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Temporal discrepancies of reanalyses over Siberia and their effect on dynamical downscaling results

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Dynamical downscaling using a regional climate model depends on the realism of the driving data. The aim of this study is to investigate the quality of two reanalyses (ERA40 and NCEP-R1) for Siberia in terms of providing temporal consistent lateral boundary data for long-term regional climate simulations prior to 1979. The assessment is carried out for mean sea level pressure, tropospheric temperature, geopotential, specific humidity and horizontal wind components which are considered at 850, 500 and 200 hPa. The analysis additionally presents the sensitivity of downscaled model results to the driving reanalysis. The regional climate model (RCM) COSMO-CLM (CCLM) was used to obtain reconstructions over Siberia at 50 km spatial resolution. This study provides a regional and seasonal overview to what extent both forcings and reconstructions differ or agree in terms of their inter-decadal changes and variability of atmospheric variables. The temporal consistency is evaluated by assessing the degree of similarity. Besides the inter-annual variations and inter-period differences of seasonal means, a metric of agreement is defined based on the spatial means of correlation, difference and standard deviation of seasonal means. The agreement is analyzed separately between both reanalyses and both RCM reconstructions for the period of 1959-2001.
Both conducted reconstructions show for near-surface variables, such as, e.g., mean sea level pressure, geopotential and wind component, significant differences in terms of inter-annual variability prior 1968 over southern parts of the model domain, especially during summer. These temporal discrepancies can be related to the varying large-scale atmospheric forcing presented by NCEP-R1 and ERA40. In the 1970s, CCLM can partly compensate the large-scale discrepancies of driving data and thus adds value to the temporal reliability. In the arctic and subarctic regions the temporal consistency is given both by the reanalyses and derived reconstructions throughout the entire considered time period. This assessment shows which variables, seasons, years and regions of used reanalyses for Siberia and the derived reconstructions are consistent over time or are of concern for the use of dynamical downscaling and trend analysis.