Spontaneous-potential (SP) is the electrical potential mainly generated by thermoelectric, chemical and groundwater flows in the subsurface. SP data is in general acquired as the distribution of potential on the surface and is used to locate dominant sources that would reflect the flow of groundwater. The direction of SP increase in the distribution corresponds to that of groundwater flow, as a primary interpretation. The former studies indicate that the existence of the subsurface inhomogeneity in electrical resistivity, permeability, etc. could change the distribution of SP. The distribution of SP, therefore, is obviously influenced by the subsurface structure. How the existence of inhomogeneity in the groundwater flow with respect to the SP has, however, not been discussed in detail.

In this study, we simulated a groundwater flow and obtained the distribution of SP according to the flow. We try to discuss the relation among the subsurface factors such as permeability on the groundwater flow and the distribution of SP. Our simulation results show that the anomaly of SP appears just above the boundary of abrupt permeability change in the subsurface structure. This effect is prominent when the permeability difference is high. In addition to this effect, the SP anomaly is observed at locations of high flow rate of groundwater due to the effects of subsurface structure. Our results suggest that the SP is sensitive to the groundwater flow and the hydrological information is retrievable for known subsurface structure.