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Geophysical mapping of soil texture variability in the root zone to improve modelling of the water and nutrient flow.

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Modelling is often used to acquire information on water and nutrient fluxes within and out of the root zone. The models require detailed information on the spatial variability of soil hydraulic properties derived from soil texture and other soil characteristics using pedotransfer functions (PTFs). Soil texture can vary considerably within a field and is cumbersome and expensive to map in details using traditionally measurements in the laboratory. The electrical conductivity (EC) of the soil have shown to correlate with its textural composition.

This study investigates the ability of electromagnetic induction (EMI) methods to predict clay content in three soil layers of the root zone. As the clay fraction often is a main predictor in PTFs predicting soil hydraulic properties this parameter is of high interest. EMI and soil textural surveys on four Danish agricultural fields with varying textural composition were used. Sampling density varied between 0.5 and 38 points per hectare. The EMI data was gathered with a Dualem21 instrument with a sampling density 200-3000 points per hectare. The EC values were used together with the measured values of the clay content creating a statistical relationship between the two variables. Co-kriging of the clay content from the textural sampling points with the EC as auxiliary variable produces clay content maps of the fields. Unused (80%) texture points were used for validation. EMI-predicted clay content maps and clay content maps based on the survey were compared. The two sets of soil texture maps are used as predictors for PTF models to predict soil hydraulic properties as input in field-scale root zone modelling.

The comparisons between EC and clay content show some degree of correlation with an R^2 in the range of 0.55 to 0.80 for the four fields. The field with the highest average clay content showed the best relationship between the two parameters. Co-kriging with EC decreased mean error by 0.016 to 0.52 and RMSE by 0.04 to 1.80 between observed and predicted clay maps.