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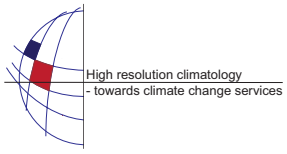

Spatial modelling of summer precipitation over the Czech Republic using auxiliary geographical variables

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The aim of this study is to develop the spatial model of summer precipitation over the Czech Republic using auxiliary geographical variables in order to produce gridded data needed for various applications. Daily precipitation data from 203 stations for the period 1971 – 2003 are used. Model is performed at different time steps (year, ten-years, and entire period). Considering that models performed at different time steps can vary significantly, it was necessary to verify two assumptions before the development of spatial prediction: (1) whether geographical variables control significantly the spatial distribution of summer precipitation over the Czech Republic; (2) and whether the effects of significant geographical variables (model parameters) do not vary significantly in time. Various candidate geographical predictors are evaluated in the stepwise regression models for summer precipitation: (1) a set of omnidirectional parameters of the elevation characterizing an area of 3 km x 3 km around meteorological stations, (2) various cross products calculated between geographical coordinates and elevation or topographic parameters, (3) slope and four facets of slope aspect which characterize the orographic regimes over the Czech Republic, (4) land cover parameters describing areas of about 10 km by 10 km around meteorological stations and (5) geographical coordinates. The orographic parameters are derived from the 1 km resolution digital elevation model (DEM), while the land cover parameters are derived from the 1 km resolution CORINE (Coordination of information on the environment) land cover data. To assure stability of the regression equations and comparability of regression models in time, both orthogonally rotated Principal Component Analysis (PCA) and frequency of significant predictors – selected using stepwise regression at each time step – are used to select identical significant independent variables for various time steps. Multivariate regression precipitation models are then generated using finally (PCA or stepwise based) selected predictors. From the set of geographical independent variables, ten have been selected as frequently significant predictors for precipitation regression models: latitude, longitude, slope aspect of the grid westward from the central grid, slope aspect of the grid northward from the central grid, slope of the grid northeastward from the central grid, slope of the grid eastward from the central grid, slope of the grid northward from the central grid, maximum value of elevation (percentile 95%) of northwestern grid from the central grid, minimum value of elevation (percentile 5%) of the central grid and vegetation. The parameters of models are stable in time. Regression-kriging is used to interpolate mean summer precipitation of the entire period onto the 1 km x1 km grid over the Czech Republic. Spatial prediction is calibrated across 153 stations and validated to 50 stations. The final regression-kriging prediction model shows a high coefficient of determination (68-70%) and moderate error (5mm -6mm MAE or 8 mm RMSE). The standard error of predicted maps represents about 23% of a global variance.