Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03939, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03939
EGU General Assembly 2008

High-resolution electrostatic measurements for detecting compacted zones in a loamy cultivated soil

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Within the framework of the French national project, DST (Dégradation physique des Sols Tassés), an in-field investigation of a new electrostatic device has been carried out at Estrée-Mons (Somme, France) on INRA (Institut National de la Recherche Agronomique) experimental station. The main objective of this work was to study the ability of the electrostatic method to detect compaction states induced by both traffic and tillage.

The studied soil is a Haplic Luvisol developed on loess material, with 20% of clay, 75% of silt, 5% of sand, 1% of organic carbon. The electrostatic device is constituted in two quadripoles in a square-type configuration: the distances between the parallel dipoles are 137 mm and 274 mm for the short quadripole and the long quadripole, respectively. From these electrode separations, the depths of investigations are estimated in the range of a few centimeters up to a dozen of centimeters.

Three electrostatic profiles using a 20 mm sampling step were repeated four times during 2007 spring, on two plots: (1) two parallel profiles, 3 m long, in a plot scoured up to a depth of about 10 cm in order to work on a plane soil surface (2) a third profile, 1.6 m long, on a plot without scouring.

The results which have been compared with a visual morphological profile indicated that (1) the longer electrostatic quadripole is able to detect the highest compacted zones, (2) this detection is facilitated when the soil is in its driest state, (3) in this

particular experiment, the roughness of the soil surface has a low impact on measurements, (4) the results already obtained in laboratory with galvanic measurements were confirmed (decrease in resistivity in the compacted zones). Indeed, soil compaction generates two phenomena: a drastic reduction in air-filled macropores and an increase in the contact area of clay-filled clods.