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A Comparison of Soil Moisture Estimation Models for Different Soil Particle Sizes Using Digital Image Analysis

Cheng-Ying Chuang (1), Yong-Lin Chen (2), Hong-Ru Lin (2), Shao-Yang Huang (3), Jet-Chau Wen (3,4)

(1) Graduate School of Safety Health and Environmental Engineering, National Yunlin University of Science and Technology, Douliou, Yunlin, Taiwan, (2) Graduate School of Engineering Science and Technology, National Yunlin University of Science and Technology, Douliou, Yunlin, Taiwan, (3) Research Center for Soil & Water Resources and Natural Disaster Prevention (SWAN), Douliou, Yunlin, Taiwan, (4) Department and Graduate School of Safety Health and Environmental Engineering, National Yunlin University of Science and Technology, Douliou, Yunlin, Taiwan

Many researchers investigate time-efficient methods for soil moisture measurements, such as image analysis through reflectivity and remote sensing. However, when such methods are applied in soil moisture estimations, the obtained data are not always precise and specified. A recent study uses the distributions of different soil particle sizes in such estimation models in order to improve their accuracy (Ghanbarian et al., 2015). Nevertheless, this approach has not been fully developed yet and as a result, it presents different advantages and weaknesses for each model. This study evaluates 3 different ranges of soil particle sizes so to improve the time and efficiency of soil moisture estimations in relative models that use digital imaging. Specifically, this research uses soil samples of #60 sieve (0.420 – 0.250 mm), #100 sieve (0.250 – 0.149 mm) and #200 sieve (0.420 – 0.075 mm) particle sizes for moisture analysis. First, soil samples of every range are placed in water until they reach a saturation state. Then they are placed in a dark, closed space with a fixed light source to dry naturally. The soil moisture is measured by weighting the samples; the weighting procedure is repeated every 10 minutes until the samples present a non-changing weight condition. At the same time, images of soil samples are taken by using a digital camera. Next, the obtained images are modified in such as way so to analyze color differentiation data, including R (red), G (green), B (blue), H (hue), S (saturation) and V (value). The correlations between soil moisture and digital image color differentiation data are investigated and compared by using the GBHS, RGB and SV models (Zheng et al., 2005; Magnus, 2005). By proving the feasibility of digital imaging for soil moisture measurements, this research can provide valuable results in the field of soil science. Moreover, the promising benefits in time and resource efficiency could further allow future studies focusing on digital image methodologies, to further investigate more particle sizes of different ranges.

Keywords: Digital imaging, Color differentiation analysis, Remote sensing, Soil moisture