Transport and resuspension of ash particles from the 2014 phreatic eruption at Ontake Volcano, inferred by pollen sensor data

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Behavior of ash particle from explosive eruptions is considered to influence many environmental and economic factors (e.g., Rose and Durant, 2011). Field survey on eruptive deposit have been performed to evaluate the behavior of ash particles and obtain ground truth for numerical simulation and satellite observation during explosive eruption (e.g., Gudmundsson et al. 2012). However, it is generally difficult to reconstruct timing and strength of ash transport from the field survey for small phreatic eruption, because ash deposit by such small eruption is easy to suffer reworking by wind and rain water. So, method which can detect ash particles *in situ* is favorable to infer the behavior of ash particles during the small phreatic eruption.

We examined time series data of pollen sensor to infer the transport and resuspension of ash particles from the 2014 phreatic eruption at Ontake volcano. The pollen sensor has been developed for *in situ* detection of pollen particle which causes allergy. The pollen sensor (PS2 by Shinyei technology Co. Ltd) is laser optical analyzer for particle matters, and consists of one light emitter and two light receptors. The particles are introduced into the chamber, and shot by linear polarized light emitted by the light emitter. The number of particles introduced into the chamber by intake of air are counted from the number of outputs recorded by a receptor every second. The combination of output voltage from the two receptors brings in a polarization factor (PF) reflecting shape of the particle matter. The polarization factor of pollen and water drop with spherical shape are higher (around 0.3 and 0.8) than that of soil particle from Kanto plain (around 0) (see HP of Shinyei technology Co. Ltd).

We analyzed pollen sensor data recorded by NTT Docomo Ltd from September 21th to October 19th, 2014 with a sampling frequency of 1 Hz at Kaida-kogen site which locates 11 km away from the summit of Ontake volcano. To remove the particle counts due to pollen and water drop, we recalculated hourly counts of particles having < 0.3 of polarization factor. Strong noise of the particle count prevents us to insight into behavior of ash particles in other 150 pollen sensor sites around Ontake volcano.

The time series of pollen sensor data from Kaida-Kogen allows us to infer the transport and resuspension processes of ash particles from the phreatic eruption. We find a sudden increase of the hourly count of particle matter with low polarization factor changing from few tens to maximum value of 5355 particles at 12:00-13:00 September 27th. Because the onset of the 2014 phreatic eruption at Ontake is 11:52 Sep 27th, we consider that unusual supply of particle matter by the eruption causes the sudden increase. In detail, count value by ten minutes interval provides maximum value of the count 80 minutes after the phreatic eruption. So, transport velocity of ash particles can be estimated to 2.3m/s which is comparable with velocity of local wind around the Ontake volcano. After the sudden increase, the particle count gradually decreases with some fluctuations, and becomes few particles per hour within 1 week. The fluctuations are well correlated with temporal variation of wind velocity in Kaida-Kogen, showing wind blowing induces resuspension of ash particles. Because the wind direction at the fluctuation are randomly oriented, we consider that ash particles on the leaf, tree and load around pollen sensor were resuspended by the wind blowing. Finally, we conclude that pollen sensor data can be used to evaluate behavior of ash particles even in small phreatic eruption.

Keywords: Volcanic ash, Pollen sensor, Phreatic eruption

