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Changes in Arctic warm and cold spell occurrence during winter and summer

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In the Arctic, climate change manifests with the strongest warming trends on the globe, especially in the cold season, associated with Arctic Amplification. However, climate change is not restricted to mean temperature but also expresses itself in changes of temperature extremes. It is under debate if climate extremes change similarly strong, and what mechanisms apply. Our study provides detailed regional information about two selected temperature extreme indices in the Arctic, namely warm and cold spells in winter and summer. Both indices detect lasting cold respectively warm periods that are based on extreme temperatures: cold nights as days where the daily minimum temperature is below the 10th percentile of minimum temperatures and warm day times where the daily maximum temperature is above the 90th percentile of maximum temperatures. We analyze the temporal evolution and variability of warm and cold spells from 1979-2013, based on daily station data and the ERA-Interim reanalysis.
Calculated trends from both datasets suggest a widespread decrease of cold spells in winter and summer of up to -4 days/decade, with regional patches where trends are statistically significant throughout the Arctic. Winter trends are spatially heterogeneous, the reanalysis also shows small areas with statistically significant increases of cold spells throughout Siberia. Calculated changes in warm spells from both datasets are mostly small throughout the Arctic (below $\pm$ 1 day/decade) and statistically not significant. Remarkable exceptions are the Lena river basin in winter with a statistically significant decrease of up to 1.5 days/decade and areas in Scandinavia with statistically significant increases of up to 2.5 days/decade in winter and summer (again from both datasets).
Changes in both warm and cold spells may be caused by two separate mechanisms: changes in occurrence of the underlying extremes (changes in the number of cold nights and warm daytimes) or changes in the temporal clustering of the underlying extremes (eg the number of cold nights stays the same with time, but they occur separately instead of in a spell). Trends in cold nights for winter suggest that the occurring changes in cold spells are associated with the changes in cold nights. In summer this is mostly true as well with an exception of the Lena River Basin, where cold nights decrease while cold spells at the same locations increase. For warm spells, the observed changes seem to be associated with changes in warm daytimes in both seasons for all regions.