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Climate projections over Poland. Assessment of bias-corrected EURO-CORDEX simulations

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Simulations of one historical period (1971-2000) and two future horizons (2021-2050 and 2071-2100) assuming two representative concentration pathways (RCP4.5 and RCP8.5) were produced over Poland within the CHASE-PL (Climate change impact assessment for selected sectors in Poland). They consist of projected daily minimum and maximum air temperatures and precipitation totals of nine EURO-CORDEX regional climate model outputs bias corrected and downscaled to a 5 km $\times$ 5 km grid. We used the quantile mapping method and corrected any systematic bias in these simulations before assessing the changes in precipitation and temperature over Poland. Projected changes estimated from the multi-model ensemble mean showed that regional annual means of temperature are expected to increase steadily by 1 °C until 2021-2050 and by 2 °C until 2071-2100 assuming the RCP4.5 emission scenario. Assuming the RCP8.5 emission scenario, this warming can reach up to almost 4 °C by 2071-2100. Similarly to temperature, projected changes in regional annual means of precipitation are expected to increase by 6 to 10 % and by 8 to 16 % for the two future horizons and RCPs, respectively. Individual model simulations also exhibited warmer and wetter conditions on an annual scale, showing an intensification of the magnitude of the change at the end of the 21st century. We believe that this high-resolution bias-corrected product can serve as a basis for climate change impact and adaptation studies for many sectors over Poland. The CPLCP-GDPT5 dataset is publicly available at http://dx.doi.org/10.4121/uuid:e940ec1a-71a0-449e-bbe3-29217f2ba31d.

These results (DD) were additionally confronted to those obtained through empirical-statistical downscaling (ESD) based on the CMIP5 ensemble of climate model simulations assuming the same emission scenarios. As the DD is computationally expensive, it was only limited to a small number of climate model simulations, while, the ESD was based on a larger ensemble. Considering the same ensemble of driven global climate models, results showed that downscaled temperature values from DD and ESD are in excellent agreement, however, the ensemble size and selection of climate models may have a significant impact on the strength and range of projected climate change. Nevertheless, independent of ensemble selection or downscaling strategy, all climate projections show a significant warming in all parts of Poland. For precipitation, there was a considerable discrepancy between the results of the DD and ESD approaches which imposes a large uncertainty on the precipitation projections for Poland.