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# Direct current (DC) resistivity and induced polarization (IP) monitoring of active layer dynamics at high temporal resolution

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With climatic changes, permafrost thawing and changes in active layer dynamics influencing microbial activity and greenhouse gas feedbacks to the climate system, understanding of the interaction between biogeochemical and thermal processes in the ground is of increasing interest. Here we present results of from an on-going field experiment, where the active layer dynamics are monitored using direct current (DC) resistivity and induced polarization (IP) measurements at high temporal resolution. These DC/IP measurements are supplemented by pore water analysis, continuous ground temperature monitoring (0-150 cm depth) and structural information from ground penetrating radar (GPR).

The study site (N69°15′, W53°30′, 30 m a.s.l.) is located at a Vaccinium/Empetrum heath tundra area near the Arctic Station on Qeqertarsuaq on the west coast of Greenland. Mean air temperatures of the warmest (July) and the coldest (February–March) months are 7.1 and –16.0°C, respectively. The DC/IP monitoring system was installed in July 2013 and has since been acquiring at least 6 data sets per day on a 42-electrode profile with 0.5 m electrode spacing. Recorded data include DC resistivity, stacked full-decay IP responses and full waveform data at 1 kHz sampling frequency. The monitoring system operates fully automatic and data are backed up locally and uploaded to a web server.

Time-lapse DC resistivity inversions of data acquired during the freezing period of October – December 2013 clearly image the soil freezing as a strong increase in resistivity. While the freezing horizon generally moves deeper with time, some variations in the freezing depth are observed along the profile. Comparison with soil temperature measurements at different depths indicates a linear relationship between the logarithm of electrical resistivity and temperature. Preliminary time-lapse inversions of the full-decay induced polarization (IP) data indicate a decrease of chargeability with freezing of the ground. Once laboratory analysis of the pore water is available, we will assess if these changes in chargeability are caused by geochemical changes of the pore water.