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Constraining the dynamics of 2014-15 Bardarbunga-Holuhraun intrusion and eruption using seismic noise

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The 2010 Eyjafjallajokull volcanic eruption explosively emitted a large quantity of ash in the atmosphere and paralysed the European airspace for weeks. Several seismic scientific studies already contributed to the understanding of this complex eruption (e.g., Tarasewicz et al., 2012). Although an excellent network of seismometers recorded this eruption, some volcanological and seismological aspects are still poorly understood.

In order to gain further constraints on the dynamics of this ground-breaking eruptions, we mine the seismic dataset using the seismic ambient noise technique between pairs of stations and the Seismic Amplitude Ratio Analysis (SARA).

Our preliminary results reveal a strong contamination of the Cross Correlation Functions (CCF) by the volcanic tremor, particularly above 0.5 Hz even for station pairs located >50 km from the volcano. Although this volcanic tremor precludes the monitoring of the seismic velocities, it literally illuminated the medium. The two phases of the eruptions (i.e. effusive and explosive) are clearly distinguished in these functions due to their different locations. During the explosive phase, an intriguing shift of the main peaks of the cross correlation functions is evidenced (early May 2010). It is remarkably consistent with the downward migration proposed by Tarasewicz et al. (2012) and is interpreted as a migration of the volcanic tremor.

SARA methodology, which is continuously imaging and tracking any significant seismicity at a 10-min time scale (Taisne et al., 2010), is applied in the 5-15 Hz frequency band in order to image to continuously migrating microseismicity. The analysis displays several shallow migrations (above 5 km of depth, in March 2010) preceding the effusive phase of the eruption. Interestingly, the results also evidence a fast and deep migration (> 5 km) starting a few hours before the beginning of the explosive phase (13 April 2010). These preliminary results may shed light on the triggering of the explosive eruption.