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Extreme precipitation in the Mediterranean area – weighted multi-model ensemble projections using statistical downscaling

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Weighted multi-model ensembles are used to analyze projections of extreme precipitation changes between the end of the 20th and the end of the 21st century in eight Mediterranean sub-regions. Four indices of extreme precipitation are studied, two of them representing precipitation scarcity and two other ones heavy precipitation. For the weights as well as the projections themselves, these indices are downscaled from large-scale synoptic as well as smaller-scale thermodynamic variables employing global climate model data of the Coupled Model Intercomparison Project phase 3 and 5 (CMIP3, CMIP5) multi-model ensembles, considering two emission scenarios each. Based on performance with regard to observations of extreme precipitation as well as inter-model consistency, three weighting metrics are calculated and subsequently applied to each ensemble. While meteorological droughts are projected to increase in most cases, the tendency is less pronounced for heavy precipitation events and overall points towards reductions. The weighting does not impact on these results of multi-model means, but induces a decrease of ensemble standard deviations (although mostly not significant), implying some narrowing of model uncertainty. As the ensemble and scenario considered have minor effects on the findings and the differences between seasons and sub-regions are also not pronounced,enhanced droughts are indicated for the Mediterranean region implying major socio-economic and ecological consequences. When averaged over all situations and indices, the selected synoptic predictors slightly outnumber the thermodynamic ones, with the horizontal wind component being the most-frequently chosen large-scale predictor. Therefore, synoptic features are found to exert big influence on Mediterranean precipitation extremes.

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