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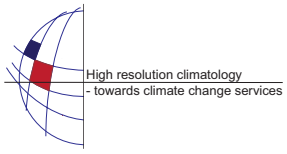

Statistical downscaling assessments of temperature and precipitation extremes in the Mediterranean area

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The Mediterranean area is regarded as a “climate change hot-spot” (Giorgi 2006) being highly affected by future climate change compared to other regions of the world. This is mostly due to the assessed decrease of precipitation as well as to an increase of the inter-annual precipitation variability, but changes in temperature, especially in its extreme tails, have also to be taken into account.
Based on station data of the Mediterranean area as well as on high resolution precipitation and temperature data (0.25° x 0.25° grid for terrestrial areas of Europe, Haylock et al. 2006) percentile-based indices of extreme events are defined.
As large-scale predictors for extreme events in the Mediterranean area sea level pressure, geopotential heights, thickness of the 1000hPa/500hPa layer, specific humidity, and relative vorticity are primarily considered.
Statistical Downscaling is established by relating the Mediterranean extreme events to the large-scale atmospheric circulation. This is done through the application of transfer functions (multiple regression analysis and canonical correlation analysis) as well as through a synoptical downscaling approach (cluster analysis).
To test the stability of the models the 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.
Output of different coupled global circulation models under A1B- and B1- scenario assumptions is used to assess changes of extreme temperature and precipitation under enhanced greenhouse warming conditions.
From the results it becomes evident that the downscaling assessment can vary considerably depending on the particular predictor used for the statistical assessment. Climatic as well as dynamic factors influence extreme conditions and should be considered in a combined manner within downscaling models.
Regarding temperature extremes the results show that the changes do not follow a simple shift of the whole temperature distribution to higher values. More precisely it is indicated that the intra-annual extreme temperature range will decrease in most parts of the Mediterranean area during the course of the 21st century. This is due to the finding that extreme minimum temperatures in winter will increase stronger compared to extreme maximum temperatures in summer.
Concerning precipitation extremes the statistical assessment results point to widespread decreases of heavy rainfall events (95th percentile of precipitation) in the Mediterranean area during all seasons of the year.
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Haylock MR, Hofstra N, Klein Tank AMG, Klok EJ, Jones PD, New M (2008): A European daily high-resolution gridded data set of surface temperature and precipitation for 1950–2006. Journal of Geophysical Research 113, D20119, doi:10.1029/2008JD010201, 2008