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How reliable are moment-tensor solutions for long-period events on volcanoes?

Ivan Lokmer (1), Johannes Thun (1,2), and Cghristopher J. Bean (2)

(1) University College Dublin, School of Earth Sciences, Dublin, Ireland (ivan.lokmer@ucd.ie), (2) Dublin Institute for Advanced Studies (DIAS), School of Cosmic Physics, Geophysics Section, 5 Merrion Square, Dublin, Ireland

There are many reported attempts of the moment-tensor inversions (MTI) of long-period signals on volcanoes. Although the inversion procedure is similar to that for standard earthquakes, there are several crucial differences related to volcanic signals: (i) the events are commonly very shallow (of the order of several hundred metres), (ii) S-P arrival time differences are much smaller than domnant period of the signal so all the phases are intertwined, (iii) recorded waveforms are strongly affected by the joint effect of topography and heterogeneity and (iv) general source mechanism is unknown (unlike in earthquake seismology where double-couple is commonly assumed). All these makes the inversion a challenging task and may lead to possible misinterpretation of seismovolcanic source processes. We extend the work reported in several published studies dealing with the uncertainties in long-period volcanic inversions. Instead of taking a standard route in testing our ability to invert for a tensile crack seismic source, we use a set of synthetic signals generated for a double couple source and test our ability to obtain the correct solution. We show that it is very difficult, if not impossible to correctly invert these type of signals in a heterogeneous volcanic environment. While this result may seem discouraging, it can be greatly improved if the inversion is moved towards lower frequencies. In cases where the lower frequency band cannot be isolated or it does not exists, either additional information (such as rotational wavefield) could be used, or a great caution should be exercised when interpreting such solutions. As a result, some of the moment-tensor solutions for long-period events should likely be revised.