



Relation of Time-Varying Vp/Vs ratio to Inflation and Deflation Episodes near Hengill Volcano, Iceland

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The Hengill area experienced an intensive and long-lived series of earthquakes in the 1990s. This coincided with a period of inflation near the Hengill volcano, which was interpreted as new influx of magma at ~7 km depth. Feigl et al. (2000) postulated that the observed seismicity was triggered by the strain accumulation associated with the magma-influx. In a similar area ~3 km to the NW, subsidence has been occurring since 2006. The timing of this subsidence coincides with the onset of geothermal production at Hellisheidi in the west and enlargement of the Nesjavellir powerplant in the North. The source of the subsidence near Hengill volcano is however estimated between 5.6 and 7 km depth and at significant lateral distances from these production sites (Juncu et al. 2016). In this study we apply newly developed methods in time-dependent seismic tomography (Hobé et al. 2020) in the Hengill area, to study if significant velocity changes can be attributed to these inflation/deflation episodes. The dataset employed for the tomography covers the inflation period, the subsidence period, and the time in-between, with varying station coverage and geometry. In this study, the artificial velocity variations due to variations in source and receiver geometries are first separated from “true” velocity variations. In the approximate source region of the 2006-onwards deflation the preliminary results show a low Vp/Vs ratio anomaly between ~4-7 km depth, with an EW extent of ~8-10 km and an NS extent of ~4 km. This anomaly coincides with a significant amount of seismicity. This may indicate an increase in the amount of compressible fluids, accompanied with hydro-fracturing. The seismicity terminates below this low Vp/Vs anomaly, underneath which there is an area of increased Vp/Vs ratios (associated with melt) in the approximate center of the inflation episode in the 1990s. Thus, this investigation provides new information about the nature of the deformation sources, and the surrounding hydrothermal system. We will further investigate the apparent connection between the current subsidence and geothermal production.

References:

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