



Analysis of simulated regional climate change for the Carpathian Basin using the ensemble of four different regional climate models

Judit Bartholy (1), Rita Pongracz (1), Andras Horanyi (2), Ilona Kruzselyi (2), Ildiko Pieczka (1), Peter Szabo (2), Gabriella Szepso (2), and Csaba Torma (1)

(1) Eotvos Lorand University, Department of Meteorology, Budapest, Hungary (bari@ludens.elte.hu), (2) Hungarian Meteorological Service, Budapest, Hungary (klimadinamika@met.hu)

Due to their coarse spatial resolution the global climate model (GCM) results are not capable to provide detailed regional estimations of future climate conditions. The 10-25 km horizontal resolution of the regional climate models (RCM) nested into GCMs is anticipated to improve the regional climate scenarios. Expected regional climate change in the Carpathian Basin (located in Central/Eastern Europe) is simulated by four different RCMs. (1) The ALADIN-Climate model was developed by Météo France on the basis of the internationally developed ALADIN modelling system. (2) The PRECIS model was developed at the UK Met Office, Hadley Centre. (3) The RegCM model was developed by Giorgi et al., it is available from the ICTP (International Centre for Theoretical Physics). (4) The REMO model was developed by the Max Planck Institute for Meteorology, Hamburg. The horizontal resolution of the model experiments are 10 km in case of ALADIN-Climate and RegCM, and 25 km in case of PRECIS and REMO. First, the control runs of ALADIN, PRECIS, RegCM, and REMO are inter-compared for the 1961-1990 period using boundary conditions from the European Centre for Medium-range Weather Forecast (ECMWF) re-analysis datasets (ERA-40). For the validation, monthly data sets of the Climate Research Unit (CRU) of the University of East Anglia are used. For Hungary, temperature is most realistically simulated by RegCM with a slight positive annual bias (with slight negative seasonal bias in most seasons except DJF). ALADIN simulations underestimate the past temperature conditions (with the largest seasonal bias values in MAM and SON), while PRECIS and REMO overestimate the past climate in all seasons (with the largest bias values in JJA). In case of precipitation, the best annual performance has been achieved by REMO and PRECIS (partly due to positive seasonal bias values in DJF and MAM, and negative bias values in JJA and SON). ALADIN and RegCM are too humid in all seasons (with the smallest seasonal bias values in SON).

Then, future climate of the Carpathian basin have also been simulated using A1B emission scenario by all RCMs: (1) ALADIN-Climate and RegCM experiments are accomplished for 2021-2050 and 2071-2100, (2) PRECIS and REMO experiments are accomplished for 1951-2100. Results of the future climate simulations are also compared and evaluated focusing on Hungary. Evidently, the ensemble evaluation of the four adapted RCMs provides added value with respect to the individual analysis of each models' results. The simulations agree in increasing mean and extreme temperature, and decreasing annual and summer precipitation for the future. On the other hand, other features of the seasonal precipitation change are uncertain, especially, the winter precipitation change where on the basis of the projections in the near future a decrease is more likely to occur, and at the end of the century an increase is more likely.