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## 3D geological models from combined interpretation of airborne-TEM and geological data- Two examples from Sweden

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The geological survey of Sweden (SGU) has carried out several detailed airborne TEM (Transient Electromagnetic) surveys in recent years. The data collected in these surveys were inverted to provide models of the resistivity of the subsurface, down to a few hundred meters depth. These resistivity models together with the data from existing boreholes and ground observations offer an excellent basis for further 3D geological modeling.

The airborne TEM data presented in this study were collected between 2013 and 2016, covering large areas of the islands of Öland and Gotland, in Sweden. Both islands face problems with water supply due to limited groundwater resources. The aim of the surveys was to identify new groundwater resources, specify the depth to saline groundwater and to improve the understanding of the geology of the islands. On Öland, the Paleozoic sedimentary succession reaches thicknesses of approximately 250 m and is composed of Lower Cambrian sandstone, Middle Cambrian siltstone, and claystone followed by the Alum Shales of Upper Cambrian and Lower Ordovician age. Above this lies an up to 40 m thick Lower Ordovician limestone succession, which forms the bedrock at the surface across much of the island. The entire sedimentary sequence rests on Precambrian crystalline rocks. On the Island of Gotland, Silurian bedrock represents the upper part of a 250-800 m thick Paleozoic sequence overlying the crystalline basement. The Silurian bedrock is dominated by interbedded layers of limestone and marlstone, where the interface between limestone and marlstone is often the primary hydraulic conductor.

After acquisition, these data were processed and inverted (1D inversions with lateral constraints), to provide a series of large airborne datasets, providing a resistivity image down to depths of about 250 m in some areas. The considerable resistivity contrast between lithologies, e.g. limestone and marlstone on Gotland, provided an excellent opportunity to resolve boundaries between the different rock types. Borehole information, geological maps, ground geophysical data and the inversion results were incorporated in a 3D geological modelling software. On comparison of the airborne models, ground geophysical data and borehole information it was clear that the airborne resistivity models correlated well with the other available data. Hence, the resistivity models were used as the basis for constructing the 3D hydrogeological and geological models over significant parts of the islands. In this study we present the 3D geological models over the islands of Öland and Gotland which were constructed from the integrated interpretation of all the available data. The models are composed of voxels, each representing a certain lithology classified

using a statistical approach. The classification is based on the resistivity range, distance to the neighboring wells/boreholes and the geological observations at the surface. The 3D voxel models will be/have been utilized in hydrological modelling, societal planning, and groundwater management.