Towards two-dimensional infiltration measurement in complex and variable soil environments

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Monitoring how the infiltration rate changes over time gives insight into how the physical characteristics such as soil structure, changes. Quantifying this change is useful when assessing how mine site rehabilitation soils settle in the years following the burial of mining waste rock. The actual technique for measuring the infiltration rate is currently done as a point measurement, which is statistically unreliable for an average reading when the environment has a high level of variability within its physical characteristics. It is proposed that Electrical Resistivity Tomography (ERT) has the capability to quantify the infiltration variability that exists in complex soil environments which contains features including mining waste rock, textural variations, and structural anomalies such as varying degrees of compaction. This research investigates the use that a time lapsed measurement of soil moisture change over a two-dimensional transect has when attempting to track a wetting front through a soil profile. The project is broken into two stages, developing a methodology for tracking a wetting front, and applying the method to a variable soil to assess the accuracy. The first stage involves creating software protocols and inversion corrections that allow measurements of soil moisture to be corrected for time due to the ERT measuring in a successive technique with a specific order. As these corrections are developed, the soil moisture across a two-dimensional transect can be measured repeatedly at a known time interval, allowing the quantification of the soil moisture rate of change, or the infiltration rate at every point along that transect. Once this method is developed, it is replicated on a variable soil, which contains a large buried rock, a textural change and a compacted region. It is predicted that the minimum, maximum and average infiltration rates can be quantified, along with a statistical distribution.