



EMS Annual Meeting Abstracts

Vol. 18, EMS2021-46, 2021

<https://doi.org/10.5194/ems2021-46>

EMS Annual Meeting 2021

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Evaluation of statistical downscaling methods for climate change projections over Spain: present conditions with perfect predictors.

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The Spanish Meteorological Agency (AEMET) is responsible for the elaboration of downscaled climate projections over Spain to feed the Second National Plan of Adaptation to Climate Change (PNACC-2). The main objective of this work is to establish a comparison among five statistical downscaling methods developed at AEMET: 1) Analog, 2) Regression, 3) Artificial Neural Networks, 4) Support Vector Machines and 5) Kernel Ridge Regression. All the five methods have been applied with a Perfect Prog approach to downscale daily maximum/minimum temperatures and daily precipitation on a high resolution observational grid (0.05°) over mainland Spain and the Balearic Islands, a region particularly challenging due to its large regional spatio-temporal variabilities. The comparison has been carried out under present conditions and with perfect predictors, based on the framework established by the VALUE network, in particular, on its perfect predictor experiment. The evaluation here performed is focused on marginal aspects, through an analysis of the four seasonal distributions of each variable. In order to enable a manageable comparison among all methods three indexes commonly used for climate change adaptation and impact studies have been used: the mean value and the 10th and 90th percentiles for daily maximum/minimum temperatures and the total precipitation amount (PRCPTOT), the total precipitation on very wet days (R95p) and the number of wet days (R01) for precipitation. For maximum/minimum temperatures, all methods display a similar behavior. They capture very satisfactorily the mean values although slight biases are detected on the extremes. In general, results for maximum temperature appear to be more accurate than for minimum temperature, and the non-linear methods display certain added value. For precipitation, remarkable differences are found among all methods: most of them are capable of reproducing the total precipitation amount quite satisfactorily, while other aspects such as intense precipitations and the precipitation occurrence are captured with more accuracy by the Analog method.