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# Borehole strainmeters in Montserrat: calibrations, analysis techniques and performance.

Selwyn Sacks (1), Alan Linde (1), Dannie Hidayat (2), and Stefanie Hautmann (3)

(1) Carnegie Institution of Washington, Department of Terrestrial Magnetism, Washington, United States (alinde@dtm.ciw.edu), (2) Earth Observatory, Nanyang Technical University, Singapore, (3) Department of Earth Sciences, University of Bristol, UK

For the past eight years a small network of borehole strainmeters has been operating on Montserrat. These highly sensitive dilatometers, (approximately 100 - 1000 times more sensitive than GPS at periods < ∼month) at distances 5.4 to 9.6 km, are carefully calibrated using earth tides and long period surface waves. All sites include barographs to record pressure waves from explosions and also so that strains induced by air pressure fluctuations at the sites can be determined. An advantage of dilatometers is that the sign of the signal depends on the ratio of epicentral distance to depth of the pressure source; this applies to both ellipsoidal and dike-like sources. Thus using dilatational strain changes from a small number of sensors allows determination of source depths. In particular, pressure changes in the shallow dike yield a distinctive character to the signal since the nearest sites, Air Studio and Trants have opposite signs.

The SHV magmatic system has been determined in a number of studies to consist of a large deep magma chamber, a smaller shallower magma chamber, a dike and finally, a conduit feeding the dome. Two well-recorded events allow us to separate the various contributions. An explosion, 3 March 2004, was fed by the upper ∼5 km deep magma chamber, deforming the dike before triggering a fragmentation event in the conduit. The pre-explosion pressure change took 53 seconds. A month-long event which was large enough to be recorded on the GPS network as well as on all the strainmeters, allowed determination of the pressure changes in the deeper, ∼11 km, and shallower, ∼5 km, magma chambers and the dike above the upper chamber. The amplitude ratios between the strain signals at the various sites are then used as a template to identify smaller events that are invisible to GPS, but also involve the same pressure sources. To date, a number of sources and source combinations have been identified. The upper magma chamber alone (July, 2003; the upper magma chamber and the dike (March, 2004); both magma chambers and the dike (December, 2008); and the conduit alone for a number of vulcanian events; all have clearly different data signatures.