



Projecting the current Depth-Duration-Frequency curves in the future climate for Sicily (Italy)

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Rainfall depth-duration-frequency (DDF) curves serve as an essential tool for the design of hydraulic infrastructures, helping engineers and planners make informed decisions about system resilience and water management strategies. Over the past decades, several works have shown how climate change is altering the characteristics of extreme rainfall events, compromising the reliability of current DDFs for the future. Indeed, as climate evolve, the historical observation on which these curves are based may become less representative of current and future precipitation scenarios.

This is the case of Sicily, which is the largest island of the Mediterranean Sea and lies in its center. The island has been always screened for changes in the characteristics of rainfall extremes and, recently, it has been found that that especially shorter duration rainfall (i.e., hourly and sub-hourly) has intensified in the past years (Arnone et al., 2013; Treppiedi et al., 2021). This has resulted in a significant underestimation of rainfall quantiles calculated by most up-to-date regional frequency analysis, which is based on observations from 1928-2010, especially at shorter durations and low return periods (Treppiedi et al., 2023).

Starting from these results, we project the current DDFs in the future climate following what has been proposed by Martel et al. (2021). This framework is based on correcting the curves by including the expected rainfall scaling of the 24-h duration and 2-year return period rainfall with temperature and by integrating some factors that consider how the rainfall extremes are projected to change with frequency and with duration. To compute the future DDFs, we use the daily rainfall and temperature data from an ensemble of regional climate models (RCMs) in the EURO-CORDEX project. After validating the historical experiment of the RCM ensemble with observations from rain gauges, we use the future projections under the Representative Concentration Pathway 8.5. In this context, the use of daily rainfall and temperature data helps to reduce the uncertainty that models generally have in simulating short-lived phenomena, providing more accurate estimates.

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