Geophysical Research Abstracts
Vol. 15, EGU2013-6065, 2013
EGU General Assembly 2013

Effects of spatial variability of soil hydraulic properties on water dynamics

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Soil hydraulic properties may present spatial variability and dependence at the scale of watersheds or fields even in man-made single soil structures, such as cranberry fields. The saturated hydraulic conductivity (K_{sat}) and soil moisture curves were measured at two depths for three cranberry fields (about 2 ha) at three different sites near Québec city, Canada. Two of the three studied fields indicate strong spatial dependence for K_{sat} values and soil moisture curves both in horizontal and vertical directions. In the summer of 2012, the three fields were equipped with 55 tensiometers installed at a depth of 0.10 m in a regular grid. About 20 mm of irrigation water were applied uniformly by aspersion to the fields, raising soil water content to near saturation condition. Soil water tension was measured once every hour during seven days. Geostatistical techniques such as co-kriging and cross-correlograms estimations were used to investigate the spatial dependence between variables. The results show that soil tension varied faster in high K_{sat} zones than in low K_{sat}ones in the cranberry fields. These results indicate that soil water dynamic is strongly affected by the variability of saturated soil hydraulic conductivity, even in a supposed homogenous anthropogenic soil. This information may have a strong impact in irrigation management and subsurface drainage efficiency as well as other water conservation issues. Future work will involve 3D numerical modeling of the field water dynamics with HYDRUS software. The anticipated outcome will provide valuable information for the understanding of the effect of spatial variability of soil hydraulic properties on soil water dynamics and its relationship with crop production and water conservation.