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Investigating seismic source mechanism at Turrialba volcano, Costa Rica

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Long-period (LP) seismic events (with a frequency between 0.5 to 5 Hz) have been recorded at many volcanoes across the world. In some cases LP event swarms have occurred as precursors to volcanic eruptions. The similarity between the waveforms of different LP events observed at a volcano suggests a non-destructive, repeatable generating mechanism within the volcano that is constant or changes only very slowly with time. Proposed models for the source mechanism of these events attribute them to resonance within a fluid-filled cavity within the volcano. This means that the study of LP events at volcanoes is very important to (i) determine the internal structure and dynamics of a specific volcano; (ii) determine the true source mechanism of these events; and (iii) aid in volcanic eruption prediction. This study aims to examine these three points. In order to achieve this, a field experiment was implemented between March and September 2009 at Turrialba volcano, Costa Rica. Activity at Turrialba volcano has increased significantly in recent years with higher levels of seismic and fumerolic activity. In this study 16 broadband seismometers were deployed on the summit and flanks of the volcano, including a 5 station array that was in operation for $\sim$2 weeks. Network deployment was based on lessons learned from previous studies, which have shown that seismometers should be located in a dense network across the top of a volcano (above the source), in order to gain as accurate a source inversion as possible. This was possible at Turrialba due to an access road leading up to the summit craters. The data from the field experiment have been analysed. As well as LP events, large quantities of volcanic tremor (including harmonic tremor) and a high number of explosion events (exhibiting high energy across low to high frequencies) have been recorded. The initial focus of the study is on the LP events. These have been grouped into families according to their waveforms and the locations of these families have been resolved. LP events are located below the summit craters at shallow depths. Using these locations, the source mechanism has been computed using moment tensor inversion. This may lead to a much greater understanding of the internal dynamics and structure of Turrialba volcano and better constraints on the source mechanism of LP events in general.