

Spatial and temporal controls on active layer dynamics in an Arctic mountain valley

This project is concerned with active layer of permafrost in High Arctic, in the unglaciated area, on an example of the Brattegg valley in south Spitsbergen. Permafrost is ground / soil remaining at or below the freezing point of water 0 °C (32 °F) for two or more years. Its upper part, called 'active layer' thaws during summer season up to a depth of tens of cm to more than 2 m.

The main objective of the project is to define how the process of thawing of the active layer, both in time and space, occurs. There are various conditions which determine the course of this process. Although thawing of the active layer depends mainly on incoming solar radiation to ground, it is also conditioned by soil properties, the presence of snow cover, flowing water, as well as topographical location (altitude, aspect).

We would like to recognize active layer using geophysical imaging – electrical resistivity and electromagnetic methods. They allow to determine selected physical characteristics of ground, and thus an interpretation of geological structure. This type of investigation does not require excavations and helps to detect of frozen and unfrozen parts of ground. Our measurements will be carried out in test areas, representing different altitudes, slope aspects and their characteristic morphology. They will be verified by permanent, automatic measurements of soil temperature. We are going to use data on weather conditions, outflow of water from the catchment, as well as on landforming processes like solifluction or scree derived from terrain mapping. Collection of data will allow modelling of the active layer in space using Geographic Information Systems (GIS).

The proposed project is highly relevant to the current concern about contemporary climate change. The permafrost is very sensitive to temperature rise. The research will allow comparison with its state recorded in the study area during measurements 30-50 years ago. Execution of the project should expand knowledge on active layer changes in an area rarely considered in the scale of the Arctic: away from coast. It will be conducted in an uninhabited area. Nevertheless, its result may significantly impact the modelling of the functioning of the active layer of permafrost in other regions of the Arctic, contributing thereby to its societal relevance.



View of Brattegg valley towards the South-West. Photograph by M. Kasprzak.