Direct current (DC) resistivity and Induced Polarization (IP) monitoring of active layer dynamics at high temporal resolution - DTU Orbit (08/11/2017)

Direct current (DC) resistivity and Induced Polarization (IP) monitoring of active layer dynamics at high temporal resolution

With permafrost thawing and changes in active layer dynamics induced by climate change, interactions between biogeochemical and thermal processes in the ground are of great importance. Here, active layer dynamics have been monitored using direct current (DC) resistivity and induced polarization (IP) measurements at high temporal resolution at a heath tundra site on Disko Island on the west coast of Greenland (69°N). Borehole sediment characteristics and subsurface temperatures supplemented the DC-IP measurements. Data acquired during the freezing period of October 2013 – February 2014 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 depth-specific soil temperature indicates an exponential relationship between resistivity and below-freezing temperature. Time-lapse inversions of the full-decay IP data indicate a decrease of normalized chargeability with freezing of the ground, which can be the result of a decrease in the total unfrozen water and thus a higher ion concentration in the pore-water. We conclude that DC-IP time-lapse measurements can non-intrusively and reliably image freezing patterns and their lateral variation on a 10-100 m scale that is difficult to sample by point measurements.

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