

## Influence to GNSS signals by volcanic ash plume

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Recently, GNSS data of the continuous observation system GEONET are utilized for monitoring and study of crustal deformation. Oota et al. 2013 presumed the GPS carrier phase balance residual and found conspicuous phase Post fit Phase Residual with the about 24 th July 2012 eruptive event in the Minami crater of Sakurajima Volcano by using PPP.

The purpose of this study is to presume LC PPR by using a same method as the above, and to deliberate the factor of LC PPR change. Eruptive event is a large typical volcanian that occurred at Shintake crater of Kuchinoerabujima on May 29, at 9:59 local time JST. Volcanic ash diffused from WNW to ESE.

This study analyzed the GEONET GPS data acquired on the observation station at Kuchinoerabujima by using GAMIT software ver.10.5.

A result of the analysis, LC PPR of PRN18,22,26,29 changed conspicuously. LC PPR of PRN18,22,26 increase about 20cm. But It LC PPR of PRN29 decreases minus 32cm, and increases 42cm for during a short term, increases about 20cm for long term. These changes were almost synchronous with the abnormal changes of atmospheric pressure changes recorded at the northeastern foot of volcano. It is for the first time that the variation of such extreme LC phase residuals detected by this study along with volcanic eruption.

From the space images of the weather satellite HIMAWARI, it was confirmed that, just after the eruptive plume was started to form, the umbrella ash cloud was once spread around the volcanic body, and that the ash cloud flew from WNW to ESE direction. Checking both the behavior of this plume and the results of GAMIT analysis, it was found that radio waves from the PRN18,22,26 reached the observation station through

the spreading umbrella cloud, while those of PRN29 had reached through the eruption column.

Based on the video recording immediately after the start of the eruption and the timing of the communication failure of barometer system, rapid reduction and recovery of the air pressure or strong electrification including volcanic lightning, caused by over expansion of air accompanied with the sudden towering of plume pillars could account for the cause of the sharp minimum and maximum within a short time in the variation of LC PPR of PRN29 passed through the eruption column. Moreover, from the fact that the maximum of PRN29 was synchronous with the maximum of about 1 minute seen in PRN18,22,26 which passed through the spreading umbrella cloud, a possible factor for delay is considered due to water vapor increase or the temperature rise in the plume. For the broad increase in a long time of PRN29 was considered related to factors such as an increase of volcanic gas concentration, the subsequent rise in temperature or water vapor increase due to the diffusion of long plume umbrella.

The present study suggested a correlation between the events of the growth and towering of the volcanic plume and the LC PPR variation of GNSS radio waves. However, in order to elucidate the causes of changing the LC PPR it is necessary to perform a detailed study about the relationship between the LC PPR and dynamics of the eruption plume.

