

Ground Deformation of Mayon Volcano Revealed by GPS Campaign Survey 2005 - 2015

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Geodetic observations such as GPS and gravity surveys conducted regarding the Mayon volcano (Jentzsch et al., 2001) detected no fine changes in deformation accompanying the 1993 eruption. To detect temporal changes in pressure sources caused by magma accumulation and discharge, we have installed a GPS survey network consisting of over ten sites around the Mayon volcano since 2005, detected changes in deformation accompanying the 2009 Mayon eruption.

The GPS campaign network, operating since 2005, consists of five survey lines arrayed radially from the volcanic summit. The survey has been repeated 2 or 3 times a year from May 2005 to June 2014, numbering 24 over the ensuing decade. An MG-2110 all-in-one single-frequency receiver (Furuno Electric Co., Ltd.) was used for its advantage such as a low power consumption of 0.5 W and its 1.5 kg weight. Such high-mobility devices make surveys efficient. Static observation was conducted 1 to 4 days using 30-second sampling. We estimated relative positions bihourly for individual stations in relation to a reference site using Bernese GPS software Ver. 5.0, then averaged bihourly positions as the final position for each survey.

No baseline has changes exceeding 4 cm in the last 10 years, but several had rapid contractions of 2 to 3 cm from 2009 to 2010. A lava flow eruption occurred at the Mayon volcano in December 2009, and we assumed that the volcanic edifice was deflated when magma associated with the 2009 eruption was discharged. We thus estimated the position and volume change of the reduced pressure source accompanying the 2009 eruption using ground deformation from August 2009 to February 2010. We applied the Mogi model (Mogi, 1958) to estimate a spherical source consisting of only four unknown parameters. Optimal parameters of the deflation pressure source were estimated to be at a depth of 8.5 km beneath the summit (latitude 13.2425deg., 123.6914deg.) and the amount of volume change $-13 \times 10^6 \text{m}^3$.

Although the survey frequency is low before the 2009 eruption, some baselines seem to have extended slightly. This probably means that the GPS survey recorded magma accumulating before the 2009 eruption.

New lava dome approximately 30m-50m high appeared on the summit crater in August 2014 (PHIVOLCS, 2014). It was difficult, however, to detect the temporal change by GPS observation. The total amount of magma discharged was too small to deflate the volcano edifice.

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