Ellipse-approximated isopach maps for estimating ashfall volume at Sakurajima volcano

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In studies of volcanic tephra, it is usual that the overall volume of tephra is estimated ashfall volumes based on representative locations within the ashfall area. The precision of the volume estimation largely depends on the number of the locations. However, in the case of ongoing eruptions in island volcanoes, such as Sakurajima volcano, the observation locations are usually limited. We therefore have developed a practical method for estimating ashfall volume and distribution in such case. The method approximates the distribution of ashfall as ellipses, with the distribution area (A) and thickness or weight of deposit (T) determined by $A=\alpha T^{-1}$. The ellipse-approximated isopachs (EAI) can be determined by using the direction of the ellipse axis and ashfall data at two points. In determing the ellipse axis exactly, we usually need additional ashfall amounts from the other locations. We set 37 samplers around Sakurajima volcano, and retrieved the samplers 15 times, from April to December, 2008.

The EAI provided a swift geometric method for assessing ashfall eruptions. In many cases, the distributions calculated using the EAI method correlated well with the observed data for the Usu and Asama volcanoes, in which small eruptions recently produced low columns. Under these conditions, we could approximate the ashfall distribution as a single exponential function. The EAI method is useful for small, continuous eruptions and for small island volcanoes where terrestrial ashfall is naturally limited to the area of the island. When using the EAI method, it is important to determine the correct EAI calculation axis and to confirm the fit between several observation points and the calculated distribution. This method will be useful for spatial ashfall monitoring for lahar risk assessment, analysis of rate of current eruptions and volume estimation of historical ashfall records.