Imaging of hydrogeologic structure in a coastal zone by electric survey

Toshiharu Misonou[1]; Hisafumi Asaue[2]; tohru yoshinaga[3]; Katsuaki Koike[1]; Jun Shimada[4]; Makoto Inoue[5]

[1] Graduate School Sci. & Tec., Kumamoto Univ.; [2] Department of Civil and Environmental Engineering, Kumamoto Univ.; [3] Faculty of Enginnering,Kumamoto Univ.; [4] Grad. Sch. of Sci. & Tech., Kumamoto Univ.; [5] ROCK ENGINEERING CENTER

Hydrogeologic structures in coastal zones are important for disaster prevention and mitigation against large earthquakes that originate in latent fault movement in the sea areas, identification of flesh/salt water boundary, and evaluation of nutrient loads on sea environments associated with groundwater discharge. However, geological investigations in the coastal zones have not been much accumulated because of the difficulty in approaches. Then, we applied an electric survey method to clarify hydrogeologic structure in a coastal zone.

The Kumamoto Plain facing the Ariake Sea is well-known groundwater resource because of high mountains behind the plain such as Mt. Aso. Resistivity value is an important physical property of geologic media, which is related to porosity and water content of rocks and soils. Chargeability is also an important electric property which is calculated from the temporal change of electric potential after stopping the current supply. In addition to the traditional electric survey, we measured temporal resistivity change and calculated the saturation of shallow sediments based on the Archie's law which were aimed at detecting inflow and outflow of groundwater (or seawater) in the sediments using the large difference in resistivity between seawater and groundwater. The measurements were carried out four times during 2007 to 2008 with 2D measurement lines of 150 m and 260 m lengths, using an equipments, Syscal-R2 (IRIS instrument) and multi electronode system. The measurement lines were set to be parallel and perpendicular directions to the coastal line.

A 2D inversion technique was used to convert the obtained apparent resistivity data into the true resistivity distribution from the ground surface down to 30m depth. The resultant resistivity distribution clarified the especially low resistivity zone in the western side of the line and local changes of chargeability, which signifies the local change of soil types (mixture ratio of sand and clay), groundwater flow path, and a latent fault that may be connected with the active fault in the Uto Peninsula.

Clarified hydrogeologic structure from resistivity, chargeability and saturation value that deeper 20m depth is separated non-permeability zone of clay mineral and permeability zone of sand.