORDEX European project, considering the rcp4.5 and rcp8.5 future emissions scenarios. To project the RCM data at local scale properly, a quantile–quantile adjustment has been applied to the simulated regional scenarios. The method is based on detecting changes in the cumulative distribution functions (CDFs) between the recent past and successive time slices of the simulated climate and applying these changes, once calibrated, to the observed series of max, min temperature and precipitation. But for our specific purposes dealing with the extreme phenomenology, the general method has been first adapted to explicitly focus on the tails of the distributions, instead of deriving the calibration parameters from the general spectrum of the CDFs.

Results about expected future incidence of droughts, heavy precipitation episodes, heat waves and cold spells at annual and seasonal scale will be presented for each emission scenario, scaling down the results from the whole European continent throughout Southern Europe and the Mediterranean lands. The most vulnerable geographical areas in terms of heavy precipitation, drought, heat waves and cold spells incidence as the century progresses will be identified.

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