



Recent changes of seasonal snow cover in Siberia derived by a regional climate model

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In this study, recent changes of Siberian snow cover over the period of 1981-2010 are presented, focusing on the seasonal trend patterns of snow water equivalent (SWE) and the temporal variability of seasonal snow cover extent. The reconstruction of Siberian climate including historical fields of SWE was obtained by means of dynamical downscaling of NCEP-R1 reanalysis data using the regional climate model COSMO-CLM (CCLM). Reconstructed fields are available over a period of 1948-2010 at 50km grid spacing. To evaluate the model output in a larger scale, the satellite-derived SWE estimate provided by ESA GlobSnow is used as reference for the years 1987-2010 in combination with the SWE products of several reanalyses. Russian station SWE data is used for cross-checking the findings. The comparison reveals that the reconstructed SWE fields of CCLM are in good agreement with GlobSnow during mid-winter, whereas it overestimates SWE during the melting season. The temporal consistency of CCLM in terms of SWE is higher than that presented by ERA-Interim and NCEP-R2. Before 1979, the hindcast data of CCLM is neglected due to temporal inconsistencies that are introduced by the NCEP-R1 reanalysis.

Changes and interannual variations of mean SWE are characterized by strong spatial and seasonal variability. According to CCLM, regional averages for the period of 1981-2010 show only minor changes of SWE in fall, whereas during winter and spring stronger changes occur with varying patterns throughout the regions. A slight decrease in mean winter SWE is evident south of Lake Baikal, northeast of Mongolia and northern China ranging from 5 to 10 mm per decade and reaching 20mm per decade at single points in the reconstructed data. Strong significant decreases of SWE during the winter seasons in the recent decades are evident according to CCLM in the most elevated parts at the Central Siberian Plateau and Verkhoyansk Mountains up to 30mm per decade. Snow accumulation has increased strongest west, northwest, and northeast of Lake Baikal and along the coast of Sea of Okhotsk. Along the Sayan Mountains and Stanovoy Range, CCLM presents an increase up to 20-30mm per decade and even to 40mm per decade in certain regions. CCLM show stronger interannual variations of snow cover extent during the transition seasons spring and fall than in winter. During spring a negative tendency is presented since the early 1980s. This tendency has ceased in recent years.