

Climate Change and Urban Infrastructure: Quantitative Assessment for Russian Permafrost Regions

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Planned socio-economic development during the Soviet period promoted migration into the Arctic and work force consolidation in urbanized settlements to support mineral resources extraction and transportation industries. One of the most significant impacts of climate change on arctic urban landscapes is the warming and degradation of permafrost which negatively affects the structural integrity of infrastructure. In this paper we focus on quantitative assessment of potential changes in stability of Russian urban infrastructure built on permafrost in response to projected climatic changes using permafrost - engineering model. To address the uncertainties in climate projections produced by state-of-the art General Circulation Models (GCMs), we have utilized results from six GCMs participated in most recent Climate Model Inter-comparison Project (CMIP5). The analysis was conducted for entire extent of the Russian permafrost-affected area and on several representative urban communities. Our analysis demonstrates that significant climate-induced reduction in urban infrastructure stability throughout the Russian permafrost region should be expected by mid XXI century. Although high uncertainty, resulted from GCM-produced climate projections, prohibits definitive conclusion about the rate and magnitude of potential climate impacts on permafrost infrastructure, the results presented in this paper can serve as guidelines for developing adequate adaptation and mitigation strategy for Russian northern cities.

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