COMPARISON OF HIGH RESOLUTION ELECTRICAL RESISTIVITY AND GROUND-PENETRATING RADAR MEASUREMENTS IN A SHALLOW VADOSE ZONE ENVIRONMENT

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While previous studies have clearly demonstrated the capacity of both electrical resistivity tomography (ERT) and ground-penetrating radar (GPR) reflection profiling as surface hydrogeophysical methods for characterizing soil moisture in the vadose zone, there have been very few direct comparisons between these two techniques. Further, the low resolution of those earlier data sets do not facilitate detailed analysis of moisture variations in the shallow (i.e., within the upper meter) vadose zone.

To address this issue, we have collected coincident sets of high resolution ERT and GPR images at a site near Waterloo, Ontario during an annual cycle of unfrozen conditions. GPR data acquisition included reflection profiles and common midpoint surveys using high-frequency (900 MHz) antennas. The ERT surveys included Dipole-Dipole and Wenner arrays at 0.25 m electrode spacing. The geology of our study site is a sequence of interbedded medium to coarse grained sand units ranging from a few centimeters to a few decimeters in thickness within the upper few meters of vadose zone; the local water table is located 15 m below ground surface. While the clean sand resulted in excellent depth of investigation for the GPR profiling, the very high contact resistance during dry conditions restricted ERT data acquisition to periods when there was adequate near-surface soil moisture.

While analysis of data is ongoing, preliminary results show good correlation between depths of resistivity boundaries and reflection events. Seasonal variations due to moisture are evident from the analysis of resistivity data. We will be conducting further analyses on the spatial and temporal relationship between GPR interval velocities and ERT resistivity values as well as examining the affect of electrode array choice on the ERT-GPR comparison.