Augustine Volcano: PBO Data

Jeff Freymueller » Geophysical Institute, University of Alaska Fairbanks

PBO data recorded before and during the eruption of Augustine Volcano provided new insights into the magmatic plumbing system at Augustine volcano, as well as surprises that will require further research to understand. These results give an example of the future gains expected from measuring deformation at other PBO volcanoes.

The first sign of unrest at Augustine appeared in early summer 2005, with an increase in seismicity accompanied by a small inflation signal. Surprisingly, from the beginning the inflation signal indicated a source at shallow depth, roughly at sea level. Campaign GPS measurements over the 15 years prior to the eruption indicated no previous accumulation of magma at such shallow depth. The initial inflation source was small, detectable only by high-quality continuous GPS, and it may be that deformation associated with the rise of this small initial pod of magma was simply too small to record with GPS – strainmeters or tiltmeters such as those that PBO plans to install might have provided further important data about the initial rise of magma.

Once significant extrusion of magma began, about two weeks after the first major explosions, the surviving PBO sites recorded a deflation signal with a different spatial pattern than the inflation. Although only weakly constrained by PBO data because two sites were destroyed quickly, the deflation source clearly came from a significantly greater depth than the inflation source. Additional data from temporary sites deployed just before the volcano became too dangerous to visit helped constrain the source depth to mid-crustal depths. Together with the lack of pre-eruptive deformation prior to 2005, these observations lead to a model for the magma rise in which small leading pods ascended from mid-crustal depths, eventually reaching the surface. After there was a continuous magma column from the surface to mid-crustal depths, sustained extrusion began.

The destruction of some sites in the initial explosions and the first major pyroclastic flow also illustrated the need for redundancy in network design. Additional instrumentation installed on Augustine since the eruption addresses that need. The value of additional temporary continuous sites also suggests a future use for part of the PBO campaign instrument pool, as long as funding and approval for rapid response can be obtained.

References