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A Comparative assessment of estimated soil hydraulic conductivity from rainfall simulator and infiltrometer using laboratory repacked soil samples

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Near surface soil hydraulic conductivity is an essential parameter for various hydrological, geotechnical, and environmental-related studies. Currently, many instruments are in practice for evaluating this parameter, both in field, and laboratory. The rainfall simulator (RS) and mini disc infiltrometer (MDI) are two instruments used for the indirect estimation of hydraulic conductivity by many researchers and engineers. However, both the devices differ in their working philosophy and evaluation methodology. While the RS works by considering large soil volumes and providing a positive soil pressure, the MDI works for small sampled volumes and supply negative boundary head. Therefore, the two devices can result in varying estimates of hydraulic conductivity. In this study, a comparative assessment is carried out between the saturated hydraulic conductivity (K_s) estimates from the two instruments using laboratory experiments for two different soil textures (loam and sand). The infiltration results from the RS are analyzed using the Green-Ampt method, and from the MDI is analyzed using the Zhang's method followed by the Kutilek and Nielson method to produce K_s values. The K_s results from both the instruments are compared with the values obtained using the laboratory falling-head permeameter test. A one-way ANOVA and the Fisher's Least Significant Difference (LSD) test as a posthoc test are carried out to analyze the statistical significance of the differences in the estimates of K_s by the two devices. The results showed that the two devices produced varying K_s results for both the soil textures, with the MDI mean values being one order higher than the RS mean. Compared with the permeameter values, the mean values from the RS were closer to the permeameter than the MDI. However, the ANOVA test and the Fisher's LSD test reported that the variations between the two devices with that of the permeameter were not significant for both the soil textures. On the other hand, the RS and MDI variations were reported significant by the ANOVA and post hoc test.