

Utilization of 3-D Geologic Modeling for a Large-scale Water Supply Project in Southwestern Finland

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The three-dimensional (3-D) geological model of the Virttaankangas aquifer in southwestern Finland (Artimo et al, 2003a; Artimo et al, 2003b) recently has been updated with new research data obtained during the last two years (Saraperä and Artimo, 2004). This 3-D model will constitute an important part of the studies conducted in the Virttaankangas area, which will be used for production of artificially infiltrated groundwater for the Turku region. The next step in the studies will involve the development of a 3-D groundwater flow model based on the data obtained from the 3-D geological model. The aim is to constantly develop and adjust the 3-D understanding of the aquifer, and to incorporate this data into the mentioned models. However, the further development of the 3-D models requires better control of the primary data. Therefore, a set of simple tailored GIS-tools were developed to facilitate and quicken the export of the primary data into the 3-D modeling software and the 3-D groundwater flow model.

In the water project for the Turku area, the 3-D geologic model is not only used to depict and understand the complexities of the Quaternary esker aquifer, but also as a tool to achieve the best available conceptual model for groundwater flow modeling. A feedback procedure is being implemented whereby results of groundwater flow modeling may require modifying the previously established 3-D geological model, such that the internal structures and architecture of the aquifer are modified to produce “a more accurate depiction” of the 3-D geology. Therefore, the 3-D geologic model would be updated first. The most significant fact is that the GIS system and the models are planned to be updated continuously, because the production of the artificially infiltrated groundwater will require these modeling tools both in the planning and in the actual groundwater production phases of the project. Therefore, the precise control of the growing amount of primary data and the ability to export the data to other software packages becomes essential (Figure 1). The time lag between the new observations that

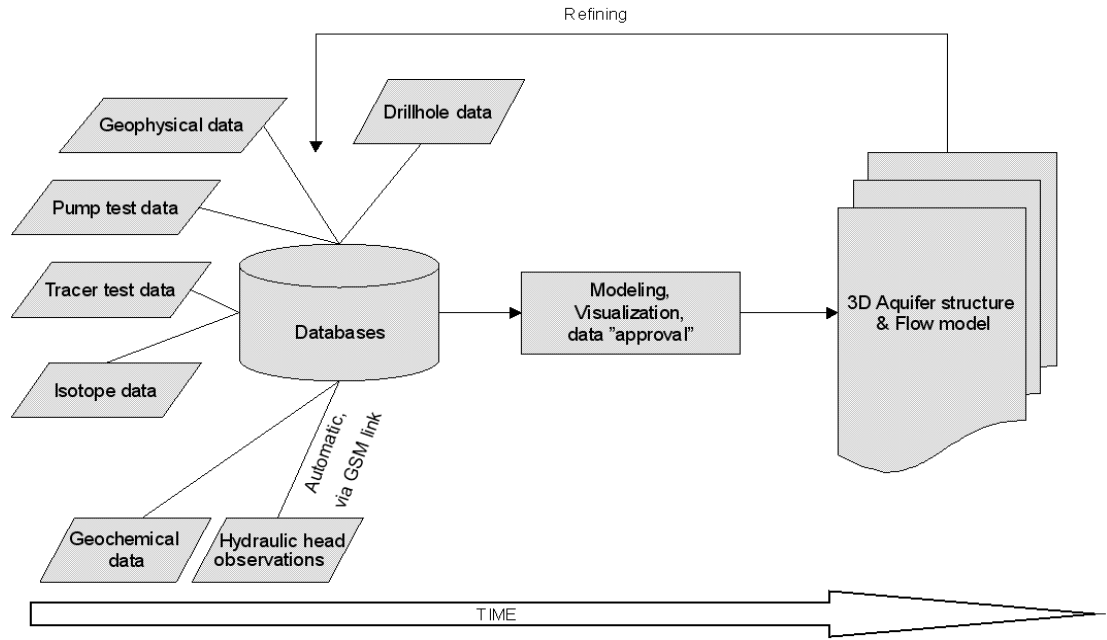


Figure 1. Virttaankangas data flow chart.

result in changes of the 3-D structures of the aquifer, and the updating of the 3-D geological and flow models is planned to be about 1-3 weeks. The average residence time of the artificially infiltrated groundwater in the aquifer is estimated to be about 3-6 months.

The ongoing development of both the GIS system and the 3-D geological and groundwater flow models will result in an integrated system including vast amounts of different data from drill holes, geophysical measurements (mostly gravimetric measurements, GPR soundings, and seismic soundings), hydrological measurements (including automatic hydraulic head measurements), and geochemical, pump test, tracer test, and isotopic investigations (carbon, oxygen, hydrogen). The 3-D geological model (Figure 2) will work as a tool to visualize these data, and the 3-D flow model will be used to simulate the flow system presuming that all the primary data have been taken into consideration in compiling of the model.

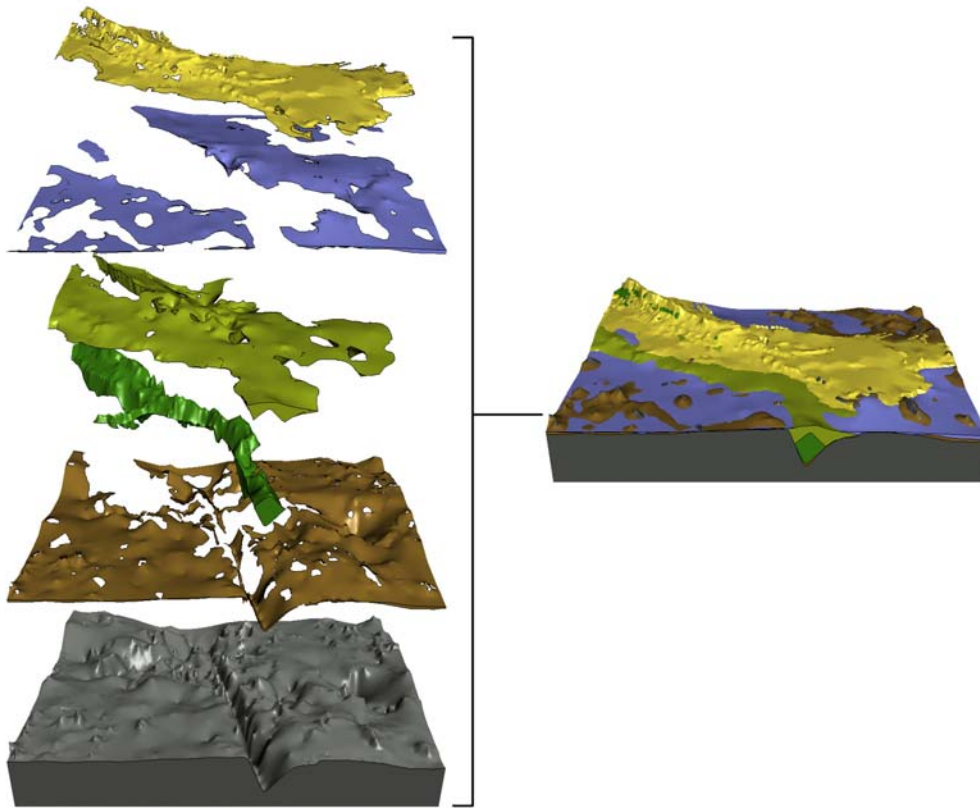


Figure 2. The latest version of the Virttaankangas 3-D hydrogeological model.

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