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Downscaling of precipitation extremes in the Mediterranean area

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For the study of the regional characteristics of global climate change in the Mediterranean area, statistical downscaling assessments as well as regional climate model output are considered. Special focus is given to extreme precipitation.

Based on daily station data of the Mediterranean area as well as on high-resolution (0.25°) gridded precipitation data, 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. Thus, different indices are available to characterize changes in the frequency and intensity of heavy rainfall events.

In the scope of the statistical downscaling approach, geopotential heights of the 500hPa level, 850hPa- specific humidity, and 1000hPa- relative vorticity are considered as large-scale predictors. Statistical Downscaling is performed by relating the Mediterranean extreme precipitation indices to the large-scale atmospheric circulation. This is done by deriving particular transfer functions via multiple regression analysis and canonical correlation analysis. To test the stability of the models, analyses are realised for different calibration periods and corresponding verification periods. Model performance in the verification periods is assessed by means of the correlation coefficients between modelled and observed extremes indices. Additionally the reduction of variance is calculated, being similar to the root mean squared skill score. Predictor output of different coupled global circulation models (several ECHAM5/MPI-OM ensemble members, one HadCM3 member) under A1B and B1 scenario assumptions is used to assess changes of extreme precipitation under enhanced greenhouse warming conditions.

In the context of the dynamical downscaling approach, simulations with the high-resolution (0.5°) regional climate model REMO nested into the global circulation model ECHAM5/MPI-OM are available for the time period 1960-2050. For 1960-2000 observed GHG emissions and for 2001-2050 A1b and B1 emission scenarios as well as FAO scenarios for anthropogenic land use change are considered. Extreme precipitation events are defined similarly to the statistical downscaling approach.

With regard to the future evolution of extreme precipitation in the Mediterranean area, the statistical downscaling results and the regional model output are compared and reasons for possible disagreements area discussed under the inclusion of the specific forcing features from the global circulation model ECHAM5/MPI-OM.

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