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Future changes in the precipitation regime over southeastern Romania and associated uncertainties

A. Busuioc, M. Baciu, and Al. Dumitrescu

National Meteorological Administration, Climatology Division, Bucharest, Romania (busuioc@meteoromania.ro, +40 21 3163143)

High resolution changes in the monthly/seasonal precipitation regime (including some extreme events) over the southeastern Romania for the periods 2020-2050 and 2070-2099, compared to the period 1961-1990, under A1B scenario, are presented in this paper. These results are obtained by statistical downscaling models (SDMs) applied to a multi-model ensemble simulations supplied through the ENSEMBLES project (stream 1 simulations). The SDM robustness and the uncertainties associated to the downscaled changes are explored.

For this purpose, two kind of statistical downscaling techniques (linear and nonlinear) are used. Statistical downscaling models based on canonical correlation analysis (CCA) were developed for 16 stations placed in southeastern Romania under the framework of the CECILIA project. These models were developed for standardized monthly precipitation anomalies for each season (winter, spring, summer and autumn) using as predictors the sea level pressure (SLP), geopotential height at 500 hPa (H500) and specific humidity at 850 HPa, either used individually or together. The most skillful models were found for the combination of these predictors and for SLP alone for all season. The models are stable over various subintervals and it has been found that the observed changes over the period 1991-2007 are well reproduced by the statistical downscaling models calibrated over the period 1961-1990, the results being similar for both set of predictors. The best results were obtained when the observed climate signal is strong over the entire area (for example, decreases from January and February and increases from September and October).

The ENSEMBLES simulations of five global models (control run and scenarios) (BCM2, INGV, FUB, HADGEN, ECHAM-DMI) were considered to be used as inputs in our statistical downscaling models. The simulated predictors for two of them (HADGEN, ECHAM-DMI) seem to be unrealistic (identical values in couples months or similar long term means for all months, probably because of an archiving error). The rest of three models were statistically downscaled and the monthly ensemble mean of these values was computed, being noted the cases when all models give same climate signal that shows less uncertainties.

Changes in some extreme precipitation indices (mean duration of wet/dry intervals, maximum of daily precipitation amount; maximum duration of wet/dry intervals, frequency of precipitation exceeding some thresholds) were estimated through a conditional stochastic model developed at 10 stations placed in the same region, under the framework of the ENSEMBLES project. All these parameters are calculated as the ensemble mean over 1000 model runs and 90 % confidence intervals are estimated.

For some selected stations, the comparison between the results obtained through the two statistical downscaling techniques, for seasonal precipitation amount, is presented.