Contribution ID: **976** Type: **Poster + 3 Minute Pitch**

Modeling Soil Water Retention Curve under Non-Isothermal Conditions

Tuesday, 15 May 2018 17:13 (2 minutes)

Several emerging problems in geotechnical and geoenvironmental engineering pose multi-physics problems involving non-isothermal processes in unsaturated soils. Properly studying these problems requires the development of models for the Soil Water Retention Curve (SWRC) to describe the constitutive behavior of unsaturated soils under non-isothermal conditions. This study aims to develop analytical expressions of non-isothermal SWRCs. Closed-from expressions are presented to consider the effects of temperature on adsorption and matric suction in unsaturated soils. The formulation for the non-isothermal matric suction accounts for the effects of temperature on the surface tension, soil-water contact angle, and adsorption by the enthalpy of immersion per unit area. The formulations are then employed to extend several existing isothermal SWRCs to non-isothermal conditions. The extended SWRC models are used in a parametric study to examine changes in adsorbed water, capillary water and total water content versus matric suction for Ottawa sand and Wyoming bentonite subjected to several temperatures ranging from 25 ℃ to 100 ℃. The results show that temperature can have significant effects on SWRCs, depending upon the soil type and range of temperature. Further, the results obtained from the proposed formulations are compared against three independent laboratory test results and very good agreement is observed with the tests conducted on sand, silt, and clay under different temperatures. The proposed formulations can be readily incorporated into analytical solutions and numerical simulations of thermo-hydro-mechanical models of unsaturated soils. The findings of the study can facilitate using numerical models to simulate various non-isothermal applications involving geo-energy systems and soil-atmospheric interaction problems.

References

Acceptance of Terms and Conditions

Click here to agree

Primary authors: VAHEDIFARD, Farshid (Mississippi State University); Dr CAO, Toan (Mississippi State University); Mr THOTA, Sannith (Mississippi State University); Dr GHAZANFARI, Ehsan (University of Vermont)

Presenter: VAHEDIFARD, Farshid (Mississippi State University)

Session Classification: Parallel 5-B

Track Classification: MS 1.21: Hydraulics and mechanics of unsaturated porous media: current state of knowledge and practice