

Abstract

Title: Uncertainties in regional climate models outputs
Author: RNDr. Eva Holtanová
Supervisor: doc. RNDr. Jaroslava Kalvová, CSc.
Department: Dept. of Meteorology and Environment Protection
Faculty of Mathematics and Physics
Charles University in Prague

Present doctoral thesis focuses on the analysis of uncertainties in regional climate model outputs in the area of the Czech Republic. Generally, the uncertainties in model outputs come from inaccuracies of initial and boundary conditions, further from the necessity to parameterize the small scale processes, and the structure of the model, e.g. the choice of numerical schemes or spatial resolution. In case of the simulations of future climate, another source of uncertainty arises. It is the unknown development of forcings that influence the climate system.

The analysis in this work focuses on two multi-model ensembles, that come from two international European projects PRUDENCE and ENSEMBLES. The simulated 30-year mean seasonal air temperature and precipitation amounts are used, for the reference period 1961-1990, and several future time periods.

Two techniques were employed to assess the uncertainties. The first one was aimed at dividing the variance of a multi-model ensemble into contributions of regional model, driving global model and emission scenario (in case of future climate simulations). Among others, the results showed that when the PRUDENCE models are considered, the variance of simulated mean seasonal air temperature is mainly influenced by the regional climate model. On the other hand, in case of the changes of air temperature in the period 2071-2100 relative to 1961-1990 the driving global model plays a major role. For model simulations from the ENSEMBLES project this conclusion is valid for the spring season only. No similar general conclusion was found for simulated precipitation amounts.

With the second technique, the Reliability Averaging method (REA), we have focused on the uncertainty coming from the RCM itself, which was evaluated using the weighted standard deviation of simulations driven by one global climate model, or the reanalysis ERA40. The weights for individual models were based on two criteria, the model performance and model convergence. The first criterion evaluated the agreement of simulated and observed climate characteristics in the reference period, and the latter was based on the convergence of simulated climate changes in a future time period. The results showed, among other conclusions, that the uncertainty of simulations of present day climate is larger than uncertainty of simulated changes.