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## Velocity and attenuation models of Tenerife and La Palma (Canary Islands, Spain) through Ambient Noise Tomography.

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Tenerife and La Palma are active volcanic islands belonging to the Canarian archipelago. The island of La Palma is the most occidental and volcanically active island of the archipelago. The youngest volcanic rocks are located in the Cumbre Vieja volcanic complex, a fast-growing North-South ridge in the southern half part of the island. On the other hand, the central part of Tenerife island hosts the Teide composite volcano, the third tallest volcano on Earth measured from the ocean floor. The volcanic system of the island extends along three radial dorsals, where most of the historical eruptions occurred. Those two volcanic islands have potential geothermal resources that could be exploited to increase the percentage of renewable energy in the Canary Islands.

The main objective of this work is the use of Ambient Noise Tomography (ANT) to determine high-resolution seismic velocity and attenuation models of the first few kilometres of the crust, in order to detect anomalies potentially related to active geothermal reservoirs. In the case of Tenerife, previous tomographic studies were performed on the island using active seismic data. They allowed to image the structure of the first 8 km depth. However, for the purpose of geothermal exploration, a higher spatial resolution is needed for the first few kilometres and the determination of the shear wave velocity has a particular importance when searching for fluid reservoirs. In the case of La Palma, no seismic tomography was performed yet.

To realize the ANT, we deployed temporary broadband seismic networks in the two islands. In total, we deployed seismic stations on 41 measurements points in Tenerife and 23 points in La Palma. The campaigns lasted at least 1 month, using jointly the permanent seismic network Red Sísmica Canaria (C7) operated by INVOLCAN. After performing standard data processing to

retrieve Green's functions from cross-correlations of ambient noise, we retrieved the dispersion curves using the FTAN (Frequency Time ANalysis) technique. The inversion of dispersion curves to obtain group velocity maps was performed using a novel non-linear multiscale tomographic approach. The forward modelling of surface waves traveltimes was implemented using a shortest-path algorithm which takes the topography into account. The method consists of progressive non-linear inversion steps at increasing resolution. This technique allows retrieving 2D group velocity models in presence of strong velocity contrasts with up to 100% of relative variation.

In parallel with velocity model, we retrieved maps of seismic attenuation (i.e. quality factor  $Q$ ) retrieved from the coda envelope decay of noise cross-correlations (Q-coda). For each source-receiver pair, a Q-coda value was calculated, and mapped to the target area by using 2D empirical sensitivity kernels for diffusion (Del Pezzo and Ibañez, 2019). We compared 2D velocity and attenuation images at different dominant periods, evidencing structural features for Tenerife and La Palma islands which seem to be relevant for the purpose of geothermal exploration.