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CPT-measurements of electrical conductivity in coastal areas for salt-fresh water investigations, a promising alternative.

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For fresh – salt water investigations in river deltas and other coastal areas, geophysical methods, based on contrasts in the electric conductivity of salt - and fresh water are commonly used. Ground truth is often derived from borehole logs and chemical analysis of groundwater samples obtained from monitoring wells. Cone Penetration Tests with simultaneous measurement of the soils electrical conductivity offer a cost effective alternative for investigations in areas with a soil profile consisting of unconsolidated sediments, providing an almost continuous profile with a resolution that does not diminish with depth.

The technique has recently been applied in several projects ranging from groundwater exploration studies, ASR projects for storage of fresh water in salt water aquifers to environmental impact studies related to large scale coastal protection projects. In these case studies the CPT data have been compared to data from different geophysical techniques obtained from measurements carried out at the surface, airborne measurements, lithological and geophysical borehole logs and chemical analysis from monitoring wells, proving the accuracy of the in situ CPT measurements and added value for the interpretation of the data obtained by other geophysical techniques.

A CPT tool is being developed to carry out in-situ electrical conductivity measurements of the groundwater at multiple depths, allowing calculation of the formation factor required to translate geophysical resistivity measurements to groundwater electrical conductivity. Knowing the formation factor at multiple depths in a soil profile enhances the accuracy of the interpretation of other surface - and airborne geophysical data. More accurate information of the formation factor will also improve the interpretation of the soil profile from CPT data based on water pressure, cone resistance and sleeve friction. The additional information about the formation factor is also likely to provide additional insight in variations in hydraulic conductivities within aquifers. The first test results from the tool that is being developed are expected to be available before the conference and will be included in the presentation.

The presentation will give a detailed introduction to the measurement principles that can be used in combination with CPT's, advantages and limitations of the technique, a description of the method used to calculate the conductivity of the groundwater at various depths, practical experience from case studies in the Netherlands, some concluding remarks and proposed future work to further improve the technique.