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# Seismic tomography of the continental wedge and geometry of Nazca slab beneath Ecuador

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Following the work initiated in 2016 (Araujo, 2016) we propose a new tomographic model of the Ecuadorian region. This new model is based on an increased dataset from the Ecuadorian seismic network (RENSIG) between 1988 and 2016. The catalog contains 62,551 earthquakes recorded at 305 seismic stations over the country, resulting in nearly 700,000 P- and more than 220,000 S-wave arrival-times. As large dataset generally contain a certain proportion of outliers, we applied a pre-processing protocol to improve data quality previous to tomography – basically an automatic filter based on Wadati's diagram analysis.

The INSIGHT tomography software used in this study follows a stochastic inversion algorithm for both hypocenters and velocity models determination. It was successfully used in regional tomography studies in the western Alps, in Ecuador, Chile and Lebanon. The software performs inversion of P- and S-wave arrival-times for determining hypocenters and vP and vP/vS fields.

Resulting earthquakes relocalization and P-wave velocity model lead to accurate images of the subduction of the Nazca slab beneath the South American Plate in Ecuador. Slab topography is imaged in great details and present more undulations than the reference Slab2 model (Hayes et al., 2018). Such undulations indicate how stress is accommodated at depth, along the bending of the trench line, between North where the slab plunges with a dip of 23º, the center where the dip reaches 40º and the South where the subduction is almost flat with a dip of 10º. Concerning the seismic activity, four seismic nests are clearly identified under the crust and are correlated with the slab subduction. Three of them are located West of the western Cordillera, approximately beneath the cities of Pedro Vicente Maldonado, La Maná and Guayaquil, at intermediate depths, between 75 km and 100 km. The fourth nest, located in the eastern Sud Andean Belt, close to the city of Puyo, is located deeper, between 150 km and 250 km depth.

The P-wave velocity model reveals a slab discontinuity extending from the trench to Puyo nest and passing through La Maná nest. This 50 km wide discontinuity is orientated N60ºW. It is characterized by a low velocity of approximately 7.8 km/s, lower than the average 8.2 km/s of the surrounding slab. This discontinuity could be the result of a vertical tear in the Nazca slab, as suggested by previous studies and similar observations in Japan, in the Philippines and also in Colombia, a few hundreds of kilometers north from Ecuador. Extensive study including S to P conversion phases, focal mechanisms of local and neighboring earthquakes, S-wave velocity, earthquakes propagation paths will now be necessary to define clearly the Nazca slab tear beneath Ecuador.