NUMERICAL MODELING OF HYDROTHERMAL SYSTEM AROUND A VOLCANO BASED ON SELF-POTENTIAL DATA.

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Self-Potential (SP) survey was broadly carried out around the Waita volcano and the Takenoyu hot spring area, Kyushu, Japan, covering the summit of the volcano. As a result, a peak negative SP anomaly of 600 millivolts was observed at the middle height of the Waita volcano. Since SP has a negative linear function with the elevation for homogeneous earth, the anomaly at the mid-height can be interpreted as a non-topographic SP anomaly. Then a numerical simulation of the subsurface fluid flow and its corresponding SP was conducted based on the mass and energy conservation equations and available resistivity data. Negative SP anomaly has been generally interpreted as an indicator of a recharge zone which has a higher permeability. However, the simulation result shows the negative anomaly cannot be explained by a high permeability zone at the mid-height. Further simulation suggests the existence of a high permeability column underneath the summit of the volcano, which results in relatively high SP value at the topographic summit, is essential for the observed SP profile. According to the best fit model, hot fluid flows up from a depth beneath the volcanic body and then turns into lateral flow toward a geothermal reservoir lying at the foot of the volcano. Thus a coupled fluid flow and SP simulation enables to clarify the physical structure of a hydrothermal system.