

Dense seismic network provides new insight into the 2007 Upptyppingar dyke intrusion

Hilary R. Martens¹, Robert S. White¹, Janet Key¹, Julian Drew¹,
Heidi Soosalu^{1,2} and Steinunn S. Jakobsdóttir³

¹*Bullard Laboratories, University of Cambridge, Madingley Road, Cambridge CB3 0EZ, UK*

²*Geological Survey of Estonia, Kadaka tee 82, Tallinn 12618, Estonia*

³*Icelandic Meteorological Office, Bústaðavegur 9, 150 Reykjavík, Iceland*

hilarymartens@gmail.com, rsw1@esc.cam.ac.uk, ajk65@cam.ac.uk, drew2@slb.com, heidi@hi.is, ssj@vedur.is

Abstract — *Factors such as network geometry, network size and phase-picking accuracy have significant effects on the precision of seismic hypocentre locations. In turn, the precision of the hypocentral locations dictates the degree to which morphological details within seismic swarms may be resolved. The Icelandic national seismic network (SIL) is designed to monitor seismic activity across large expanses of Iceland in real-time using automated earthquake detection and location software. Here we examine the performance of the SIL network relative to a much denser, local network of seismometers deployed around the Askja volcano in the Northern Volcanic Zone. A subset of earthquakes from the 2007–2008 dyke intrusion beneath Mt. Upptyppingar is used to compare single- and multi-event hypocentral locations. Specifically, we highlight 288, high signal-to-noise ratio events that occurred during an intensive sequence of earthquakes from 6–24 July 2007, when the temporary Askja network was active. A careful refinement of phase onsets recorded by our well-configured, dense network of receivers reveals hypocentres clustered tightly on a planar structure, interpreted as a dyke dipping at 49°. The root-mean-square (RMS) misfit to the plane (114 m) is only slightly greater than the uncertainties in relative locations of the earthquakes themselves, and constitutes a three-fold reduction in RMS misfit over SIL relative locations. The improved precision, facilitated predominantly by a more favourable network size and configuration, permits a more detailed analysis of the intrusion.*