

MIS003-05

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Changes in Snow Cover Characteristics over the Asian part of Russia

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Since 1881, the annual surface air temperature in Northern Eurasia has increased by 1.5K and in the winter season by 3K. In the Northern Asia and over the interior of the continent (in Siberia) this warming has been "slightly" weaker in winter and stronger annually and in all other seasons (e.g., during the past 130 years with standard instrumental observations in Siberia, the annual and winter surface air temperatures have increased by 1.8K and 2.4K respectively). Nearby to the north in the Arctic Ocean, the late summer sea ice extent decreased by 40% exposing a near-infinite source of water vapor for the dry Arctic atmosphere in early cold season months. Both large-scale processes, global warming and the Arctic sea ice retreat, substantially affected the cold season climate in this part of the world. Its duration, severity and frequency of cold spells, frequency of thaws and "cyclonic" days favorable for snowfall (with negative but relatively mild temperatures) have changed in the past several decades causing changes in various snow cover characteristics over the interior regions of Eurasia, first of all over the Russian Federation east of 60E (Asian Russia). Presentation will describe the contemporary changes of these characteristics for the 1966-2010 period.

For our analyses we used the NOAA snow cover satellite monitoring data from October 1966 to 2010, a standard suite of synoptic observations that for snow cover includes snow depth, snow type, state of the ground at the meteorological site and its surroundings and the national snow survey dataset archived at the Russian Institute for Hydrometeorological Information. This dataset has routine snow surveys run throughout the cold season each decade (during the intense snowmelt, each 5 days) at all meteorological stations of the former USSR, thereafter, in Russia since 1966. Prior to 1966 snow surveys are also available but the methodology of observations had substantially changed at that year. Therefore, this analysis includes only data of stations within the Asian part of Russia (i.e., east of 60E) from 1966 to 2010. Surveys run separately along all types of environment typical for the site for 1 to 2 km, describing the current snow cover properties such as snow density, depth, water equivalent, and characteristics of snow and ice crust.

During the past several decades, the following changes in snow cover characteristics over Asian Russia have been observed: (a) in autumn the dates of the onset of snow cover have not changed noticeably despite the strong temperature increase in this season; (b) in late spring, snow cover extent has decreased over most of the region (but somewhat increased in the southeastern areas of Asian Russia); (c) in the cold season, maximum snow depth and snow water equivalent (SWE) at open areas have increased, and (d) days with winter thaw became more frequent. The snowmelt process over Asian Russia can be lengthy but even the first such melt initiates a process of snow metamorphosis on its surface changing snow albedo and generating snow crust as well as on its bottom, generating basal ice crust layer. In the Asian part of Russia, the entire process of the spring snowmelt has become shorter in duration and (taking into account a parallel rise in the maximum snow depth and snow water equivalent) more intense.

Keywords: snow cover, snow water equivalent, snow depth, Siberia, climatic change