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Slab curvature in Ecuador and plate interface geometry

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We establish the geometry and depth position of the top of the Nazca Plate (TNP, beneath its sedimentary cover) based on the integration of multiple geophysical data. The TNP geometry is mapped from the outer trench to a depth greater than 180 km, between southern Colombia and northern Peru. At shallow depth, we use active-source seismic-reflection and refraction profiles collected since almost 3 decades, seaward and landward of the trench, to delineate a smooth position of the TNP (leveling all small-scale rugosities). Larger-scale subducted oceanic reliefs are incorporated and delimited at depth (on the plate interface) using the extent of the characteristic topographic bulge at the surface. Deeper, earthquake hypocenter locations, from dense array deployment near the coast (between 15 and 35 km depth), or from the RENSIG and/or teleseismic catalogs (lower than 40 km depth), allow to track the TNP beneath the onshore forearc and the Andes. The TNP observation data is interpolated, making the hypothesis of a single slab, using a bicubic-spline method on pre-processed data. The preprocessing consists in a near-neighbor technique adjusted to up-weight the trench parallel direction (quadrant).

The resulting image of the slab geometry shows a large-scale contortion that broadly follows the trench curvature. The transition from one dip-angle to the other is relatively sharp, confined within a NW-SE corridor between 1 and 1.5°S. South and north of this 50 km-wide transition corridor, the slab presents different characteristics. To the south, the slab gently (20°) dips eastward. Its associated seismicity can be observed down to 180 km. To the north, the slab dips southeastward with a dip-angle of 25°. While the slab seismicity is much active between 60 and 80 km depth than to the south, no or very few seismicity is observed deeper than 110 km. Active volcanoes concentrate in this northern domain.

On the outer trench slope, the position of the transition corridor coincides with a narrow (~15 km), deeper (almost 1 km) and trench-normal sedimentary basin that develops on top of a deeper position of the TNP, bounded north and south by 2 linear topographic features that might locally offset the TNP. The basin position strongly suggests a relation with the slab curvature. It is sited on the larger-scale Carnegie topographic high (220 km long) and separates a southward dipping TNP at its highest position to the south (facing the highly-coupled La Plata segment) from a deeper and flat TCN to the north (up to the latitude of Cabo Pasado from where it deepens northward). This overall pattern of the Carnegie Ridge and its lateral depth variations can be discerned on the shallow interface geometry that presents very similar topographic variations. On the poster, these patterns will be compared to the map of interseismic seismic coupling, the sites of slow-slip even ts and the distribution of the Pedernales aftershocks.