NEW HIGH-RESOLUTION GRIDDED DATASETS OF CLIMATE OBSERVATIONS AND PROJECTIONS OVER POLAND

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ABSTRACT

The main objective of this study was to provide high resolution climate projections that can serve as the basis for studying the impact of climate change on various sectors in Poland.

First, a new high-resolution climate product was constructed from observational weather station located in Poland and neighbouring countries. This gridded 5 km resolution dataset consists of (minimum and maximum) temperature and precipitation developed for the Odra and Vistula watersheds. The gridding was based on a comprehensive kriging technique (DOI: 10.5194/essd-8-127-2016) applied using more than seven hundred observational weather stations. Next, the new gridded product was used as a reference to correct the bias in modelled temperature and precipitation from nine regional climate simulations from the Euro-CORDEX dataset for the historical (1971-2000) period. The bias correction technique applied a quantile mapping procedure to adjust the distribution of historical model data so that it matches the observations. Finally, the same correction was applied on the climate projections of the same climate model ensemble to produce bias-corrected climate projections for two future horizons: near (2021-2050) and far (2071-2100) future, assuming two of the four existing Representative Concentration Pathways (RCP4.5 and RCP8.5).

Minimum daily temperatures were projected to increase by 1.1 °C for 2021-2050 and 2.2 °C (ensemble mean changes) for 2071-2100 under RCP 4.5. Similarly but with lower magnitude, maximum daily temperatures were projected to increase by ~1 °C for 2021-2050 and 1.9 °C for 2071-2100, respectively. The corresponding increases under RCP 8.5 were of similar magnitude in the near future, but much higher (by 3.3-3.7°C) in the far future. Most of temperature changes were highly robust (significant, and characterized by high model agreement). Projections differed between seasons, with winter increase much higher than the increase for other seasons.

The results also showed that projected annual total precipitation averaged across all models and Poland increased by 5% until 2021-2050 and by 6.5 % until 2071-2100 assuming RCP4.5. The increases of precipitation under RCP 8.5 were even higher, reaching over 15 % in the far future. Despite this overall increasing trend, precipitation changes were not robust, with some cases showing lack of significance and other cases showing a largely different

direction or magnitude of changes between models. Winter and spring increases were much higher than projected changes in summer and autumn. Even though spatial variability in projections was high, the patterns differed between models.

The developed dataset of bias-corrected climate projections over Poland will be made freely available for use in two different ways: (1) in a long-lasting research data repository, (2) through a dedicated CHASE-PL geoportal (ClimateImpact.sggw.pl). The first option is meant to serve mainly researchers, particularly users of environmental models, to use the bias-corrected high resolution climate data as a consistent forcing dataset for projecting climate change impacts on different sectors in Poland. The second option is expected to serve both researchers and a wider audience, including students, stakeholders and public authorities, as climate change science has not been disseminated widely in Poland to date.

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