# Comparison of the shallow and deep structure beneath the Abrolhos Archipelago and the Trindade Island with passive-source seismology

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## Abstract

The Earth's surface is dynamic, the result of several moving lithospheric plates overlying a plastically flowing asthenosphere, where these plates can pull apart, collide, or slide one another along faults. Tectonic processes generate several geological features, like mountains, volcanoes, sedimentary basins, lakes, and faults, among others. However, an island or archipelago is a geologically anomalous feature found at ocean basins; and one of the biggest challenges to understand its origin is the mismatch between its orientation/shape and the regional fracture zones trends. Understanding the shallow and deep Earth architecture beneath these emergent land features is a key point for improving our comprehension about ongoing and past geological processes in these areas. Lithospheric-scale processes, such as the origin and evolution of islands, leave behind a trail of footprints on the subsurface that can be retrieved by geophysical methods. Our study area is located at the Brazilian continental margin, which includes several volcanic islands and submerged volcanic seamounts related to post-breakup magmatic episodes. The Abrolhos Archipelago is a group of small islands with a semi-circular shape composed of igneous bodies on the continental shelf at different depth. The Trindade Island corresponds to the easternmost island of the submarine E-W Vitória-Trindade Chain, composed of seamounts, guyots and oceanic islands starting 175 km off the coast of Espírito Santo State and extending for 950 km eastward. The main goal of our study is to compare the shallow and deep structure beneath these emergent land areas and highlight seismic discontinuities, in order to improve our understanding of its architecture and help constrain models for its origin and evolution. Due to the technical difficulties to maintain a permanent station far away from the continent, each island has only one seismic broadband station working, thus we implement robust methodologies for single station measurements, including stochastic methods and deep learning. The dataset has been collected from two permanent broadband stations of the Brazilian Seismographic Network (RSBR) installed at the islands. Regarding the shallow structure, we calculated the Fundamental Frequency (f0) using the horizontal-to-vertical spectral ratio (HVSR) technique, which is normally used to retrieve information about the subsoil seismic properties. In the case of deep structure constraints, the receiver function technique (RF) is one of the most successful methodologies in broadband seismology for imaging of the crust and mantle. We expect to infer details about the architecture of the crust and mantle beneath the islands and contribute towards a better understanding of the role of magmatic processes and the thermal and mechanical properties of the lithosphere.

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