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Towards a Global Permafrost Electrical Resistivity Survey (GPERS) database

Antoni G. Lewkowicz (1), Thomas Douglas (2), and Christian Hauck (3)

(1) University of Ottawa, Ottawa, Ontario, Canada, (2) Cold Regions and Engineering Research Laboratory, Fairbanks, Alaska, USA, (3) University of Fribourg, Department of Geosciences, Fribourg, Switzerland (christian.hauck@unifr.ch)

Hundreds, and perhaps thousands, of Electrical Resistivity Tomography (ERT) surveys have been undertaken over the past two decades in permafrost areas in North America, Europe, and Asia. Two main types of ERT configurations have been conducted: galvanic surveys using metallic rods as conductors and capacitive-coupled surveys using towed cable arrays. ERT surveys have been carried out in regions with mountain permafrost, lowland permafrost, and coastal saline permafrost, and in undisturbed, naturally-disturbed (e.g. fire-affected), and anthropogenically-affected sites (e.g. around buildings and infrastructure). Some surveys are associated with local validation of frozen ground conditions, through borehole temperatures, frost probing or creep phenomena. Others are in locations without boreholes or with clast-rich or bedrock active layers which preclude this direct confirmation. Most surveys have been carried out individually on particular dates but there are increasing numbers of repeated ERT measurements being made to detect change, either at intervals using a fixed array of electrodes, or at high frequency with a fixed and automated measurement apparatus.

Taken as a group, ERT profiles represent an untapped knowledge base relating to permafrost presence, absence, or partial presence (i.e. discontinuous permafrost), and in some cases to the thickness of permafrost and ice content. When combined with borehole information, ERT measurements can identify massive ice features and provides information on soil stratigraphy. The Global Permafrost Electrical Resistivity Survey (GPERS) database is planned as a freely available on-line repository of data from two-dimensional electrical resistivity surveys undertaken in permafrost regions. Its development is supported by the Permafrost Carbon Network and an application for an International Permafrost Association (IPA) Action Group is also underway.

When the future GPERS records are compared with the GTN-P database it will be possible to see which boreholes or CALM sites are associated with ERT surveys and which are not. This can be used to target particular sites for ERT surveys to provide a more holistic view of what GTN-P measurements represent. GPERS data will permit empirical analyses of relationships between measured resistivities and permafrost conditions, including ground temperature, ice and liquid water content, and sediment type. These analyses will assist researchers in interpreting their local surveys. The spatial coordinates of the surveys in the database will also permit reacquisition of data in the future to examine changes over years or decades.
The purpose of this presentation is to communicate the initiation of GPERS, to explore the level of interest in its development, and to help guide its maturation. In particular, we wish to discuss whether the database should initially focus on meta-data, including site location, vegetation type, and frozen ground conditions, or whether researchers would be willing to supply measurement data immediately which would lead to a more rapid development of GPERS but would also require more resources.