Information of volcanic ash material from satellite infrared sounder data

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Brightness temperature (BT) spectrums of the volcanic ash clouds in the IR window region measured by a satellite infrared sounder has been simulated in detail from the radiative transfer calculations by taking into account the appropriate atmospheric profiles, sea surface temperature/emissivity, atmospheric gas absorptions, and ash-scattering properties. From iterative least-square calculations using measured and simulated BTs, we made estimations of the ash refractive index (RI) as well as the ash cloud parameters (optical depth, particles effective radius, and ash cloud pressure heights). The absorption spectral feature of the RI in wavelength region around 10 micron depends on the Si-O bond characteristics of the erupted silicate material and therefore it is correlated with the mineral type and SiO2 content. From the retrieval analysis, it is found that some estimated RIs were consistent with the reported rock types of the volcanoes, which had been previously classified by compositional analyses in the literature. Furthermore, weak absorptions likely due to Si-O and/or Al-O vibrations, which have been proposed in reports from previous laboratory FTIR experiments for some silicate glass samples were identified. The spectral RI estimated from the analyses of data from a satellite infrared sounder can be used to analyze other satellite measurements. In particular, information for the detailed RI in the infrared region contribute to ash cloud quantification and monitoring from measurements by next-generation geostationary satellites, such as the Japanese HIMAWARI-8. Moreover, it is possible to discuss the time evolution of components of the eruption products from changes in the RI estimated from IR sounder measurements.

Keywords: volcanic ash, satellite infrared sounder, refractive index

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