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Extreme rainfall changes induced by future climate in Mediterranean area

Domenico Caracciolo, Angelo Forestieri, Francesco Lo Conti, Laura Bidera Miceli, and Leonardo V. Noto
Università degli Studi di Palermo, Dipartimento di Ingegneria Civile, Ambientale, Aerospaziale, e dei Materiali, Palermo, Italy (domecaracciolo@gmail.com)

Extreme rainfall events have large impacts on society and are likely to continue to do so under predicted future climate change. Indeed, extreme precipitations show intensification in many regions of the world and this is of key importance to society as a result of the large impact of flooding. Thus, for planning and management decisions of the hydraulic infrastructures, accurate estimates of precipitation magnitudes at different durations are needed. Moreover, extreme precipitation events represent an increasing threat to society under global warming and are among the most serious challenges. In fact, future climate change is likely to lead to the change of extremes events that will become more frequent and could have significant impacts according to the outcomes of the IPCC 5th report. Therefore, the research of more accurate tool to build the Depth-Duration- Frequency (DDF) curves under future climate change is justified by the engineering applications that need more reliable and correct estimates of extreme precipitation in order to reduce the damage and loss of human lives.
Starting from this premise, the primary objective of the present study is to explore response of the rainfall extremes under possible future climate change in Sicily using an ensemble of outputs of General Circulation Models (GCMs). The future climate scenarios are generated using a stochastic downscaling technique based on the hourly 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 precipitation. The stochastic downscaling is carried out using simulations of GCMs adopted in the IPCC 5th report, for the future periods of 2046-2065 and 2081-2100. The evaluation of extreme precipitations has been carried out for two different climate scenarios Representative Concentration Pathways (RCP) 4.5 and 8.5, related to the future increase of the CO_2, assessing the impact of the climate change embracing scenarios from the moderately optimistic one to the most pessimistic one, respectively. The generalized extreme value (GEV) frequency distribution was selected for the DDF curves derivation for different return periods. The analysis of climate change of extreme precipitation has shown an increase of the quantiles with a simultaneous decrease of mean annual precipitation. Moreover, the precipitation for the highest duration has shown an increase lower than that relative to the precipitation for the shortest duration.