

STRESS AND STRAIN ALONG AN OBLIQUE PLATE BOUNDARY, THE REYKJANES PENINSULA IN SW ICELAND

Marie Keiding (1), Björn Lund (2), and Þóra Árnadóttir (1)

1. Nordic Volcanological Centre, University of Iceland; 2. Uppsala University, Sweden

Abstract

This study presents stress inversions of focal mechanisms from micro-earthquakes on the Reykjanes Peninsula, from the SIL seismic catalogue, and a comparison with geodetic strain rates.

During 1997–2006 most earthquakes on the Reykjanes Peninsula were located in two areas, Fagradalsfjall and Krísuvík on the central part of the peninsula. Pronounced swarm activity was observed in both areas, as well as moderate mainshocks in the Krísuvík area. A close spatial relationship between the area of high seismicity and the geothermal field in Krísuvík suggests that the geothermal activity has some influence on the seismicity in this area. No geothermal alteration is observed at the surface in the Fagradalsfjall area, and it is not known if there are particular triggering mechanisms behind the pronounced swarm activity in this area.

The state of stress estimated by inversion of micro-earthquake focal mechanisms from the SIL catalogue is mainly oblique strike-slip, with a tendency towards a normal stress state. Mapping the directions of the least compressive horizontal stress (S_{hmin}) shows an average direction of $N(120\pm 6)^\circ E$ and a remarkable agreement with the directions of greatest extensional strain rate (ϵ_{Hmax}) derived from GPS velocities during 2000–2006. The agreement between the directions of stress at depth and strain rate observed at the surface indicates that the earthquakes are primarily driven by plate motion. Geothermal fluids may, however, act as a secondary triggering mechanism of the seismicity in the Krísuvík area.

References

Keiding, M., B. Lund, and T. Árnadóttir, 2009. Earthquakes, stress and strain along an obliquely divergent plate boundary: the Reykjanes Peninsula, southwest Iceland, *J. Geophys. Res.*, doi10.1029/2008JB006253, in press.

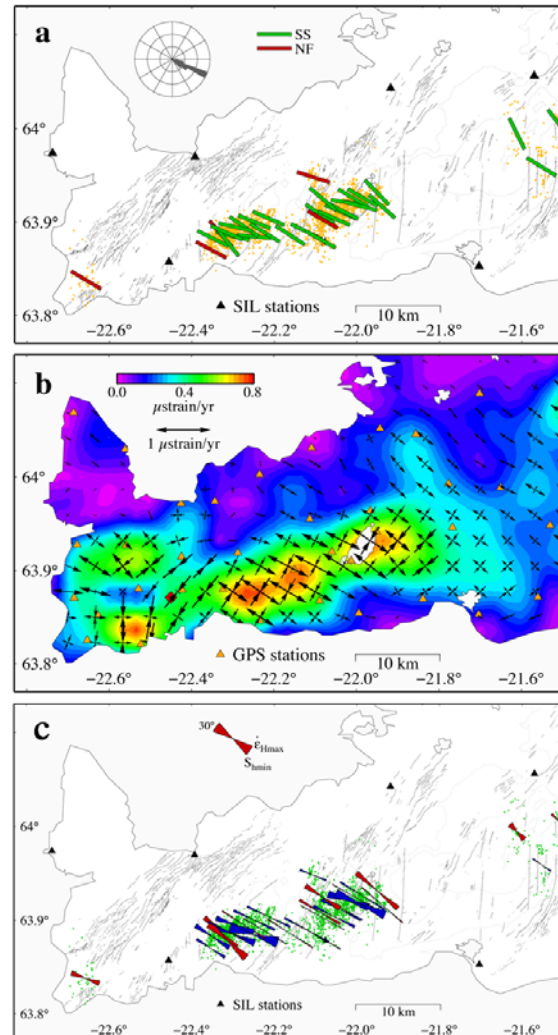


Figure 1: a) Directions of S_{hmin} from inversion of earthquake focal mechanisms, from July 2000–April 2006. The colours indicate the stress state: strike-slip (green) and normal (red). b) Greatest extensional and contractional horizontal strain rates (arrows), and magnitude of maximum horizontal shear strain rate (contours), based on GPS velocities from 2000–2006. c) Comparison of the S_{hmin} directions in panel a and the ϵ_{Hmax} directions in panel b. The bow-ties show the differences between the directions of S_{hmin} and ϵ_{Hmax} , with fill colours indicating whether S_{hmin} is oriented clockwise (red) or counter-clockwise (blue) to ϵ_{Hmax} . Modified after Keiding et al. (2009).