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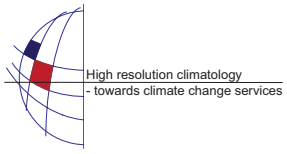

21-st century precipitation estimation in the Danube middle and lower basin by EVT modelling

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The simulated precipitation for the 20-th and 21-st centuries at 10 stations from the Danube middle and lower basin are analysed together with the daily pressure values at sea level from March, April, May for 42 years obtained from the four GCMs (CNRM, ECHAM5-MPI, EGMAM and IPSL). For the 20-th century the period 1958-1999 was considered and for the 21-st century 2 periods of 42 years were selected: 2009-2050 and 2051-2092 from the A1B scenario.
In the pressure field, the predictors from three key zones were selected as being significant for the precipitation behavior from the Danube middle and lower basin.
A nonhomogeneus hidden Markov model (NHMM) with 7 states was applied for the precipitation from 10 stations, for observations and also for each of the considered scenarios, with 3 predictors defined in the key points. The precipitation values were corrected by bias and the predictors were the same for all models, calculated from pressure values corrected by bias.
After the modelling of the daily precipitation through a NHMM, a simulation was done on 100 achievements each one with 42 years and 90 days each year. In this way, the daily maximum precipitation amounts during spring from 4200 years were selected. This simulation was necessary in order to increase the statistical selection volume necessary within the modelling through distribution of the extreme values. From these precipitation simulated with NHMM for 4200 years, the maximum daily amounts during spring were selected and then modelled with a generalized distribution of the extreme values (GEV). For the modelling by generalized Pareto distribution (GPD) the daily precipitation values which exceed a certain threshold were selected. After testing several thresholds values, it was concluded that the most adequate is the 50 mm threshold for each of the 10 considered stations. Also it was made an average of the precipitation on the 10 considered stations and from the analysis of the different thresholds it was concluded that the 15 mm threshold is the most suitable for this average precipitation.
After the extreme value theory (EVT) modeling of the simulated precipitation by NHMM, the results related to maximum daily spring precipitation are lightly different for the two basins. It was observed that for middle basin the models estimate an increasing of the return level compared with the observations while for lower basin, the models indicate generally a decreasing of the return level corresponding to the return period of 100 years.
The amounts of the maximum daily precipitation corresponding to the 100 years return period in spring months in the average fields on the Danube middle and lower basin, have a light increase tendency in the second half of 21-st century in comparison with the first half of this century.
The results lead to the conclusion that in average a light increase of the extreme hydrological events occurrence is expected especially in the second part of the 21- st century in comparison with the 20-th century with some differentiation between the two basins.