



Thermal regime of Kola Peninsula and Franz-Josef Land in view of permafrost and geomorphological processes evolution in XX and XXI centuries

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Lots of Arctic environmental processes and systems are affected by permafrost. Our field works were aimed to observe some of them like coastal dynamics linked to thermodenudation and thermoabrasion at Franz-Josef Land and relief processes linked to sporadic and insular permafrost in Kola Peninsula. The presence and state of permafrost depends on regional “thermal potential”: year sums of daily positive and negative temperatures. Within the climate change the change of the permafrost state and related processes is expected.

We investigated all the available observation data at the regions mentioned above and completed them with CRU4.1 and reanalysis (ERA Interim) data. Our data samples cover the period from 1897 to 2016.

Air temperature analysis at the stations of the southern part of Kola has revealed its quasi-cyclic changes with the period of about 70 years, characterized by a distinctly seen linear trend of average mean annual air temperature increase with the rate of about 1.0oC per 100 years. In all seasons, the linear air temperature trend is positive; in winter it is the most significant. The modern warming has an uneven distribution over the Kola Peninsula increasing from the west to the east: in Kandalaksha it is almost unseen, while on Sosnovets Island it becomes statistically significant. Nevertheless, up to the current day the warming strength is not enough to melt the sporadic permafrost located in the Kola Peninsula southern part which was expected to disappear even in the previous warming of 1930-40th [1].

At Franz-Josef land the warming is extremely rapid: about 4oC per 50 years (compared to 1,2-1,7 oC at Kola Peninsula). Still this recordbreaking warming is provided by winter temperature growth, while summers' temperatures, which are crucial for cryogenic processes, remain stable since 1958. In the same time, we do observe coastal dynamics activation in recent 10-20 years which must be explained by ice-free (abrasion) period extension.

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Reference:

[1] Lavrova M.A., 1935 A note about found permafrost on the southern coast of Kola Peninsula // Proceedings of the Commission on permafrost studies. Vol. IV. [in Russian].