Freezing Precipitation and Freezing Events over Northern Eurasia and North America

*Pavel Groisman[1,4], Xungang Yin[2], Olga Bulygina[3,4], Irina Partasenok[5,4], Olga Zolina [6,4], Inger Hanssen-Bauer[7]

1.University Corp. for Atmospheric Research Project Scientist at NOAA National Centers for Environmental Information, Asheville, North Carolina, USA, 2. ERT, Inc. at NOAA National Centers for Environmental Information, Asheville, North Carolina, USA, 3. All-Russian Research Institute of Hydrometeorological Information–World Data Centre, Obninsk, The Russian Federation, Obninsk, Russia , 4. RAS P.P. Shirshov Institute for Oceanology, Moscow, The Russian Federation, 5. Republican Hydrometeorological Centre, Minsk, Belarus, 6. Le Laboratoire de glaciologie et géophysique de l'environnement, Grenoble, France, 7. Norwegian Meteorological Institute, Oslo, Norway

With global climate change in the extratropics, the 0°C isotherm will not disappear and associated precipitation events will continue to occur. The near-0°C temperatures should generally move poleward and to the higher elevations and arrive at many locations earlier in spring or later in autumn. This could potentially affect the seasonal cycle of near-0°C precipitation. The overall warming, together with a larger influx of the water vapor in the winter atmosphere from the oceans (including ice-free portions of the Arctic Ocean) can also affect the amount of near-0°C precipitation. The issue of near 0°C precipitation is linked with several hazardous phenomena including heavy snowfall/rainfall transition around °C; strong blizzards; rain-on-snow events causing floods; freezing rain and freezing drizzle; and ice load on infrastructure.
In our presentation using more than 1,500 long-term time series of synoptic observations for the past four decades, we present climatology and the empirical evidence about changes in occurrence, timing, and intensity of freezing rains and freezing drizzles over five countries of Northern Eurasia and two countries of North America.
The regions with the highest frequency of freezing rains (from 3 to 10 days per year) reside in the northeastern quadrant of the conterminous United States and adjacent areas of southeastern Canada south of 50°N, over the south and southwest parts of the Great East European Plain, and Central Europe. The frequency of freezing drizzle exceeds the frequency of freezing rain occurrence in all areas. During the past decade, the frequency of freezing rain events somewhat decreased over the southeastern U.S. In North America north of the Polar Circle, it increased by about 1 day yr^{-1}. Over Norway, freezing rain occurrences increased substantially, especially in the Norwegian Arctic. In European Russia and western Siberia, the frequency of freezing rain generally increased (except the southernmost steppe regions) while freezing drizzle frequency decreased over entire Russia. The number of days with freezing events over Belarus did not change, however, the duration of these events (in hours) substantially increased. In the mountains of Central Asia (Kyrgyzstan) we documented increases in freezing rain and drizzle frequencies only at high elevations, while they decrease at elevations below 1 km (matching to a similar decrease over the steppe zone of southern Russia).
In the former Soviet Union, instrumental monitoring of ice load has been performed by ice accretion indicator that in addition to the type, intensity and duration of ice deposits reports also their weight and size. Estimates of climatology and changes in ice load based on this monitoring at 958 Russian stations will be also presented.
This work is supported by the Ministry of Education and Science of the Russian Federation (grant 14.B25.31.0026) and the NASA LCLUC Program.

Keywords: freezing precipitation, climatic change, northern extratropics