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キネマティック PPP データによる噴煙柱検出の試み
Detection of eruption column by using the kinematic precise point positioning

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We investigate the ability of kinematic precise point positioning to detect volcanic plumes at Minami-dake of Sakurajima Volcano. In Houlié et al. [1], the authors processed the GPS data obtained during the eruption of Miyakejima volcano, occurred in 2000, and found anomalous values in the ionosphere-free linear combination of the L1 and L2 phase measurements (LC). They related these anomalous values to the path delay effects caused by the presence of a hot volcanic plume; by applying techniques of seismic tomography. Another test was carried out during the eruption of Mt. St. Helens on March 9, 2005, and again the GPS signal showed a clear signature of the volcanic plume presence [2].

In this study, we describe the July 24, 2012 activity at Minami-dake of Sakurajima Volcano. We analyzed the data from 18 continuous GPS stations (3 GEONET sites and 15 Kyoto University sites), which located on the volcano flanks. For the GPS analysis, we used GIPSY-OASIS II version 6.1.4 software [3]. We estimated the post-fit phase residual in the ionosphere-free linear combination for each pair of GPS satellites and ground stations for the detection of eruption column. We applied absolute IGS phase center corrections for satellite and receiver antennas. The wet zenith tropospheric delays and its gradient at all the GPS sites were estimated at all processing epochs (every 30 seconds) under the assumption of a random walk stochastic model. Firstly, we analyze the all of the GPS data in July 21, 22 and 23, 2012 for the reference. Obtained post-fit phase residual of the reference days showed the noise-level for the path delay effects caused by the volcanic plume. This reference post-fit phase residual contained many noise sources such as multipath effects, local atmospheric disturbance, and so on. The noise level of the post-fit phase residual strongly depends on the each GPS satellite and ground station pair. Finally, we analyzed the data of the July 24, 2012. The post-fit phase residual clearly shows large disturbance just after the eruption. For example, the phase residual between SVN34 satellite and GEONET 0720, which located in the east coast of Sakurajima, suddenly increased just after the eruption. The obtained residual amount reached 80mm. It is clearly larger than the noise level measured on the reference days. Furthermore, other GPS satellite and ground station pairs also clearly showed significant amounts of disturbance. These results suggest that the eruption column moved to the westward by the wind after the eruptive event.

[1] Houlié et al. GRL, 2005. [2] Houlié et al. Eos Trans, 2005. [3] Lichten and Border, JGR, 1987.