Geophysical Research Abstracts
Vol. 20, EGU2018-4786, 2018
EGU General Assembly 2018

Fertilization effects on the electrical conductivity measured by EMI, ERT, and GPR

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Near surface geophysics such as electromagnetic induction (EMI), electrical resistivity tomography (ERT), and ground penetrating radar (GPR) are widely used for field characterization, to delineate soil units, and to estimate soil texture, bulk densities and/or soil water contents. Hereby, the measured soil apparent conductivity (ECa) is often used. Soil ECa is governed by horizontal and vertical changes in soil texture, mineralogy, soil water content, and temperature, and the single contributions are not easy to disentangle. Within single fields and between fields fertilization management may vary spatially, which holds especially for field trials. As a result, ECa might vary due to differences in electrolyte concentration and subsequent pore fluid conductivity, but secondary fertilization effects might also play a major role in ECa differences such as differences in soil water uptake by growing plants. To study the direct effect of mineral fertilization on ECa, a field experiment was performed on 21 bare soil plots each of a size of 9 m2, where 7 different fertilization treatments were established in triplicates. As mineral fertilizers, commercial calcium ammonium nitrate and potassium chloride were chosen and applied in dosages of 200, 400, and 2000 kg ha-1 N equivalent. Additionally, soil water, soil temperature, and EC were recorded in a pit at different depths using commercial sensors. Changes in ECa were measured every 10 days using EMI and monthly using GPR and ERT. Additionally, soil samples were monthly taken at all plots and nitrate, chloride, and potassium contents were measured in the lab.
The poster will show the effect of ECa changes due to fertilization and corresponding leaching of the fertilized elements over time. The experimental results provide information of how fertilization is influencing ECa readings and how long the fertilizers are influencing ECa measurements with geophysical instruments. This study helps to overcome restricted interpretation of ECa measurements on managed agricultural soils.