Remote-sensing data application for permafrost monitoring on Yamal, Russia

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Field studies in permafrost areas of Russia provide ground truth to evaluate geomorphic and permafrost-related modelling and remote-sensing data. Cryogenic processes as well as thermal features of permafrost are controlled by a complex of environmental and climatic parameters. Combination of parameters results in synergetic effect and may lead to unexpected response of permafrost. Remote-sensing is an instrument to follow changes in time on vast areas which is impossible to reach by ground observations. Remote-sensing data interpretation with the help of land-based information yet needs coordination of approaches from both sides.

Remote sensing study of the Earth surface in the tundra is challenging due to the relatively homogeneous patterns as well as ground cover spectral characteristics. It is therefore necessary to develop a comprehensive methodology for the interpretation of remotely sensed data for the analysis of permafrost with the involvement of the land-based permafrost study at the reference locations of cryolithozone.

At present, a set of remote sensing studies relating to the receipt and interpretation of aerial and satellite images from various sensors within various spatial and temporal scales is applied at Vaskiny Dachi research station by an International team within a framework of several projects. Research station is located in Yamal Peninsula in Tundra zone of West-Siberian lowland, highly dissected by ravines and thermokarst lakes, with continuous permafrost and active slope processes.

The study presented here is dealing with four permafrost related aspects: (1) seasonal thaw, and (2) snow thickness, structure and redistribution, both as characteristics representing thermal state of permafrost; (3) thaw lake dynamics, and (4) active layer detachments both indicating climate change. These investigations contribute to the development of methods for permafrost monitoring through remote sensing data.