EGU24-12738, updated on 19 May 2024
https://doi.org/10.5194/egusphere-egu24-12738
EGU General Assembly 2024

Evaluating the PolarRES regional models using tailor-made climate indices for Arctic reindeer herding communities

Heidrun Matthes[1], Jussi T Eronen[4], Xavier Fettweis[5], Bruce C Forbes[3], Ella Gilbert[6], Joachim Otto Habeck[2], Tim Horstkotte[9], Kirill Istomin[2], Teresa Komu[3], Oskar Landgren[12], Jan Landwehrs[1], Roza Laptander[2], Priscilla Mooney[8], Ruth Mottram[10], Christiaan van Dalum[11], Willem Jan van den Berg[11], Sirpa Rasmus[3], Annette Rinke[1], and Hans Tømmervik[7]

[1]Alfred Wegener Insititut Helmholtz-Zentrum für Polar-und Meeresforschung, Potsdam, Germany
[2]Universität Hamburg, Hamburg, Germany
[3]Lapin Yliopisto, Rovaniemi, Finland
[4]Helsingin Yliopisto, Helsinki, Finland
[5]Université de Liège, Liège, Belgium
[6]British Antarctic Survey, Cambridge, UK
[7]Norsk institutt for naturforskning, Tromsø, Norway
[8]Norwegian Research Centre, Bergen, Norway
[9]Umeå universitet, Umeå, Sweden
[10]Danmarks Meteorologiske Institut, København, Denmark
[11]Universiteit Utrecht, Utrecht, Netherlands
[12]Meteorologisk institutt, Oslo, Norway

From a combination of the operational system of reindeer herding and meteorological seasonality, we developed a range of climate indices reflecting critical events in the reindeer herding year that influence the success of this livelihood. These critical events can be described as combinations of specific meteorological conditions, and therefor rendered as equations we can compute from climate model output, creating a capability for analysing different projections of the future and delivering relevant information on climate change to reindeer herding communities.

For this purpose, we can use a wealth of different global and regional climate projections, with distinct advantages and disadvantages (e.g. model resolution, different greenhouse gas futures, high number of models in the ensemble for uncertainty estimates, process representation, availability of variables). For example, the CMIP6 ensemble enables the analysis of a broad range of greenhouse gas futures from a wide variety of models, allowing us to assess scenario uncertainty, but it is limited by its coarse spatial resolution. On the other hand, the PolarRES ensemble has a higher spatial resolution but is only available for one RCP/greenhouse gas future. The PolarRES ensemble consists of regional climate simulations generated by multiple regional climate models that dynamically downscale CMIP6 global climate simulations selected using a novel storyline approach. Both ensembles provide hindcast simulations that allow us to evaluate the ensemble performance with regard to the climate indices we defined.

This study uses these simulations to evaluate and compare model performance to understand the potential and limitations of future projections of specific climate indices relevant for reindeer herding. We use in-situ based observations from the data set Global Summary of the Day to evaluate onset and end of the continuous freezing period, hot summer days, thawing days in autumn and freeze-thaw cycles in both spring and autumn.