Current Plate Boundary Deformation and the State of Stress on the Reykjanes Peninsula, South Iceland

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The Mid-Atlantic Ridge comes onshore on the Reykjanes Peninsula where it forms a complex and highly oblique left-lateral spreading zone between the North American and the Eurasian Plates. The NUVEL-1A predicted spreading rate across the Reykjanes Peninsula is 19 mm/yr in the direction of N103E. The plate boundary on the Reykjanes Peninsula has an overall orientation of N79E and is expressed at the surface as five NE-striking volcanic fissure swarms and a series of NS-oriented strike-slip faults. Seismicity along the plate boundary shows both spatial and temporal variation and earthquakes tend to occur in distinct clusters separated by areas of low seismicity.

Annual GPS campaigns have been conducted on the Reykjanes Peninsula since 2000, when two M6.5 earthquakes and several triggered events occurred in southwest Iceland. Using the geodetic data collected since 2000, we study the spatial and temporal variation of the crustal deformation. We model the postseismic velocity field assuming left-lateral motion along the Reykjanes Peninsula and opening across the Western Volcanic Zone. The model parameters cannot be uniquely determined due to trade-off between the model parameters, especially between the locking depth and the deep slip rate. Preliminary results for a locking depth of 7 km indicates deep-slip rates of 16-26 mm/yr parallel motion and up to 10 mm/yr of extension across the peninsula.

We investigate the state of stress at seismogenic depths along the Reykjanes Peninsula using earthquake focal mechanisms from the SIL network. The large seismic data set allows us to estimate a large number of stress tensors, providing high stress resolution in both space and time. We study how the stress estimates compare to the surface deformation inferred from the GPS data and how to integrate the data sets to constrain our models.