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Regional Climate Modeling of Arctic Temperature Extremes and Their Variability

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Within the scope of the WCRP CORDEX program, various regional climate models (RCMs) were applied over the Arctic, using a common domain (roughly everywhere north of 65degrees North) and the same horizontal resolution (approximately 50km). In a first step, the models are used for downscaling the ERAInterim reanalysis data from 1989-2010, to allow intercomparison of the models as well as validation with reanalysis and observational data.
We analyzed the model output concerning temperature extremes and their variability, using climate extreme indices. For example, we calculate intra-seasonal extreme temperature range (ETR) as a first measure of temperature variability; warm spell days (WSDI) as a measure for lasting warm periods or growing degree days (GDD) as a measure for potential plant growth. We present here an evaluation of the RCM derived indices with the forcing ERAInterim data for spatial patterns and with observational station data from the NCDC dataset Global Summary of the Day in the form of time series.
The focus of our analysis is not only on the models' ability to reproduce mean values of the temperature extreme indices, but also on temporal development and decadal variability. For ETR, we find that both reanalysis data and observations show no significant trends (exception: spring over Eastern Russia), a development which is well reproduced by almost all models. In GDD, trends and their significance depend on region and season. While in the western Arctic, trends are mostly positive and not significant, the eastern Arctic shows significant positive trends. The models seem to capture the temporal development of GDD well, however an offset from the station data can frequently be found, especially over the western Arctic. WSDI show non-significant trends over all seasons and regions (except, again, eastern Russia in spring).
In general, we find that model performance is highly dependent on geographical region and analyzed season, for both temperature extreme indices means as well as their variability.