Estimating the water retention curve of stony soils from on-the-spot tension infiltrometry

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The soil-water retention curve (SWRC) is one of the key characteristics for prediction of water and vapor flow in soils. Unfortunately its classical determination by measuring soil-water content at different matric potentials is time consuming and expensive. Furthermore, undisturbed soil sampling can be an intricate task when coarse fragments (>2 mm) are present. The objective of present work was to test whether on-the-spot measurements with a tension infiltrometer could be used to estimate the SWRC of stony soils, and to investigate to what extent the latter was affected by coarse fragments. Tension infiltrometer measurements were conducted at 44 sites with stony loam and sandy loam soils in arid Chile. At each site rock fragment content and size distribution in terms of mean weighted diameter was determined. SWRCs obtained from inverse modeling of measured tension infiltrometer data were compared with lab-determined water retention data pairs obtained using tension plates and pressure chambers between -1 and -1500 kPa. Differences between both were found to be small, with a mean absolute difference in modeled soil-water content never exceeding $0.016 \ \mathrm{m}^3 \ \mathrm{m}^{-3}$, confirming the applicability of the inverse modeling method. Further, it was observed that extra information on the saturated hydraulic conductivity did not substantially improve the inverse modeling results. Rock fragments had a significant indirect influence on water retention for matric potentials higher than -20 kPa which could be attributed to their direct influence on pore-size distribution.