

Topographic surveys in Ny-Alesund, Svalbard, and improvement of mapping methods

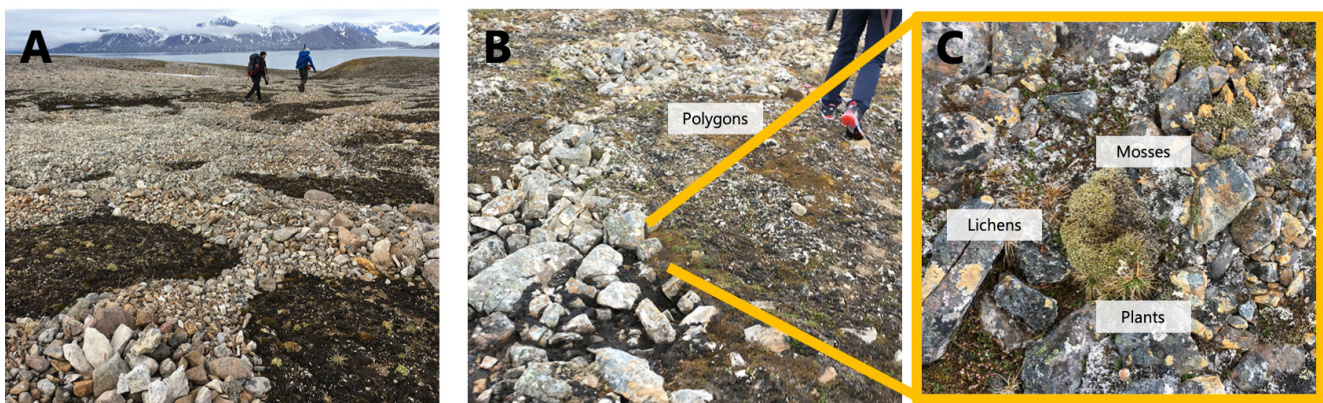
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In Ny-Alesund, Svalbard in the Arctic, frozen layers with the active layer that melts only in the summer and the impermeable permanently frozen layer distribute widely. The vertical structure affects the distribution of groundwater as well as the surface environment and sediment movement. In addition, patterned-ground formed by repeated freezing and thawing and associated vegetation are the basis of polar ecosystems. Recent global warming alters the surface environments especially the expansion of the active layer and increased groundwater flow. In order to quantitatively understand such changes in the surface environment, we developed the technique of high-resolution mapping in Ny-Alesund. As field surveys in the polar regions have limitations in terms of site accessibility and duration, we utilized data from not only our fieldwork but also past fieldwork, along with satellite/aerial images and other geospatial data.

We analyzed altitude slope, aspect, curvature, and solar radiation for the area near the Ny-Alesund Science Village using DEMs produced by the Norwegian Polar Institute. We evaluated the reliability of the terrain analysis using TopoSvalbard satellite images and aerial photographs. We also utilized ground photographs and high-resolution ground mapping with the SfM-MVS method to produce a topographic map of the area. Since legal restrictions on the use of radio frequency in Ny-Alesund limit the use of UAVs, we made a pole camera with stabilizer function, which provides photographs with about 3 mm resolution. Such photographs are useful for very high-resolution mapping for small areas.

Keywords: Ny-Alesund, Permafrost, High-resolution mapping



The images of frozen layer taken in field survey in Ny-Alesund, 2017.

A) Well-developed polygon shape patterned ground., **B), C)** Vegetation on the polygons.