Geophysical Research Abstracts
Vol. 18, EGU2016-14794, 2016
EGU General Assembly 2016

A tale of ambiguities and interpretation pitfalls: seismology based source models for the Bárðarbunga caldera collapse earthquakes, Iceland

Sebastian Heimann (1), Simone Cesca (1), Martin Hensch (2), Torsten Dahm (1), and Vala Hjörleifsdóttir (3)

(1) GFZ Potsdam, Section 2.1: Physics of Earthquakes and Volcanoes, Potsdam, Germany (sebastian.heimann@gfz-potsdam.de), (2) Icelandic Meteorological Office, Reykjavík, Iceland, (3) Departamento de Sismología Instituto de Geofísica Universidad Nacional Autónoma de México, México City, México

The 2014-2015 collapse of the Bárðarbunga caldera was accompanied by a notable seismic sequence of more than 80 events with Mw >= 4.5. We analyse these earthquakes using broadband recordings from the Icelandic regional seismic network using standard and probabilistic centroid moment tensor inversion. Our results reveal that the centroids of the events cluster beneath the northern and southern caldera rims and are characterized by the superposition of a near-vertical negative compensated linear vector dipole (CLVD) and shear faulting of different orientations. It is well known that moment tensor decompositions are non-unique. We demonstrate that in this particular case, applying the standard moment tensor decomposition scheme would lead to wrong conclusions, incompatible with independent observations like the fault orientations at the caldera rims. We propose an alternative decomposition scheme which is well compatible with the observations. Furthermore, we propose a simple mechanical model for asymmetric, drainage-driven caldera collapses, capable of explaining the seismological observations at regional distances: an initial failure along a steep fault is followed by a deformation response of a deeper magmatic source. The shear faulting contribution occurs either as thrust faulting along an outward dipping fault (northern rim) or as normal faulting along an inward dipping fault (southern rim). As a side note, we discuss the parameter trade-offs in our full and deviatoric centroid moment tensor inversion problems and show how to rigorously quantify uncertainties on the results.