Ambient noise tomography of Eyjafjallajökull

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We present the first tomographic model of Eyjafjallajökull volcano, south Iceland, using ambient noise tomography. The data were collected on a dense network of temporary and SIL seismometers prior to and during the 2010 eruption. Cross-correlations between stations enabled us to construct phase-velocity dispersion curves and create phase-velocity maps, for periods between 1.6-6.5 s. From the phase-velocity maps we constructed local dispersion curves and used them to invert for structure in depth. The resulting 3-D shear wave velocity model has a lateral resolution of 5 km and vertical resolution down to 10 km. The 3-D model shows two high-velocity zones, with a shear-wave velocity of 3.5 km/s, due east and west of the summit caldera of Eyjafjallajökull, at approximately 5-7 km depth. The high velocity zones are elongated in the east-west direction, in line with geological surface features and are separated by a zone of relatively lower velocity (3.0 km/s), where earthquakes prior to and during the 2010 summit eruption were located. The high velocity zones most likely correspond to intrusive bodies similar to those previously imaged beneath both Tertiary and Neovolcanic central volcanoes in Iceland. A low-velocity zone, with a shear-wave velocity of 2.0 km/s, centered 5 km southwest of the caldera reaches into the caldera at a 3-5 km depth. Our model resolution is not sufficient enough to resolve whether small pockets of melt reside within the low-velocity zone.