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MT inversions for anomalous earthquakes in Iceland using local observations.

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The assumption of planar faults in volcanic environments appear to be an oversimplification following geological observations and studies of micro seismotectonics. In a previous endeavour we studied the radiation patterns of complex faults, which considers dyke faults (two opposed sliding faults at close proximity) and ring ruptures and addressed the main differences with single planar fault rupture. Intriguing datasets from Iceland show two seismic events from Krafla volcano which appear to be the response to an implosion, and one from Askja volcano which has been reported as an imploding crack. Moment tensor inversions performed using first arrival P wave polarisation can lead to misinterpretations on the real slip on the fault if the source is a complex rupture instead of a point source. Here we perform full waveform moment tensor inversions in order to retrieve the slip history on the fault and constrain better the source parameters. Results show that the slip on the fault for the three cases are characterised by a deflation and then a recovery inflation to retrieve the initial state. However, Askja event for example, was labelled as an imploding crack due to the long term deflation of the caldera, leaving with no explanation the second part of the slip on the fault (recovery inflation). Synthetic seismograms of dyke and ring ruptures show similarities with the seismic observations; therefore, these ruptures can be a possible explanation for the seismic events observed. Moreover, the slip on the source based on a dyke and ring ruptures show a step function deflation, which is more appropriate to describe and conciliate the seismic and geodetic observations.