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DC Electrical Resistivity Imaging at a High-Arctic Continuous Permafrost Site in Svalbard, Norway

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Direct-Current (DC) electrical resistivity imaging has proven to be a suitable technique for a number of permafrost related questions. We present measurements from a high-arctic continuous, maritime permafrost site near Ny Alesund, Svalbard (Norway). The area under investigation features a great diversity of soil types and soil water contents. The surface is characterized by sparse vegetation alternating with rock fields and exposed soil.

We investigated 25 different transects each of 47.5m length using a DC-Resistivity and Electrode Control System (RESECS) with 96 electrodes at a spacing of 0.5m in Wenner-alpha configuration. At three transects, fixed electrode arrays were installed and measured on a weekly basis in order to capture temporal changes. The study started in August, just before the active layer reached its maximum thickness, and extended until the beginning of freeze-up in mid-September.

The specific resistivities at the surface ranged from less than 50Ωm in areas with damp clay to more than 1000Ωm in rock fields and on dry hill crests. In most cases, areas with such high resistivities only extended to depths of less than 1 m. From depths between 1m and 1.5m onwards, specific resistivities increased continuously, indicating the position of the freeze-thaw interface. This is in general agreement with thaw depths that were determined by point measurements along individual transects using a drill.

The repeated measurements of the fixed electrode arrays displayed the most pronounced changes in the beginning of August, where up to a 50% decrease in specific resistivity over a period of two weeks was measured at depths below 1 to 2m. This

is interpreted to be the seasonal thawing of the active layer. A subsequent increase in specific resistivities at these depths until mid-September corresponding to the refreezing of the soil was only observed in some areas, which suggests spatial variations in the course of the refreezing process.