Geophysical Research Abstracts
Vol. 14, EGU2012-6739, 2012
EGU General Assembly 2012

Measurement errors of water retention curve using pressure plates: consequences on parameterization

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Pressure plates are very common experimental devices to measure the soil water retention curve. However, recent studies have demonstrated the lack of reliability of pressure plates when measuring the soil water retention curve in the dry range, due to low plate and soil conductance, lack of soil-plate contact and soil dispersion. In a recent investigation on a silt loam soil, water retention data were determined using pressure plates only and a combination of pressure plates and a dew point meter, showing errors in the measurement of the soil water retention curve at potentials less than 20 m-H_2O. This error led to unreliable evaluation of soil hydraulic properties and their parameterization. We extended the investigation on the effects of water retention measurement error to eighteen soils having different textural properties, by comparing measurements of soil water retention curves obtained with a combination of Stackman's beds and pressure plates and soil water retention curves obtained with the chilled-mirror dew point technique. The aim of this research was to investigate the differences between the soil water retention curves as function of different soil textural properties and their effect of soil hydraulic properties and water drainage. Comparison between retention curves and fitting van Genuchten parameters, showed an error in measurements made by the combination Stackman's beds and Richards' pressure plates, for potential values below 1 m-H_2O to 57 m-H_2O. By characterizing textural properties by using geometric mean diameters, a clear relationship between texture and errors in water retention was established. In particular coarser soil displayed errors at lower potential (in absolute value) with respect to finer textures. The occurrence of these errors in the water retention measurement performed with pressure plates showed that it is advisable to use a combination of methodologies to correctly measure an entire soil retention curve and current parameters database should be used with caution.