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Hydrological regime modifications induced by climate change in Mediterranean area

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The knowledge of river flow regimes has a capital importance for a variety of practical applications, in water resource management, including optimal and sustainable use. Hydrological regime is highly dependent on climatic factors, among which the most important is surely the precipitation, in terms of frequency, seasonal distribution and intensity of rainfall events. The streamflow frequency regime of river basins are often summarized by flow duration curves (FDCs), that offer a simple and comprehensive graphical view of the overall historical variability associated with streamflow, and characterize the ability of the basin to provide flows of various magnitudes. Climate change is likely to lead shifts in the hydrological regime, and, consequently, in the FDCs.
Staring from this premise, the primary objective of the present study is to explore the effects of potential climate changes on the hydrological regime of some small Mediterranean basins. To this aim it is here used a recent hydrological model, the ModABa model (MODel for Annual flow duration curves assessment in ephemeral small BAsins), for the probabilistic characterization of the daily streamflows in small catchments. The model has been calibrated and successively validated in a unique small catchment, where it has shown a satisfactory accuracy in reproducing the empirical FDC starting from easily derivable parameters arising from basic ecohydrological knowledge of the basin and commonly available climatic data such as daily precipitation and temperatures. Thus, this work also represents a first attempt to apply the ModABa to basins different from that used for its preliminary design in order to testing its generality.
Different case studies are selected within the Sicily region; the model is first calibrated at the sites and then forced by future climatic scenarios, highlighting the principal differences emerging from the current scenario and future FDCs.
The future climate scenarios are generated using a stochastic downscaling technique based on the weather generator, AWE-GEN. This methodology allows for the downscaling of an ensemble of climate model outputs deriving the frequency distribution functions of factors of change for several statistics of temperature and precipitation from outputs of General Circulation Models (GCMs). The stochastic downscaling is carried out using simulations of GCMs adopted in the IPCC 5AR, for the future periods of 2046-2065 and 2081-2100.