Geophysical Research Abstracts
Vol. 14, EGU2012-6000, 2012
EGU General Assembly 2012

Scale-Specific Field Bromide Transport and Identification of Leaching at Different Scales

O. Wendroth (1), C.J. Matocha (), and V. Vasquez ()

(1) University of Kentucky, Department of Plant & Soil Sciences, Lexington, KY, United States (owendroth@uky.edu, +1 859 257-3655), (2) University of Kentucky, Department of Plant & Soil Sciences, Lexington, KY, United States, (3) Former grad. student at 1), now at Department of Agroecology and Environment, Aarhus University, Denmark

Inherent soil spatial variability complicates the experimental diagnosis and understanding of tracer transport at the field scale. Spatial soil processes vary at different scales and the study of rainfall scenarios on solute transport appears obsolete using a randomized treatment design. The objectives of this study were to derive a field experimental approach resulting in a spatially representative process of bromide leaching depth under different rainfall treatments and to develop a statistical protocol that helps to quantify the spatial covariance structure and decompose scale-specific treatment effects. In a Maury silt loam soil in Kentucky, treatments of rainfall amount, intensity and time between surface application of the tracer and subsequent rainfall initiation were laid out across different scales. Bromide concentrations were measured from soil samples taken every 0.5 m in horizontal distance at 0.1 cm depth increments down to 0.5 m. Spatial variation scales of the leaching behavior and their association with scales of spatial treatment distributions were identified using semi- and cross-semivariograms and co-spectral analysis. In a subsequent analysis, the impact of rainfall and intensity representing the variation at the large scale was separated from the small-scale effect imposed through the time delay between tracer application and rainfall. This decomposition of scale-specific variation was based on an additive state-space model approach adapted from time series analysis. The large-scale trend component was then described in an autoregressive state-space model. In our case, the origin of the large-scale component of bromide leaching was known. In many field and landscape experiments, the cause for large scale variation is unknown when small-scale treatments are imposed on top of large scale variation. The analysis applied here reveals opportunities to address and quantify the causes of large scale processes. Therefore, the experimental and analytical procedures and the results of this study have strong implications not only for agricultural management experiments but also for large-scale hydrological and transport studies in watersheds.