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Statistical assessments of extreme precipitation and dry periods in the Mediterranean area until the end of the 21st century

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In the context of future climate change, questions about changes related to precipitation are of particular interest. Thus, the present contribution is related to changes of heavy rainfall events, dry periods and the relation of these extremes to total precipitation changes in the Mediterranean area until the end of the 21st century.

Based on high-resolution (0.25˚) gridded precipitation data, seasonal precipitation totals as well as different percentile-based indices of extreme precipitation are defined with a seasonal resolution: the number of events exceeding the 95th percentile of daily precipitation from the reference period 1961-1990, percentage, total amount and mean daily intensity of precipitation from these events. Furthermore, the number of consecutive dry days is taken into account to represent dry periods.

Mediterranean precipitation is generally induced by large-scale advection and/or it is a matter of smaller-scale convective activity. Therefore various predictors are chosen to describe the large-scale circulation as well as convective processes.

Generalized linear models (GLMs) are used to derive relationships of the various predictands with the large-scale predictors. A specific statistical ensemble technique which comprises up to five statistical ensemble members per grid box with varying calibration periods is used for the assessments. This leads to a range of possible future realizations of precipitation changes depending on the specific predictors-predictand-relationships identified in the individual calibration periods. Furthermore two different scenarios (A1B and B1), multiple runs for each scenario, and output of two different AOGCMs (ECHAM5 and HadCM3) are included.

As a result, a different evolution of precipitation-related events over the western and central-northern Mediterranean regions becomes apparent compared to the eastern Mediterranean area. This feature has already been described for observational periods and may be seen in the context of the so-called “Mediterranean Oscillation”. Thus, in general, total and extreme precipitation over the western and central-northern Mediterranean area are mostly reduced in summer and autumn, but increased in winter. In contrast to that, precipitation over the eastern Mediterranean area shows widespread increases in summer and autumn, but it declines in winter. Only in spring, this opposite behaviour is not apparent, total and extreme precipitation decreases rather dominate over the whole Mediterranean area and are often accompanied by a prolongation of the maximum number of consecutive dry days. Commonly precipitation increases are accompanied by dry-period decreases with the exception of large parts around the central-northern Mediterranean area in winter indicating increases of both precipitation and dry period length.

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