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3D geological model of the Gråbo site from ground TEM measurements

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A 3D geological model was constructed for the Gråbo site to investigate its suitability for artificial groundwater infiltration, to provide drinking water. The modelling work was performed by the Geological Survey of Sweden (SGU) as part of ongoing groundwater investigations. The site is located close to the city of Gothenburg, in western Sweden. A relatively thick succession of coarse-grained glaciofluvial sediment is located at the site, which overlies a typically finer grained and more clay rich sequence. Previously, the site has been the target of several investigations, the most extensive of these was performed in 2006, where a range of geophysical (seismic refraction, ground penetrating radar and resistivity) and borehole measurements were conducted. Based on previous studies the upper course-grained layer has the best potential for infiltration. However, although these investigations improved the understanding of the site, significant uncertainty remained as to the geometry of the upper course grained layer away from borehole locations.

In order to improve the understanding of the site, additional data was collected in 2018 using a tTEM (towed transient electromagnetic) system developed by Aarhus university. The system is comprised of a transmitter and receiver coil, which are towed behind an ATV (all terrain vehicle). Using the tTEM data a 3D resistivity model of the subsurface was generated down to a depth of between 50 and 70 m at the Gråbo site. On comparison with the available borehole data, it was clear that the course-grained layer could be mapped with relatively high accuracy as a region of high resistivity. The tTEM data was combined with the pre-existing geophysical and borehole data to construct both a voxel and layer-based model of the site. These 3D models have subsequently been used as part of ongoing efforts to evaluate the suitability of the site for infiltration (for example, to decide the location of additional investigation boreholes and to provide input to hydrogeological modelling). In this study we present the tTEM data and the 3D geological model. Finally, we exemplify how the 3D model has been used in subsequent investigations and decision making.