

New Procedures to extract geomagnetic field variations caused by volcanic activities - Bayesian model

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The geomagnetic field variations caused by thermal demagnetization or piezomagnetic effect can be powerful indicators of thermal or stress conditions of a volcano. However, the volcanic geomagnetic field varies slowly with amplitudes of 1~10 nT in most cases, while changes up to a few hundreds nT are caused by ionospheric and magnetospheric currents, secular variations, meteorological temperature variation, and currents induced by the sea water motion. Therefore, it is necessary to remove the unnecessary variations in order to investigate an on-going physical process inside a volcano.

Fujii and Kanda (2003) developed numerical procedures to extract geomagnetic field variations caused by volcanic activities from an observed geomagnetic field. A Bayesian statistical model and a Kalman filter model were separately developed for comparison, however, the Bayesian model was required to be improved from a practical point of view. We report an update version of the Bayesian model in this study.

A significant improvement was brought in by using the QR decomposition with pivoting instead of the singular value decomposition to solve a large least squares equation. Computational time was 19 times shorter than before. Optimization of parameters with the iteration procedure can be introduced to the updated Bayesian model.