Integration of conventional method and transition probability geostatistics for the evaluation of aquifer heterogeneity

Luoma Samrit[1]*, Backman Birgitta[1], Majaniemi Juha[1], Pullinen Arto[1], Klein Johannes[1] and Valjus Tuire[1]

[1] *Geological Survey of Finland, P.O.Box 96, FI-02151, Espoo Finland (*correspondence: samrit.luoma@gtk.fi)*

Under the EU Groundwater Directive (2006/118/EF), groundwater body should be identified and protected. Groundwater resources management and protection need information of geological and hydrogeological characteristics of the aquifer. For the aquifer vulnerability assessment, the hydraulic conductivity and the distribution of the protective layer of fine-grained sediments are important parameters in most of the vulnerability assessment methods. The First Salpausselkä ice-marginal formation in Hanko cape, southern Finland, case study area consists of glacial gravel, sand, till and clay, together with postglacial littoral gravel, sand and clay. The complexity of the sedimentation during Weichselian glaciation and deglaciation makes details characterisation of the aquifer heterogeneity in the First Salpausselkä ice-marginal formation difficult. This study presents the results of the integration of conventional and transition probability geostatistics methods to construct 3D geological model and evaluate heterogeneity of shallow aquifer in Hanko, to provide a geological framework for groundwater flow model and groundwater vulnerability assessment. In conventional method, the aquifer characteristic was identified utilizing great varity of data. These include gravimetric survey, ground penetrating radar survey (GPR), sedimentological as well as hydrogeological data. The transition probability geostatistical method (TPROGS) was used to estimate the aquifer heterogeneity, especially in area that lack of sedimentological and hydrogeological data. The distributions of five hydrofacies (gravel, sand, fine sand, silt and clay) were determined based on sediment descriptions from 220 drilled wells and sedimentological information from 1022 m of GPR survey lines under the geological framework identified from the conventional method. Based on those results, the distribution of the protective layer of fine-grained sediments and also aquifer hydraulic condutivity were be able to predict.