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Characterization of peat-electrical properties by means of geoelectrical measurements

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Peatlands have an important function for the storage of global carbon. These functions are reduced significantly due to intensive agricultural drainage which leads to decomposition of the organic material and hence to the loss of carbon. In order to reduce these losses, assessments of the peatlands in their current function as a carbon sink, and adequate management are required. In this context, information about both the peat thickness and their condition (degree of decomposition) are crucial. Methods which can estimate the latter in the field other than time-consuming conventional coring techniques are still missing in practice. Our approach is to gather this information in fen soils by means of non-intrusive geoelectrical techniques through the measurement of electrical conductivity of bulk soil (ECb), which is correlated with parameters such as cation exchange capacity (CEC), organic carbon (OC) and the electrical conductivity of the soil solution (ECe), which, furthermore, are functions of the peat condition. In order to assess the field-applicability of this technique, we examined as a first step the electrical properties of peat in different stages of decomposition by measuring ECb of undisturbed samples derived from various study sites in the laboratory. All parameters (ECe, CEC, OC, bulk density, pH-value and volumetric water content), which may potentially influence the ECb of peat were analyzed simultaneously.
Multiple regression analysis revealed a strong response of ECb on ECe followed by CEC and water content if all samples from different locations were incorporated. ECe explained about 60%, CEC 30% and volumetric water content 10% of variability in ECb. Whereas CEC was primarily a function of the degree of decomposition of the peat, ECe levels varied from site to site and no correlation with the latter could be identified. Therefore, we assume that the estimation of peat properties, describing its condition, through electrical measurements is appropriate when considering a site specific calibration function.