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Climate change scenarios of short-term and multi-day precipitation extremes in the Mediterranean and their links to atmospheric circulation

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The study examines climate change scenarios of precipitation extremes over the Mediterranean region for the late 21st century (2070–99) in an ensemble of high-resolution regional climate model (RCM) simulations. Precipitation extremes are considered at a wide range of time scales from hourly to multi-day amounts and in individual seasons (DJF, MAM, JJA, SON). We focus on (i) dependence of the results on the time scale of precipitation aggregation (short-term vs. multi-day amounts), (ii) seasonal differences, (iii) uncertainties of the scenarios related to differences amongst the RCM simulations, and (iv) identification of regions and seasons in which the projected changes in precipitation extremes are particularly large and/or robust in the RCM ensemble.

The examined ensemble of RCM simulations captures basic precipitation patterns for the recent climate (1961–90), including seasonal changes. Climate change scenarios for the late 21st century differ substantially for short-term (hourly) and multi-day precipitation extremes, mainly in the western Mediterranean. Projected increases in short-term extremes exceed those of daily and multi-day extremes, and occur even in regions and seasons in which mean precipitation is projected to decline. This change in the patterns of extreme precipitation may have important hydrological consequences, with increases in the severity of flash floods in a warmer climate in spite of the overall drying projected for the region. However, uncertainty of the scenarios of precipitation extremes related to within-ensemble variability is large. Consistency of the projected changes amongst the RCMs is highest in winter and lowest in summer, and generally it is higher for short-term than for multi-day extremes.

Links of the projected changes in precipitation extremes to indices of atmospheric circulation, including the North Atlantic Oscillation (NAO), the Mediterranean Oscillation (MO) and the Western Mediterranean Oscillation (WeMO), are also discussed.