



Active Layer Monitoring using Geoelectrical Resistivity Tomography

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The active layer complicates the atmosphere-ground temperature relationship. This is largely due to the presence of water in the active layer and latent heat effects involved in thawing and freezing. Understanding the spatio-temporal distribution of water and ice in the active layer is therefore important for improved understanding of several periglacial processes controlled by the active layer ice and/or water content and for permafrost modelling. In maritime arctic areas with warm permafrost exposed to significant interannual meteorological variation active layer deepening is causing permafrost degradation and therefore detailed monitoring of active layer conditions are essential.

As part of the IPY project 'Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost in Norway and Svalbard' (TSP NORWAY), three permanent electrical resistivity layouts has been established in different landforms in the Longyearbyen and Adventdalen areas in the most continental part of central Svalbard. Our aims are to monitor (1) active layer development and freeze-back, and (2) soil moisture content in summer and ice content in winter. The results form the basis for improved understanding of solifluction processes and for ground temperature modelling.

The three monitoring sites were installed in spring and autumn 2007 and include (1) a gently sloping solifluction sheet, (2) a valley bottom loess terrace, and (3) a vertical sandstone rock wall. The loess site is located at the UNISCALM site (CALM – Circumpolar Active Layer Monitoring network) where thaw progression is monitored by

probing throughout the thawing season, thereby providing excellent validation for the resistivity method. The layouts are 12-16 m long, giving a maximum measurement depth of 1.8 to 2.4 m, which is more than the expected active layer depth (about 1 m at the CALM site). Permanent electrode spacing is 0.15 and 0.20 m, and measurements are made at a fortnightly to monthly resolution allowing studies of seasonal and even meteorological variations. Meteorological parameters and ground temperatures are also measured at the sites.

So far (12 January 2008) 2, 6 and 16 sets of measurements have been made at the rockwall, loess site and solifluction site, respectively. Results showing active layer development and freeze-back in the 2007-2008 period will be presented.