Using field measurements towards an improved understanding of shallow hydrogeology in an unsaturated sandy soil under tropical climate conditions

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Abstract. Subsurface temperature, soil matric pressure, and moisture content measurements were collected for nine consecutive months at a sandy constructed fill site on the coast of Singapore to better understand shallow vadose zone dynamics in a tropical climate. Soil moisture and soil temperature measurements were taken at three depths: 0.10 m, 0.35 m and 0.50 m, and soil matric pressure was measured at 0.35 m and 0.50 m below the ground surface. Meteorological measurements were also recorded at the site, including surface air temperature, solar radiation, precipitation, and wind speed. Diurnal soil matric pressure changes corresponding to isothermal fluxes driven by evaporative demand are observed throughout most of the period recorded. During the drier period, the shallowest measurements demonstrate a clear pattern that is consistent with thermal fluxes as described in previously published literature. While it is widely recognized that vapor fluxes and thermally-driven flow in unsaturated soil is often important in arid and semi-arid environments, this study demonstrates that thermal gradients can impact the shallow vadose zone hydrology in a tropical climate as well.

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