Three dimensional resistivity structure of Kirishima volcanoes inferred from magnetotelluric data

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Broad-band magnetotelluric (MT) measurements were conducted on 2010-2011 around Shinmoe-dake volcano in the Kirishima volcanic group, Japan, where sub-Plinian eruptions took place three times on 26-27 January 2011. Combining with the previous MT data, it is found that the anomalous phase in excess of 90°is commonly observed at the northern part of the Kirishima volcanic group. Because the anomalous phase is not explained by 1-D or 2-D structure with isotropic resistivity blocks, 3-D inversions were conducted. By applying the small error bars on anomalous phase, we successfully estimated a 3-D resistivity structure that explains not only the usual data but also the anomalous phase data. The final model shows a eastward inclined and clockwise twisted pillar-like conductor that connects a deep-seated conductive body (at a depth greater than 10 km) to a shallow conductive layer at the central part of Kirishima volcanoes. By using the geophysical and petrological studies of the 2011 sub-Plinian eruptions, we infer that the pillar-like conductor represent the zone of hydrothermal aqueous fluids over 400 ℃, in which a magma pathway (interconnected melt) is partly and occasionally formed before magmatic eruptions. To the north of the deep conductor, earthquake swarms occurred on 1968-69, suggesting that these earthquakes were caused by volcanic fluids.