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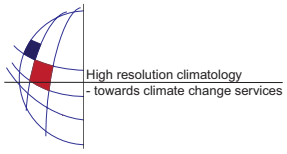

Statistical downscaling of the pressure for extreme spring precipitation estimation in the Danube middle and lower basin for 21–st century

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In this study the observed and simulated spring daily values of sea level pressure (SLP) over Europe and of the precipitation at 10 stations from the Danube middle and lower basin were analysed for the 20-th and 21-st centuries.
The following climate models were processed: CNRM, ECHAM5-MPI, EGMAM, IPSL. It was considered the A1B scenario, used in the researches made under IPCC and also within the ENSEMBLES project.
The daily values from March, April and May for 42 years were analysed: for the observation data the period 1958 – 1999 and for the simulated data for the 20-th century (1958-1999) and 2 periods of the 21-st century: (2009-2050) and (2051-2092).
The downscaling procedure is achieved by means of a nonhomogeneous hidden Markov model (NHMM). Before applying the NHMM procedure, a selection of the predictors from the observed SLP field was realised.
In what concerns the predictors for the precipitation modelling by NHMM, their selection is a relative difficult problem. The atmospheric fields must be filtered in order to reduce the data volume, but in the same time they must contain enough information so that they can be associated with the precipitation. First we must analyse the sea level pressure influence on the precipitation from the middle and lower basin of the Danube on observational data for the period 1958-1999. In this first stage the correlations were tested between precipitation and SLP in grid points on the 10 – 40 E and 37-55 N region. According to the statistical significance of those correlations there were considered 3 key areas centred around the coordination points (45N; 12.5E), (42.5N; 17.5E) and (40N; 25E), areas in which the correlations between precipitation and pressure have the highest significance level. In each of these 3 key points the following measures were calculated: vorticity, pressure averages, North – South gradients and West – East gradients. In the next stage it was tested the models capability of reproducing these pressure indices, making correlations between the 12 predictors calculated from observational data (ECMWF) and control simulations of the 4 models considered in this study for the reference period 1958-1999. Taking into account the statistical significance of the correlation coefficients values in the case of the 4 climate models and the fact that the predictors must be the same for all models, in order to be consistent the comparisons, only 3 predictors were selected. These predictors are: the vorticity values centred in the point (45N;12.5E), the SLP average values calculated around the second point (42.5N;17.5E) and the values of the W- E gradients calculated by considering the pressure in the point (40N; 25E).
Then, the precipitation amounts from 10 stations were simulated by NHMM with 7 states and including 3 predictors from SLP.
The results present a slight trend of increase in the 21-st century of extreme events in the precipitation field in comparison with the 20-th century, especially in the Danube middle basin.