Atmospheric circulation and weather extremes in Central Europe and their representation in climate models

– abstract for the general public –

Knowledge of climate change in future decades up to the end of 21st century is crucial for preparation of appropriate adaptation and mitigation strategies to preserve sustainable development of a human society as a whole, widely used in various sectors like environmental and water management, agriculture, forestry, energy sector, spatial planning etc. Significant technological progress, an increase in the number of available climate data consequently, has pushed forward the development of climate models. Nevertheless the current generation of climate models, used for projections of future climate, has its caveats and benefits. In order to fully employ their advantages, we have to be aware of their limits and uncertainties. The careful and well-founded selection of climate models becomes an important step in the construction of climate change scenarios on regional scale.

The aim of the project is an extensive validation process of state-of-the-art climate models and downscaling methods based on various reference datasets of observations of atmospheric conditions. Quality controlled and homogenized in-situ measurements of air temperature, precipitation, solar radiation, wind speed, air pressure and snow cover conducted by the dense network of meteorological stations in Central Europe (represented here by Poland, Czech Republic, part of Slovakia and eastern Germany) will be used to describe climate and its extremes from 1961 to 2020. The description will be supplemented with information on of global and regional circulation conditions, with particular emphasis on circulation types that favor the occurrence of weather extremes.

These datasets, analyzed from point of view of their spatiotemporal variability, will be further compared with the observed and simulated climate and its extremes to identify their strong and weak points. The quality of the climate models in simulating the European climate variability and extremes as well as their ability to reproduce individual weather extremes will be analyzed considering the role of atmospheric circulation as well as the lay of the land (mountain ranges location) as important Central European climate predictors. The role of atmospheric circulation will be determined by application of several classifications of circulation types as well as circulation indices.

We will carry out evaluation of Coupled Model Intercomparison Projects – Phase 6 (CMIP6) global climate models (GCMs), high-resolution GCM simulations following the CMIP6 HighResMIP protocol and regional climate models (RCMs) from the Euro-CORDEX initiative.

Based on the validation results, recommendations for further use of RCMs and GCMs with respect to specific features of the area of Central Europe, providing a general road map of proper application of model outputs in climate projections, will be formulated. Obtained knowledge about climate change in the studied region of Central Europe will represent important knowledge necessary for evaluation of the future climate and its extremes depending on various emission and climate scenarios. The proposed recommendations he climate model outputs will be well suitable also for impact studies in various sectors of can serve as a background material for decision makers both on national or Central European levels.

The results will be available to scientific and public community via scientific publications as well as dedicated web pages.