

Surface Electrical Resistivity Tomography: Infiltration Test Monitoring in Vegetated and Bare Soils

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Summary:

Perennial crops of *Miscanthus X Giganteus* cultivated for energy purposes have already been proved to reduce water erosion and are used also as a natural barrier for mud flows on border of fields, in addition of these properties, in this work, this plant is studied to assess its infiltration potential.

In order to demonstrate the better infiltration in soils with presence of miscanthus, a runoff infiltration experiment has been conducted in Gembloux (BE) monitored by Electrical Resistivity Tomography (ERT) surface profiles. The runoff setup was equally distributed in a miscanthus parcel and the bare soil of a field, uncultivated at the moment. The experiment was repeated 3 times and timelapse measurements were performed to study the dynamics of the infiltration. The processing of these data revealed few challenges mainly related to artifacts of resistivity increase and the influence of a water sheet flow during the infiltration step on the data acquisition. Firstly, to assess this influence, a synthetic model is construct and revealed that the top resistivity of the profile calculated by the inversion is misinterpreted (lower calculated resistivity than real resistivities). From this model, it is determined that despite misinterpreting the real resistivities, relative change is still qualitatively interpretable. For the other main problem (about artifacts), advanced processing consisting in applying full timelapse processing with spatial and temporal constraints revealed to be successful to reduce artifacts but also reduce the accuracy of the inversion result by over smoothing, nonetheless, change of resistivity is still proved to be accurate qualitatively.

At the end, timelapse study with before and after analysis revealed an overall greater resistivity decrease in the miscanthus plot, nevertheless due to limitation to convert this decrease in water content variation, the better infiltration potential cannot be rigorously proved but clues in the timelapse study are encouraging to suppose a better infiltration in the vegetated soil. An overall infiltration pattern has been distinguished, linking it with the initial conditions revealed limitations of the infiltration at a change of soil horizon at this time scale, at an estimated depth of 40-50 cm. Finally, perspectives of infiltration monitoring by ERT were investigated through the assessment of an infiltration stick that has for purpose to be installed in small boreholes and increase resolution at higher depths when coupled with classic surface setups. The analysis between the stick and a classic setup revealed a good efficiency of the studied instrument.

Figure: 3D representation of the initial conditions (Left) and the resistivity change (Right) after the infiltration test with the miscanthus on the right of the profile (transparent plan for separation) for the 3 repetitions

