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Applying seismic ring-fault models to real case scenarios

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Previous studies have found discrepancies concerning the seismic radiation between planar and curved faults; moment tensor (MT) interpretations, seismic moment estimation and waveforms change dramatically when the rupture is not planar. Therefore, assuming a point source on a planar fault for earthquakes in volcanic environments can be an oversimplification that needs to be addressed if we observe some seismological clues. First, we study waveforms for LP events at Etna. To explain these waveforms we propose a full-ring rupture with an inner net movement of magma, in contrast to the planar fault approach that returns a pulsating rupture. Second, we study MT inversions for the biggest earthquakes during the 2014-2015 collapse of the Bardarbunga caldera, which show non-double couple solutions, with vertical compression axis. We calculate synthetic seismograms for partial-ring ruptures using an “ideal” seismic network, and one emulating the existing monitoring network at Bardarbunga. Observations using distal stations can return a better-constrained seismic moment, but they fail to characterise the dynamics involved. On the other hand, using proximal stations we obtain a reliable representation of the forces involved; however, the seismic moment is systematically overestimated due to the proximity to the curved source and the corresponding focussing effects. Finally, we correct the area of rupture due to fault shape to estimate the real cumulative seismic moment during the caldera collapse. The result shows a closer relationship between seismic and geodetic moment.