Construction of 3D geological models of coastal areas

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Geological disposal is internationally recognized as a method for isolating high-level radioactive waste (HLW) generated from nuclear power generation from the human environment. In Japan, research on HLW disposal was initiated by the Power Reactor and Nuclear Fuel Development Corporation (PNC, currently Japan Atomic Energy Agency), around 1976, and it was reported that geological disposal is technically feasible in the second progress report compiled in 1999. Solicitation of municipalities, seeking potential repository site to carry out Literature Survey, has been underway since 2002.
In order to explain the safety of the geological disposal and to gain trust from stakeholders in the project, it is necessary to build geological models that evolve through each stage of the project (Literature Survey, and Preliminary and Detailed Investigation stages). In the Literature Survey stage, a conceptual model is constructed on the basis of topographic maps and geological maps issued by national institutions and publicly available literature. In the Preliminary Survey stage, a Site Description Model (SDM) is constructed using new geological information and thermal distribution (T), hydraulic system (H), mechanical (M) and chemical properties (C) (THMC).
In this study construction of the conceptual model and the SDM for coastal area of Horonobe in northern Hokkaido, Japan was implemented in preparation for the upcoming project. The model domain was defined as a rectangular area of about 50 km in north-south and about 80 km in east-west (about 20 km in land, about 60 km in sea). The conceptual model was constructed using geological maps published by Geological Survey of Japan and seafloor topographic data issued by the Japan Coast Guard. In the SDM, THMC data were added from “Geothermal Potential Map in Japan (AIST, 2009)”, “Achievement report of R&D for coastal seawater / freshwater interface and fault evaluation technology (AIST, 2008)”, “Data of Groundwater Chemistry Obtained in the Horonobe Underground Research Laboratory Project (FY2011-2013) (Sasamoto et al., 2014)”, and so on.
In construction of the geological models of the coastal area, the uncertainties of the models become larger in the sea area where the amount of data is smaller than that in the land area. In order to evolve into more detailed geological models, investigations are needed to reduce their uncertainties. The geological models of the coastal area including the uncertainties can help in planning the investigations, such as types, locations and quantities to be implemented.

Keywords: High-level waste (HLW) , geological disposal, coastal area, 3D geological model, conceptual model, site description model

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