Probability of eruption in the case of detecting ground deformation events caused by deeper pressure sources

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Precursory changes of ground deformations before eruptions were checked by GNSS data to contribute to the research how volcanic activities develop. The probability that changes of ground deformations trigger eruptions was estimated for some volcanoes in Japan.

Eight active volcanoes, Asamayama, Hakoneyama, Meakandake, Shinmoedake, Niigata-yakeyama, Ontakesan and Kuchinoerabujima, were checked out because geodetic events were observed in these volcanoes. We focus the GNSS baselines across the volcano. Baselines longer than 20 km of the GEONET, the GNSS network managed by GSI, after around 2000 were used for this research, because we need to check deeper pressure sources. We picked the geodetic events of baseline-length changes greater than 1 cm and duration period of changes. In addition, volume changes of pressure sources of these events estimated by previous researches were listed up. Then we checked the relationship between eruption/no-eruption and precursory geodetic event.

In 12 cases out of 28 geodetic events, eruption followed the geodetic evemt. And in 11 cases out of 12 eruptions following geodetic events eruptions occurred during the geodetic events. Furthermore, we showed that there is not a positive correlation between volume changes of pressure sources and duration period of geodetic events, but there is a weak positive correlation between gross amounts of volume changes and rates of volume changes.

And then, we estimated the probability of eruptions following geodetic events by using the thread score (TS) which is one of indexes for performance evaluation and is frequently used for weather forecasting. The averaged TS value for all events was estimated to be around 0.4. In the case of Asamayama and Shinmoedake, higher value of TS as 0.67 was estimated. On the other hand, lower value was estimates in the case of Hakoneyama and Asosan.

Keywords: eruption, attempted eruption, ground deformation, Global Navigation Satellite System, threat score