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New insights on the structure and active deformation of the North Ecuadorian-South Colombian margin

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Along the Ecuadorian margin, the Nazca plate is subducting beneath the South American plate at a rate of approximately 58 mm/y in an east-west direction and four megathrust earthquakes had occurred north of 0.5°S along this margin, during the 20th century.
Since these large interplate earthquakes, the activity is very moderate, according to seismological global catalogues or the Ecuadorian national catalogue (RENSIG) established by the Instituto Geofisico de la Escuela Politecnica Nacional (IG-EPN), including very few events with magnitude > 6. The interseismic seismicity of the region (both marine and land) is not accurately located, due to the poor coverage of the RENSIG seismological network. Consequently, the deep structure and deformation location, between the trench and the Cordillera and particularly the slab geometry is still debated.
In the frame of the ESMERALDAS campaign, 26 OBS and 31 seismological stations were installed in the northern part of the Ecuadorian margin during three months. Microseismicity with magnitude ranging from 2 to 5.5 was recorded. We present preliminary results of a Local Earthquake Tomography and a seismotectonic study, performed with these data, completed with the IG-EPN data. From 3D velocity pattern and earthquake locations we show strong heterogeneity of the deep structures along the margin. A low velocity model for the mantle is found beneath the North Andean Block (NAB) and western Cordillera. A profile, facing the Carnegie Ridge and perpendicularly crossing the Andes exhibits a seismicity dipping regularly from the trench down to a depth of 150 km, beneath the Cordillera, drawing a slab dipping with an angle of about 25°. On the northern flank of the Ridge, the slab is only well imaged down to 100 km depth. No deeper seismicity is observed. We propose that this lack of seismicity would be a consequence of a lithospheric curvature of the Nazca downgoing plate, linked to the sharp curve of the Andean Cordillera in this area.
The few focal mechanisms computed from Esmeraldas data show nodal planes compatible with outer-rise faults reactivated at intermediate depths and others compatible with interplate activity. The North Andean Block, is mainly seismically active near the boundary between the Manabi and Borbon basins, that coincides with the curvature of the Cordillera. As a result, we present an interpretation of the NAB deformation, linked to the coeval influence of the relative oblique convergence between Nazca plate and NAB, the Carnegie Ridge and sharp curve of the Cordillera.