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Transient soil moisture profile of a water-shedding soil cover in north Queensland, Australia

Christopher Gonzales (1), Thomas Baumgartl (), and Alexander Scheuermann ()

(1) Sustainable Minerals Institute, The University of Queensland, Brisbane, Australia, (2) School of Civil Engineering, The University of Queensland, Brisbane, Australia

In current agricultural and industrial applications, soil moisture determination is limited to point-wise measurements and remote sensing technologies. The former has limitations on spatial resolution while the latter, although has greater coverage in three dimensions, but may not be representative of real-time hydrologic conditions of the substrate.

This conference paper discusses the use of elongated soil moisture probes to describe the transient soil moisture profile of water-shedding soil cover trial plots in north Queensland, Australia. Three-metre long flat ribbon cables were installed at designed depths across a soil cover with substrate materials from mining activities comprising of waste rocks and blended tailings. The soil moisture measurement is analysed using spatial time domain reflectometry (STDR) (Scheuermann et al., 2009)

Calibration of the flat ribbon cable's soil moisture measurement in waste rocks is undertaken in a glasshouse setting. Soil moisture retention and outflows are monitored at specific time interval by mass balance and water potential measurements. These data sets together with the soil hydrologic properties derived from laboratory and field measurements are used as input in the numerical code on unsaturated flow, Hydrus2D. The soil moisture calculations of the glasshouse calibration using this numerical method are compared with results from the STDR soil moisture data sets.

In context, the purpose of the soil cover is to isolate sulphide-rich mine wastes from atmospheric interaction as oxidation and leaching of these materials may result to acid and metalliferous drainage. The long term performance of a soil cover will be described in terms of the quantities and physico-chemical characteristics of its outflows. With the soil moisture probes set at automated and pre-determined measurement time intervals, it is expected to distinguish between macropore and soil moisture flows during high intensity rainfall events and, also continuously update data sets on soil moisture retention, especially during long periods of drought. As such, description of the soil cover water balance will be more elaborate as the soil moisture profile will be described in terms of temporal and spatial variability. Moreover, this field data set can lend support on the evaluation of the potential use of mine wastes as cover materials with respect to their hydrologic and geochemical properties.