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Resolution for a local earthquake arrival time and ambient seismic noise tomography around the Eyjafjallajökull volcano

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The explosive summit eruption of Eyjafjallajökull volcano from 14 April to end of May 2010 was preceded by an effusive flank eruption of the volcano (at Fimmvörðuháls) March 20th – April 12th. These eruptions culminated 18 years of recurrent volcanic unrest in the area, with extensive seismicity and high deformation rates since beginning of January 2010. A national network of seismic stations in Iceland (the SIL network), operated by he Icelandic Meteorological Office, monitored the precursors and development of the eruptions, in real time. We analyse a seismic dataset available from SIL stations in the vicinity of the eruption area, as well as data from additional portable stations that were deployed during a period of unrest in 1999 and just before and during the eruptions in 2010. The SIL system detected and located 2328 events between early March and late May 2010 in the area around Eyjafjallajökull. Here we present a preliminary evaluation of resolution for a local earthquake arrival time tomography. Adding the portable stations to the pre-existing SIL data set is crucial in order to identify more seismic events and improve the data coverage for tomography.

We also present a resolution analysis for Ambient Seismic Noise Tomography (ASNT) in the area. In this method ambient seismic noise, recorded at two seismic stations, is cross-correlated. This band-limited approximation of the Green's function between two stations is used to estimate surface wave velocities. The fundamental assumptions underlying this method is that the noise is constructed from a randomly distributed wavefield, but this may be violated by volcanic tremor during the eruptions. We evaluate the robustness of inter-station correlograms as a function of time during the unrest period as well as their frequency content for evaluation of depth resolution. The results can be compared to constraints on magma movements inside the volcano based on interpretation of crustal deformation and geochemical analyses.