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# Magmatic storage below Teide volcano from reflected and scattered seismic waves

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Geochemical studies have shown that magma is stored in a shallow chamber before reaching the surface. However, seismology struggles to see any clear magma storage area, either because of lack of resolution or because this storage area consists of a complex fracture network, without a strong seismic contrast, rather than a continuous body. Tomographic images indicate the presence of regions with reduce velocity, but the detailed seismic characterization of the "magma chamber" is still an issue; specific methods have to be developed to image such a zone.

Teide is a 3718m high volcano located on Tenerife, in the Spanish Canary Islands archipelago. There is geological evidence of explosive activities of this volcano and 6 effusive eruptions during the last 300 years. In 2004, an unusual increase of seismicity suggested a possible reactivation of the volcano. Its internal structure was totally unknown and this is of critical importance in understanding a volcano's state and its processes. For this reason, in 2007, a high shot density active experiment (TOM-TEIDEVS) was carried out to get a 3D model of Teide structure. 137 broadband stations were deployed on the island, and 6459 active sources were shot at sea. From this high density dataset, P-wave travel times were inverted to get a tomographical image of the island. The resulting smooth model unfortunately does not show any clear anomaly that could be possibly associated with a magmatic storage zone.

To specifically explore the presence of a possible magma chamber, in this work we look at both reflected and scattered waves. From the dataset, we extract a 2D North-South profile, which includes 25 stations on land and 253 off-shore shot points. Two approaches are then used to analyse the data, based on two different assumptions. The first hypothesis is that waves are reflected from the magma body and therefore we can process this profile with classical reflection seismic techniques. Nonetheless, as the volcano topography is quite sharp and its effect on wave propagation would be substantial in contaminating imaging at depth, redatuming techniques will be necessary as an initial step in the processing sequence to correct for this. The second hypothesis is that the magma chamber itself acts as a set of scattering points. With this in mind, using a double beam-forming approach, the secondary sources of the wavefield, i.e. the scattering points, can be located. In parallel, numerical data are generated to check the sensitivity of both methods as well as to estimate, in both scenarios, what kind of body can be reconstructed with this particular geometry. The numerical modelling thus allows us to limit the range of size, position and geometry of a possible magma body below this volcano.