

## Development of easy tools for volcanic eruption plume/cloud analysis using weather radars

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Meteorological Research Institute and Kagoshima Local Meteorological Office, Japan Meteorological Agency (JMA) have been cooperatively working on research on simple analysis methods of volcanic eruption plume using weather radars. In volcanology, since researchers of radar analysis whose target is volcanic eruption plume/cloud are minority, we are developing simple analysis tools especially for beginners of radar meteorology. As visible images of cameras were used to monitor volcano, operational analysis of volcanic eruption plume/cloud by JMA become impossible if the visibility is poor. If analysis using radar data became easier, immediate analysis of volcanic eruption cloud in all-weather would be possible, and, as a result, we can make a database of “hidden” eruptions. In this presentation, outline of the tool development and results of a case study will be shown.

In the tool development, we use the software named “Draft” developed by MRI. This software consists of many commands, e.g., format conversion, analysis of radar data, and drawing results. Although it is possible to analyze the radar echo of volcanic eruption cloud using these commands, it may be difficult for beginners of radar meteorology and “Draft”. Hence, we started to create some shell scripts that the users can perceive the shapes of volcanic eruption plumes easily with radar data. Our goal is to make easy-to-use tools that enable us to do everything, from collecting radar data to drawing the results, automatically.

As a case study, we chose the eruption from the Minamidake summit crater of Sakurajima occurred on November 11, 2017. In this case, we couldn't see the eruption plume by cloud around the summit. Considering the amount of ground deformation detected by extensometer in an observation tunnel in Arimura, Sakurajima, it's no wonder that the volcanic ash and the gas spewed to more than 5,000m with this eruption. It is because the amount of strain change associated with the eruption is almost the same with the case on June 16, 2018, whose eruption cloud height was 5,700m. In this case, we used the data of two (Fukuoka and Tanegashima) weather radars which belong to JMA operational weather radar network (JMA-RDN). As a result, we revealed that the eruption cloud was about 4,500 to 6,000m, and kept this height for about 10 minutes. In 2017, this eruption may be one of the largest eruptions, because the eruption occurred from Showa crater on May 2 is the only one eruption whose volcanic ash rose more than 5,000m.

Interestingly, we found two peaks in the radar echo distribution by the Tanegashima radar. We consider that one peak is due to the dense ash above the summit, and the other peak was made by aggregates and water coated ash. We are planning to carry out further analysis using different types of radar, e.g., polarimetric weather radar.

As a conclusion, effectiveness of the analysis tools using weather radars was confirmed in this study. It is expected that the tools enable us immediate analysis of volcanic eruption cloud in all-weather. However, there are some problems. One of them is that we may not be able to analyze an accurate eruption cloud altitude especially in the case whose amount of ash is small and the duration is a few minutes, since the time resolution of the JMA-RDN is about 5minutes. We will continuously develop the analysis tools and improve the analysis methods through analyzing more cases.

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