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Icing conditions in the northern extratropics in changing climate
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A general increase in atmospheric humidity is expected with global warming, projected with GCMs, reported with remote sensing and in situ observations (Trenberth et al. 2005; Dessler, and Davis 2010; IPCC 2007, Zhang et al. 2012). In the Arctic this increase has been and will be especially prominent triggered by the dramatic retreat of the sea ice. In the warm season this retreat provides an abundant water vapor supply to the dry Arctic atmosphere. The contemporary sea ice changes are especially visible in the Eastern Hemisphere and after the two extremely anomalous low-ice years (2007 and 2012) it is right time to look for the impact of these changes in the high latitudinal hydrological cycle: first of all in the atmospheric humidity and precipitation changes.

Usually, humidity (unless extremely high or low) does not critically affect the human activities and life style. However, in the high latitudes this characteristic has an additional facet: higher humidity causes higher ice condensation from the air (icing and hoar frost) on the infrastructure and transports in the absence of precipitation. The hoar frost and icing (in Russian: gololed) are measured at the Russian meteorological network and reports of icing of the wires are quantitative measurements. While hoar frost can be considered as a minor annoyance, icing may have important societal repercussions. In the Arctic icing occurs mostly during relatively warm months when atmosphere holds maximum amount of water vapor (and is projected to have more). Freezing rain and drizzle contribute to gololed formation and thus this variable (being above some thresholds) presents an important characteristic that can affect the infrastructure (communication lines elevated at the telegraph poles, antennas, etc.), became a Socially-Important climatic Variable (SIV).

The former USSR observational program includes gololed among the documented weather phenomena and this allowed RIHMI to create Electronic Reference Book on Climate of the Russian Federation for the national territory. This Reference Book addresses the current state of these weather phenomena. However, the ongoing and projected humidity changes in the high latitudes will strongly affect the circum-polar area (land and ocean) and impact the frequency and intensity of these potentially dangerous weather phenomena across the entire extratropical land area. Therefore the goal of the present study is to quantify icing conditions over the northern extratropics.

Our analysis includes data of 958 Russian stations from 1984 to 2011. Regional analysis of gololed characteristics was carried out using quasi-homogeneous climatic regions. Maps (climatology, trends) are presented mostly for visualization purposes. The area-averaging technique using station values converted to anomalies with respect to a common reference period (in this study, from 1984 to 2011). Anomalies were arithmetically averaged first within 1N x 2E grid cells and thereafter by a weighted average value derived over the quasi-homogeneous climatic regions. This approach provides a more uniform spatial field for averaging.

キーワード: hoar frost and icing, northern extratropics, quasi-homogeneous climatic regions, Socially-Important climatic Variable
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