Evaluation of electrical tomography to estimate soil water storage capacity in forested Karstic areas

Yingge Xie (1,2) and André Chanzy (1)

(1) INRA, EMMAH, Avignon, France (andre.chanzy@avignon.inra.fr), (2) Northwest A&F University, College of science, Yangling, Shaanxi, China, 712100

Given that the large physical heterogeneous in forested karstic areas, water storage capacity estimation is always a difficulty. This study aims to evaluate the electrical resistivity tomography for the water storage capacity estimation in forested karstic areas. The electric tomography was implemented to estimate the stone volumic content and the bedrock depth determination. These caracteristics are combined to the water storage capacity of the fine earth made by the pressure chamber method. To estimate stone content we assumed that soil is a biphasic media with stones embedded in the fine earth media. We computed the effective resistivity with the Bussian (1983) law, which was evaluated against numerical results. It has been shown that the major factors were the electric resistivity of each phase, whereas the size of the stone had a lower impact. Based on independent measurements, we found an accuracy of about 20%. The bedrock apparition can be detected by establishing a threshold. This threshold is much lower than the resitivity made on rock sample due to cracks filled by conductive media. An estimation of the water storage capacity was then made by combining fine earth hydraulic characteristics, estimation of stone content and bedrock depth. An error assessment has shown that the spatial variability is larger than the estimation error.

Bussian, A.E., 1983. Electrical conductance in a Porous-medium, Geophysics, 48(9): 1258-1268.