



Application of Depth of Investigation index method to process resistivity imaging models from glacier forefield

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At the end of August 2014 ERT measurements were carried out at the Storglaciären glacier forefield (Tarfala Valley, Northern Sweden) to study permafrost occurrence. This glacier has been retreating since 1910. It is one of the most well studied mountain glaciers in the world due to initiation of the first continuous glacier mass balance research program. Near the vicinity of its frontal margin three perpendicular and two parallel resistivity profile lines were located. They varied in terms of number of roll-along extensions and used electrode spacing. At least Schlumberger and dipole-dipole protocols were utilized on every measurement site. Surface of glacier forefield is characterized by occurrence of large moraine deposits which consists of rock blocks with air voids on one hand and voids filled with clay material on the other. It caused large variations of electrodes contact resistance on profile line. Furthermore, possibility of using only weak currents in the research, and presence of high resistivity contrast structures in geological medium made inversion process and interpretation of received resistivity models demanding.

To stabilize inversion process efforts were made to erase most noisy and systematic error data. In order to assess the reliability of resistivity models at depth and in terms of the presence of artifacts left by the inversion process Depth of Investigation (DOI) index was applied. It describes accuracy of prepared model with respect to variable parameters of inversion. For preparing DOI maps two inversions on the same data set using different reference models are necessary. Then the results are compared to each other. In regions where the model depend strongly on data DOI will take values near zero, while in regions where resistivity values depend more on inversion parameters DOI will rise. Additionally several synthetic models were made which led to better understanding of resistivity images of some geological structures observed on the cross sections. The results show high utility of DOI index in analysis of received resistivity models, on which areas poorly constrained by data were designated. It focused on two cases. The first on abnormal high resistivity contrast between two bodies. The second on internal and underneath structure of massive high resistivity zones. Thus it allowed for avoiding the over-interpretation of resistivity models.

Applied methodology allowed to draw new conclusions about the permafrost occurrence in the glacier forefield. It is not excluded that it occurs in two layers of different age, associated with the evolution of the climate in this region