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Downscaling of PDFs of daily air temperature in Northern Poland - assessment of predictors

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Contemporary GCMs provide the information which is too coarse to serve as an input to many impact studies thus there is a need to perform downscaling procedures especially for the areas of substantial variability of environment i.e. complex relief or in the vicinity of large water bodies which clearly triggers disturbances in a coarse picture of climate variability depicted by GCMs. In the course of the research CCA (Canonical Correlation Analysis) – empirical statistical downscaling (ESD) technique - was applied. The downscaling procedures were carried out in monthly scale with the variability of the local field defined with the fitted Gaussian distribution parameters (μ - average, σ - standard deviation) of daily air temperature. To account for the varying influence of advection the analysis treated the seasons separately. Local response field comprised over 20 stations located in the northern Poland. Pilot study performed for the stations located along the coast of the Baltic Sea showed that there is a substantial need to improve the performance of ESD models in case of σ parameter. Weak performance can be either due to nonstationarity of identified relations or excessive share of regional field variability left out of the models due to small spatiotemporal variability of local field (resulting in generally lesser number of forcing-response patterns in the model). The amendment was the extension of the local domain under consideration to capture greater share of forcing field variability. The aim of the research was to validate a set of potential predictors for daily air temperature PDF parameters. The regional forcing comprised SLP as well as relative pressure topography, advection stability coefficients and other temperature/advection derivatives. They were treated both individually and also as complex predictors in ESD models. The source of the regional data was NCEP/NCAR Reanalysis. The temporal scope of analysis was 1971-2010 with the calibration period comprising 30-years (1971-2000) leaving 2001-2010 period for validation purposes. The research allowed the assessment of possible regional predictors and precise model validation which is of utmost importance when applying ESD models for the prediction of future climate change in terms of air temperature PDF parameters variability.