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Seismic anisotropy in the Icelandic rift zone

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We have applied shear-wave splitting analysis to shallow events (depths < 6 km), to study the anisotropic fabric in the upper crust in the neighbourhood of Askja, a volcano in the central Icelandic highlands. We performed a grid search over two parameters: the fast polarization direction, ϕ; and the delay time between fast- and slow-polarization arrivals, δt. Cluster analysis is used to determine the most stable splitting measurements with small error. We are left with 967 events measured at 114 stations, recorded between 2009 and 2016. The fast-polarization directions measured at each station are found to be consistently rift parallel across the region, with an average direction of 7.8 ± 19.2 degrees from north. They also correlate spatially with mapped surface fissure swarms. This is coherent with an anisotropic fabric caused by the alignment of cracks in the regional stress field. Our preliminary results show that the maximum strength of anisotropy is around 3-4%. In future, we intend to map the delay times between fast- and slow-polarization arrivals from all earthquake-station combinations as 3-D variations in the strength of anisotropy using seismic tomography, in order to provide a clearer picture of the spatial distribution of anisotropy and how it relates to known geological/tectonic features. In addition to local earthquake sources, we plan to augment our model with regional and teleseismic events, providing complementary constraints on anisotropy in the mid-to-lower crust and upper mantle.