

DUALEM4UNDERWATER – FREQUENCY DOMAIN ELECTROMAGNETIC INDUCTION MEASUREMENTS FOR NEAR SURFACE SEDIMENT CHARACTERIZATION IN SHALLOW FRESH WATER, A CASE STUDY FROM EASTERN NORWAY

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Drillings on/in rivers and lakes are very expensive, therefore knowledge about the shallow subsurface below is sparse and often limited to sonar based measurements. While engineering geophysical measurements are a proven tool for pre-investigations they are mainly limited to land based application, and measurements in/over water-bodies are very rare. An ERT survey was performed in 2015 across the Oppstadåa river (Eastern Norway). Boreholes on both riverbanks revealed 20 m bedrock topography displacement on only 150 m distance and several profiles crossing the river were carried out to map the bedrock for the design of a bridge foundation. Driven by the results NGI made test measurement with a custom-built EMI streamer to map the soil/rock below the bottom of shallow (less than 10 m) fresh water.

For the survey we adapted a DualEM 421 sensor which simultaneously measures the apparent electrical conductivity at six different depth of exploration. During the measurements the sensor was submerged at a constant depth of 3 m below water level and towed from a boat. For processing and inversion, the software package EM4SOIL, a nonlinear smoothness-constrained inversion algorithm for the inversion of DualEM data was adapted, using a quasi-2D approach. For the surrounding water layer, we assumed a homogenous conductivity of 2.5 mS/m, based on continuous conductivity measurements along the EMI transects. The results showed a good fit with inversion results from ERT measurement and proved that it was possible to map the sediment for water depths below 10 m, using a low budget adaption of a standard sensor.