FREEZING PRECIPITATION, CHARACTERIZATION OF WEATHER CONDITIONS ASSOCIATED WITH IT, AND CHANGES OF THE FREQUENCY OF ITS OCCURRENCE

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Freezing precipitation events intertwine with agriculture, recreation, energy consumption, and seasonal transportation cycles of human activities. While not rare, such events are known as "human-associated extremes" (HAE) and deserve our attention, especially when their intensity, timing, and type begin changing. We have already observed significant changes in freezing precipitation occurrences in the past decade. Can we project the future changes in pattern of this HAE over the northern extratropics under conditions of increasing lower tropospheric temperatures, changes in the atmospheric circulation, water content, and vertical structure? We used supplementary synoptic information to evaluate the weather conditions during the freezing events observed at more than 1,500 long-term (i.e., 40+ years) stations in North America and Northern Eurasia to create climatologies of the freezing precipitation occurrence *near the surface and to estimate its changes in the past decade*. For these stations, we estimated the near-surface temperature (T) and humidity (H) intervals, within which the freezing events do occur. It appears that within these T and H intervals the other precipitation events occurred also and they are not necessary characterized by freezing. Therefore, we used Integrated Global Radiosonde Archive to blend our synoptic data with collocated upper air soundings and selected those that corresponded to freezing events at the ground. We found and quantified (a) unusually warm air as compared to long-term climatology values of corresponding Julian day; (b) much warmer low tropospheric air temperature than in the "nearby" days without freezing event at the ground; and (c) frequent near surface temperature inversions, when the air at the 850 hPa is warmer than at the surface. Combination of these meteorological variables (near-surface temperature, humidity, and the low troposphere temperature anomalies) allow us to build a set of the weather conditions that with high probability are *conducive* to freezing precipitation occurrence when it rains.