論　説

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光波測距の数値気象モデルに基づく大気補正
—浅間山への適用—

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Atmospheric Correction in EDM by Using the JMA Numerical Weather Model: Application to Measurement at Asamayama Volcano

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Electro-optical distance measurement (EDM) and Global positioning System (GPS) observation are applied to monitor precise time variation of the ground deformation at active volcanoes. But observations using electromagnetic waves such as these are accompanied by errors associated with inhomogeneity of refractive index along the propagation path in atmosphere. In particular, the inhomogeneity in troposphere degrades the accuracy of positioning. An improved atmospheric correction method in EDM was developed, based on the Japan Meteorological Agency (JMA) operational mesoscale analysis (MANAL) for numerical weather prediction. In this method, the precise velocity and ray path of propagated lights are estimated from the adequate vertical profile of refractive index by MANAL. Consequently distance along the bowing ray path measured by EDM is corrected to be precise slope distance. Applying this procedure to EDM data at Asamayama volcano, the seasonal fluctuation caused by inhomogeneity of refractive index in atmosphere was removed entirely.

At Asamayama volcano, very small eruptions occurred in August 2008 since the latest 2004 eruption, and then a small eruption occurred in February 2009. Based on the EDM observation by Meteorological Research Institute and Karuizawa Weather Station, we detected that the slope distance had been shortened since August 2008. Slope distances from the observation site to reflectors were corrected by using MANAL in this correction method. Though slope distances have increased in length at a rate of 1–7 mm per year since the 2004 eruptions, ground deformation turned over to inflation in August 2008 and slope distances shortened to 5–28 mm per five months by January 2009.

In order to account for those observation data, we assumed a pressure source beneath the summit crater, whose depth and volume increase were estimated to be at a height of 2380 m above sea level (200 m under the summit) and 15,300 m^3, respectively.

By developing this atmospheric correction method in EDM with the use of the JMA's numerical weather model, it became possible to precisely detect ground displacements and thus to reliably estimate their sources. Therefore, this method is very effective to monitor activity of volcanoes.

Key words: Atmospheric Correction, EDM, JMA numerical weather model, Asamayama volcano, MANAL

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