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Very Long Range Muography for Monitoring a Volcano Eruption

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A radiographic imaging technique with cosmic ray muons (muography) offers us a tool to remotely observe a hazardous erupting volcano. Practical muographic observations of a volcano from a distance are, however, difficult and thus, various observations have been carried out in the vicinity (<1.5 km) of the volcano peaks in order to suppress a background noise and enhance an image. Here, we created a muographic image right below a caldera floor of an erupting Shinmoe-dake volcano, Japan by locating our muography telescope at a distance of 5 km from the peak. Shinmoe-dake volcano started to erupt on January 19, 2011, and within less than one month, the ejected lava almost completely filled the caldera, and completely changed the topography of its caldera floor. The resultant image showed a low-density region underneath the western part of the newly created caldera floor, indicating the existence of a void there. We anticipate that our novel muography will be a practical tool to monitor and predict an eruption sequence in the near future.

Keywords: cosmic ray, muon, muography, volcano, eruption, remote