Geophysical Research Abstracts
Vol. 16, EGU2014-13846, 2014
EGU General Assembly 2014

Framework for predicting hydraulic properties of calcareous arid lands

Muhammed Khlosi (1), Ahmed Douaik (2), Hassan Habib (3), Donald Gabriels (1), and Wim Cornelis (1)

(1) Dep. of Soil Management , Ghent University, Ghent, Belgium, (2) Research Unit on Environment and Conservation of Natural Resources, National Institute of Agricultural Research, Rabat, Morocco, (3) Dep. of Soil Sciences and Land Reclamation, Faculty of Agriculture, Damascus University, Damascus

In arid areas, the availability of reliable data on soil hydraulic properties such as the water retention and the hydraulic conductivity curves, particularly of calcareous soils, is low. Such data are needed as input to mathematical models used to support arid land restoration and combating desertification studies. This paper aims at sharing new and pertinent research results that are of interest to the scientific community involved in such studies. The objective of our study was to (1) explore the interaction between soil hydraulic properties, and other physical and chemical properties, (2) test three data mining techniques for developing predictive functions, and (3) set up a framework for predicting soil hydraulic properties of calcareous arid soils. 72 soil samples were collected from rural areas throughout north-west Syria, covering most of its agro-climatic zones and soil types. Soil water content at eight different matric potentials and 11 chemical and physical soil properties were determined. We first found that when destroying carbonates in determining particle size distribution, no significant correlations were found with the water retention points, whereas good correlations were observed when carbonates were not removed and considered as part of the soil's mineralogy. Four principal components (PC) explained 77% of the variation in the data set. Three tested soil-water contents (at –1, –33 and –1500 kPa) were highly linked to PC1 which was correlated to plastic limit, texture, soil carbonate content, and specific surface area. In addition, soil-water content at –1 kPa was also linked to PC4 which is correlated to bulk density. PC2 and PC3, related to gravel, organic matter and hygroscopic water, only explained a negligible amount of variation of soil water content. When setting up predictive functions for the eight water retention points, the support vector machines approach performed significantly better as compared to artificial neural networks and multiple linear regression, when using traditional input such as texture, organic carbon and bulk density. When using the plastic limit instead of organic carbon, the predictions accuracy of the functions could still be improved. All RMSD values were below 0.04 m3 m-3, which is very low in comparison with other studies. We finally fitted mathematical expressions to the generated water retention points which were used to derive the complete hydraulic conductivity curve (including saturated hydraulic conductivity).