Simulation and test observation for omni-directional muography at Omuro-yama

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In the understanding of the eruption of the volcano, the size and the shape of the volcanic vent close to the crater are important. Generally, the size is several to hundreds of meters, and the shape is not simple cylinder. When we consider the largest vent, we need spatial resolution of several tens of meters to measure the shape of vent.

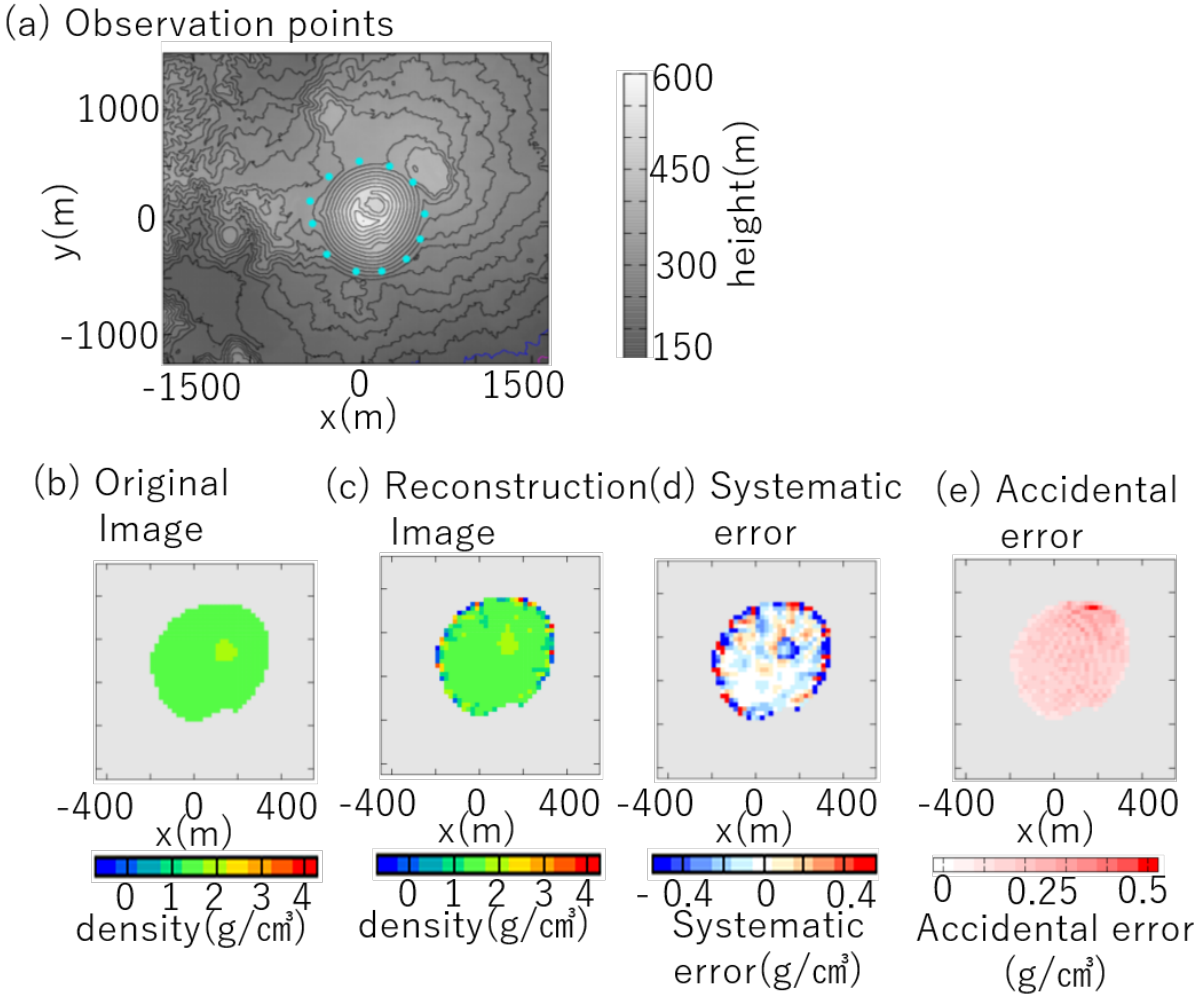
“Muography” is the technique to observe two-dimensional the inner density structure with high spatial resolution. In previous study, they attempted to reconstruct the three-dimensional (3D) density structure by observing the volcano from multiple directions, but they got three-dimensional density structure with only several hundreds of meters spatial resolution because of a few observation points. To improve the spatial resolution, we are planning “omni-directional muography”, putting ten or more observation points to surround the volcano.

We are planning to demonstrate omni-directional muography at Omuro-yama, located in Shizuoka pref., Japan. We have two reasons that we choose this volcano. First, Omuro-yama is a scoria cone formed by a single eruption, so simple structure is expected and it is easy to obtain significant result. Second, there are no objects around near it. In addition, there are no observation of muography at scoria cone.

We carried out the feasibility check of demonstration observation at Omuro-yama by simulation and test observation by using 3 points muography before full observation. In this simulation, we used a method applying Filtered Back Projection. As a result of simulation, it was found that it is necessary to ensure the minimum S / N ratio for the number of muons observed at each observation point. As a result of test observation, it was found that there was a high density part in the west part of crater rim.

In this publication, we will show the detail of simulation of feasibility check and the result of test observation.

Keywords: volcano, three-dimensional, cosmic-ray, muon



Simulation results when we set 12 observation points and use the detectors which are 0.04㎡ for 90 days. (a) DEM (Digital Elevation Map) near Omuro-yama and observation points (blue dots) in this simulation. (b)-(e) Density structure and error at 490m height in this simulation.

