Geophysical Research Abstracts
Vol. 14, EGU2012-466, 2012
EGU General Assembly 2012

Using Entropy to Quantify Soil Structure from Water Retention and Texture Data

D. Gimenez (1) and S-W Yoon (2)

(1) Rutgers University, Environmental Sciences, New Brunswick, United States (gimenez@envsci.rutgers.edu), (2) National Academy of Agricultural Science, Rural Development Adminstration, Suwon, Republic of Korea

Soil structure embodies complex interactions between particle sizes (texture) and environmental factors that lead to the formation of structural units of different sizes and shapes. Water retention curves of structured soils reflect those interactions on the distribution and connectivity of pores. The main hypothesis of this work is that a measure of soil structure is given by the entropic distance between pore systems resulting from the same particle size distribution arranged randomly (reference distribution) and in structural units. It was also hypothesized that such distance can be derived from water retention curves by assuming that the reference and structured pore systems follow lognormal distributions and that textural pore systems are the result of random arrangements of particles sizes. Reference pore size distributions were obtained from texture using an empirical model to convert from particle to pore size distributions. Soil clods were sampled in triplicate from each of 24 horizons of soil profiles under forest and agriculture management. Disturbed samples were collected to measure texture and organic matter. Soil clods were used to measure bulk density and water retention by the hanging column and pressure extractor methods (7 points between -0.3 to -10 kPa). Clods were then disturbed and water retention measured on packed soil (13 points between-0.3 to -1500 kPa on disturbed samples). Water retention data were fit with the Kosugi lognormal water retention model and the parameters from the model used to calculate the entropic or Kullback-Leibler Distance (KLD) between measured and reference pore size distributions. Values of KLD estimated from undisturbed clods were significantly ($P<0.05$) greater than the corresponding values estimated from the disturbed clods. The KLD measure of undisturbed soil exhibited distinctive trends with soil texture and aggregate size classes. The proposed measure could serve as a link between qualitative field description of soil structure and a quantitative measure of the effect of soil structure on pore size distribution.