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Conjugate strike-slip seismicity in the Icelandic Rift Zone triggered by the 2014 Barðarbunga-Holuhraun dyke intrusion

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Conjugate strike-slip seismicity accommodating rifting in Central Iceland has been detected and located using a dense local seismic network.

The Bárðarbunga-Holuhraun dyke intrusion in August 2014 was injected laterally into the upper crust 40km southwest of the study area, triggering a sharp rise in the seismicity rate and moment release. This surge in seismicity began in the geothermal area of Askja volcano, closest to the dyke. The extent of the induced seismicity propagated north-east as the dyke continued to be intruded. Intriguingly, this didn't stop after the dyke propagation ceased and the main-phase of the eruption began.

Automatic hypocentre locations have been refined using waveform cross-correlation and double-difference relocation, and focal mechanisms have been obtained by manual P-wave polarity picking. The resulting hypocentre distribution and complementary focal mechanisms reveal a network of conjugate strike-slip faults. There is excellent agreement between the geometry of the faults inferred from the relocated hypocentre distribution and the tightly constrained fault plane solutions. Small-scale features resolved in this study reveal the kinematics at the terminations of and junctions between major faults, including two intersecting conjugate faults.

Using our precise observations of the fault and slip vector orientations of the induced earthquakes, we investigate this pattern of propagation by modelling the coulomb stress change from both the dyke intrusion and by each sequential induced fault slip.