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Spatializing of soil water content measurement at the scale of the agricultural field, using geoelectrical monitoring and geostatistical method

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The knowledge of spatial and temporal variation of soil water content is important in several fields of water management and soil nutrient transfer. However, its spatial distribution is costly and hard to obtain using classical hydrological measurements (e.g. tensiometers, TDR probes …). The geophysical methods (e.g. ERT, EM ...) allow a spatial measurement of physical variables (e.g. soil electrical resistivity) sensitive to soil water content but less accurate. The main purpose of this study is to test the Bayesian Maximum Entropy (BME) approach to merge the two datasets in order to predict the spatial distribution water content: (1) punctual measurements of soil water content, which are considered as accurate data, and (2) indirect spatial measurements using geophysical method, which is considered as uncertain data. This approach has been tested on four synthetic datasets obtained with a vertical 2D domain. The simulations of soil water content were carried out with Hydrus-software with homogeneous and heterogeneous hydraulic conductivity, and continuous and punctual infiltrations. From these simulations, a conceptual resistivity models were built using forward modeling approach and punctual sampling, vertically ranged, of water content were done. These two datasets was adapted and introduced to BME method to predict the soil water content distribution and compared to initial values.

The results indicate that BME method creates more reliable model of water content distribution, closer to the initial one. This approach seems to be a powerful method integrating ERT and TDR measurements to improve the spatial distribution of water content. The approach developed in this study will be applied to an experimental dataset carried out in agricultural field to estimate infiltration and pollutant transfer from the surface to deep groundwater table. The experimental monitoring contains daily measurement of 2D-ERT (Electrical Resistivity Tomography) and two vertical profiles of soil water content using TDR probes.