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Comparison of cumulus convection schemes in RegCM experiments for the Carpathian Region

Karolina André, Ildikó Pieczka, Judit Bartholy, and Rita Pongrácz
Eötvös Loránd University, Dept. of Meteorology, Budapest, Hungary

Our research group aimed to participate in the Med-CORDEX international initiative with the specific goal of contributing to the complex regional climate modelling database with experiments at 50 km horizontal resolution using the mosaic-type subgridding option in order to take into account subgrid processes. For this purpose, we used ERA-Interim data (1981-2010) and HadGEM2 global model outputs (1951-2005) as initial and lateral boundary conditions (ICBC) for the entire MED-44 CORDEX area covering the extended Mediterranean region of Europe. The 50-km resolution RegCM-outputs serve as an ICBC input for further downscaling using 10 km as a horizontal resolution for a smaller domain covering Central Europe with special focus on the Carpathian Region.
In order to quantify the impact of the use of different parameterization schemes on regional climate model outputs, hindcast experiments are completed applying the RegCM4.3 model to the Carpathian Region and its surroundings at 10 km horizontal resolution with three different cumulus convection schemes (i.e. Kuo, Emanuel, and Grell schemes with different closure methods). Besides, sensitivity of outputs for subgrid-scale processes is also studied by activating the subgrid Biosphere-Atmosphere Transfer Scheme (BATS) model within other RegCM experiments.
RegCM simulation results are sensitive to the driving data since the completed experiments with ERA-Interim and HadGEM2-driven 50-km outputs as ICBC result in different bias patterns. However, when the same driving data are used with different specific set-ups, the simulation results look quite similar. To some extent RegCM is able to reduce the errors inherited from the global datasets. Our validation results for temperature and precipitation suggest that for the Carpathian Region the overall best performance is achieved when using the mixed Grell-Emanuel scheme together with Fritsch & Chappell closure. Moreover, turning the subgrid model on improves additionally the model performance, since surface climatology is better reproduced when it is activated than it is deactivated.