Groundwater flow analysis using a conceptual model for geological disposal in coastal areas

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At the stage of the literature survey in the geological disposal project, since the available data on underground and geology is limited, it is inevitable that groundwater flow assessment results will include some uncertainty. In order to reduce this uncertainty and to present an effective measurement plan for the next preliminary investigation stage, it is desirable to derive what investigation should be performed and what data should be acquired from the results of groundwater flow analyses. From this point of view, authors created conceptual geological models for the Horonobe site and conducted groundwater flow analyses using those models.
As a conceptual model, a 40km x 40km rectangular model (Model1) was created based on the possible installation area of the disposal facility considering the limit of the tunnel length for feasible ventilation. Then, a 40km x 100km rectangular model (Model2) was created with considering for the location of coastline in light of the sea-level change and marine regression in the future. Moreover, the model shape of Model2 was modified by taking into consideration the hydrological boundary conditions such as rivers and topography (Model3). After a preliminary study on how to set the analysis area using these models, sensitivity analysis was performed using Model3 focusing on the variation of the analysis properties (water permeability). In this study, the hydrogeological structure of Horonobe was classified into Quaternary sedimentary rocks, Neogene sedimentary rocks, Cretaceous sedimentary rocks and faults, and the physical properties of each were obtained by statistically processing measured data from all over Japan.
As a result of preliminary study on how to set the analysis area, it turns out that 40 km ×40 km model (Model1) is not enough to properly evaluate the groundwater flow field when considering the marine regression and it is necessary to take a larger area. In addition, it was confirmed that the analysis results were not significantly different between Model 2 and Model 3. As a result of the sensitivity analysis of the permeability, it was found that the groundwater velocity field at a depth of several hundred meters and the field within about 10 km from the coastline was greatly affected by the permeability of the Neogene sedimentary layer, and therefore, the importance of investigating the permeability of this layer was suggested.

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