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Assessment of Dangerous Permafrost Processes in Urban Settlements of the Russian Arctic

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Russian Arctic is characterized by developed infrastructure and high percentage of urban population on permafrost. The settlements on permafrost represent hot spots of permafrost transformations as rapidly changing climatic conditions are exacerbated by various types of human activities. To evaluate the exposure and risks of settlements to permafrost related dangerous processes, we selected several criteria, including geographic extent, duration, probability of occurrence, and total risk of damages associated with each permafrost process in 37 settlements located in various parts of the Russian Arctic. The following six types of potentially dangerous permafrost processes were considered: a) thermokarst, b) thermal erosion and thermal abrasion, c) frost heave, d) frost cracking, e) formation of icings, f) human-induced slope processes on permafrost. While risk from particular process was rather location specific, the integral assessment of all selected categories allowed to classify the overall exposure of settlements to permafrost processes. Results show that cities of Anadyr, Nadym and Kharp have rather small risk exposure, while cities of Igarka and Vorkuta have relatively high exposure. Bilibino and Norilsk were among the cities having the highest overall exposure and potential risk associated with permafrost related processes considered in this study. The research is supported by Russian Foundation for Basic Research project 18-05-600888 "Urban Arctic resilience in the context of climate change and socio-economic transformations".