A magma chamber model of Unzen Volcano inferred from geodetic and seismic data using FEM and stress tensor inversion method

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In our previous studies, we consider magma source model beneath Unzen Volcano causing ground deformation, using Yamakawa-Mogi Model which is analytical solution based on many assumptions. But it is difficult to discuss realistic physical quantities from this analytical solution. For example we can not discuss shape of magma chamber by this method. To solve this problem we use Finite Element Method (FEM) for modeling of magma source inducing 1990-1995 eruption.

FEM modeling needs physical quantities to calculate deformations. A stress condition around study region inferred from stress tensor inversion method was taken into our FEM modeling as one of a condition of constraint. We applied the method to Unzen Volcano using polarities of first onset of P wave for many earthquakes around the Volcano which occurred before and after eruption. The inversion result showed that maximum and minimum principal axes had not change largely. It means pressure source did not make effect to regional stress field even during eruption. And we used precise leveling data which obtained around Shimabara peninsula for about 20 years by the Geodetic Survey Group, Joint Observation by National Universities and Geographical Survey Institute. We examined modeling which satisfies this data and stress field condition. It is very important in discussing magma supply system of this Unzen eruption to obtain a model meeting both ground deformation data and seismic activity, which have not be combined quantitatively until now.