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Hydrology and Earth System Sciences Discussions

Interactive comment on "Comparison of three measurement methods of saturated hydraulic condutivity" *by* C. Fallico et al.

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The authors have made a thorough effort to measure ks of a field soil. They have done their work with care and with due consideration of many technical aspects that play a role. As so many others before them, they find a huge and baffling variability. In fact, the three methods produce significantly different results for the same soil with one of the methods (PI) being completely out-of-line. I have one key problem with this study. The authors acknowledge the importance of texture, structure and occurrence of macropores in determining ks., but they do not describe these features. Our group has, over the years, generated many examples showing that starting with a soil structure characterization works to define minimal sampling volumes and representative location of sampling devices on and in the soil. So we proposed to start with the soil and then select and place the measuring device accordingly. In this, and many

other soil physics studies, the sampling device comes first and results are more determined by that choice than by the soil being characterized. If you take the wrong sample size, given a certain pedality, or if you don't know how many macropores occur in your sample (and what their vertical continuity is) you can measure anything. No statistical technique can solve this problem. The authors kindly refer to some of our publications in the eighties but they don't draw the proper conclusions from them, it seems. The Bouma, 1982 publication, for example, showed that ks was not defined: it was 50 meters/day in large detached samples and 0.05 meters/day when a light crust was applied at the surface inducing zero tension in underlying soil but leaving the macropores filled with air. When one understands this, variability can be interpreted in terms of macropore flow versus matric flow, with an interesting intermediate condition where free water runs along the walls of macropores (without filling them), through a saturated matrix. I refer further to Bouma, J. 1997. Long-term characterization: monitoring and modelling. Lal et al (Eds). Advances in Soil Science: 337-358, and, recently: Bouma, J. 2006. Hydropedology as a powerful tool for environmental policy research. Geoderma 131: 275-286.

I believe that field measurement of hydraulic properties, and that certainly applies to ks, should first be based on a soil morphological characterization. If you don't do that differences obtained cannot be explained by statistics because statistics cannot change an incorrect measurement into a correct one. When this is not done, a huge variability is observed and attempts follow to explain differences in terms of qualitative descriptions and assumptions – as in this paper – and this is not interesting and acceptable in my view for a scientific journal in 2006.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 987, 2006.