Revisiting the 1986 eruption of Miharayama, Izu-Oshima, Japan: new constraints on the magmatic system by combining strain, tilt and level line data.

Alan T Linde[1], Osamu Kamigaichi[2], M Churei[2], Kenji Kajo[3], Selwyn Sacks[1]

[1]Department of Terrestrial Magnetism, Carnegie Institution of Washington, USA, [2]Japan Meteorological Agency, Japan, [3]Takamizawa Cybernetics, Japan

E-mail: alinde@dtm.ciw.edu

Deformation changes due to the 1986 eruption of Miharayama volcano on Izu-Oshima, Japan, were well monitored by using leveling surveys, tiltmeters and borehole strainmeters and a number of studies have used these data sets separately. We revisit this eruption in an attempt to determine model parameters that satisfy all the various data sets. The eruption consisted of two stages: activity from 15-20 November 1986 was followed by quiescence for about 1.5 days and then fissuring started on the 21st. For the first stage no precursory deformation can be recognized in the continuous tilt and strain records. Both types of records can be well fit by a depressurizing shallow (∼4km) reservoir, similar in depth to earlier models, but require a sub-vertical prolate spheroidal source rather closer to the surface breakout point. The strain and tilt records have very similar time signatures and, by comparison with the time history of eruptive volume, these data require replenishment of the shallow reservoir from a deeper (∼30km) source during and following the eruptive activity. The second stage was preceded by clear strain and tilt changes indicative of dike formation and both data types show that significant deformation continued for days following the cessation of eruptive product; in fact the majority of magma movement was from a reservoir into a large dike (extending to the south-east) that did not break the surface; the top depth is constrained primarily by changes at the on-island strainmeter site and by elevation changes determined by line level surveys before and following the eruption. By imposing, on a continuous basis, conservation of magma among the sources and the erupted material we obtain models, evaluated at one minute intervals, which agree very well with the strain changes and are consistent with the other deformation data. Including the large dike in the modeling is necessary to provide a good fit to the time history of all the strain sites that recorded the eruption (at distances greater than 50km), including one site for which a Mogi-dominated model would require changes of the wrong polarity.