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# *Ambient-noise tomography of Katla volcano, south Iceland*

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## Abstract

A shear-wave velocity model of subglacial Katla volcano, southern Iceland, has been developed using ambient seismic noise tomography based on data from a temporary network operating between May 2011 and August 2013 and permanent stations around the volcano. Phase-velocity dispersion curves were obtained using cross-correlations of vertical components of 136 station pairs and non-linearly inverted for phase-velocity maps between 1.7 and 7.5 s. Local dispersion curves were inverted for shear-velocity variation with depth using a grid search imposing a fixed ice layer at the top. The resulting one-dimensional (1-D) velocity models were combined to obtain a pseudo three-dimensional (3-D) model with estimated lateral resolution of 8 km and depth resolution varying from close to 1 km near the surface to about 8 km at 10 km depth. Shear wave velocities are generally higher within the Katla central volcano than in its surroundings. The most striking feature of the model is a high-velocity anomaly beneath the caldera at more than 6 km depth interpreted to be due to cumulates resulting from differentiation of shallower magma intrusions and remelting of subsiding upper crust. No shallow low-velocity anomaly is resolved beneath the central caldera, but a low-velocity region is found at 2-4 km depth beneath the western half of the caldera. $V_P/V_S$ ratios, estimated from average velocity-depth profiles from surface-wave data and higher frequency P-wave data, are anomalously high (>1.9) compared to average Icelandic crust, particularly in the top 2-3 km. This is argued not to be an artifact due to lateral refraction or topography. Instead, this anomaly could be explained as an artifact caused by velocity dispersion due to attenuation and a difference in frequency content, and possibly to a degree by the compositional difference between the transalkalic Fe-Ti basalts of Katla and average tholeiitic Icelandic crust.

**Key words:** Katla volcano, Iceland, ambient noise, surface wave tomography

## 1 Introduction