A NEW TOWED GROUND-BASED TEM SYSTEM FOR 3D IMAGING OF THE TOP 70 METER OF THE SUBSURFACE

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Most human activities take place in the top 30 m – 50 m of the subsurface. Examples are infrastructure development, artificial infiltration and surface water-groundwater interaction in the critical zone. However, hitherto the geophysical methods capable of imaging this zone have limited efficiency when it comes to creating full 3D images.

The overall design goal of the system was to develop a system capable of imaging from the surface to a depth of 30 m (which turned out to be 60 – 80 m) at a high resolution, both horizontally and depth-wise. In that sense, the tTEM depth resolution bridges the resolution gap from high-resolution, near-surface EM Induction systems and deeper lower resolutions airborne systems. Data has to be unquestionable without bias and the system transfer function (STF) completely known. To achieve this goal the system uses a one-turn 2 x 4 m transmitter loop mounted on a frame on sledges and towed by an all-terrain vehicle. The receiver coil is a 650 kHz suspended induction coil in a 9 m offset configuration. The system operates at low and high transmitter moments (LM, HM) to achieve both shallow and deep information. The LM transmits 2.4 Amp with a turn-off time of 2.6 us and a first usable gate at 4 us (times from beginning of the ramp) while HM transmits 30 Amp. The repetition frequencies for the two moments are approx. 2000 Hz and 800 Hz. A full dataset is obtained every 0.8 sec corresponding to 3 – 4 m spacing between soundings with a production speed of 15 – 20 km/h. Data are inverted using Aarhus Workbench, enabling processing, STF[aab1] modelling and spatially constrained inversion.

In the presentation, we discuss the system design and demonstrate the imaging capability in an 800-hectare large survey over highly heterogeneous glacial geological setting.