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The HIPER marine geophysical project to a high-resolution imaging of the Pedernales earthquake rupture zone

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Data collected during the post-seismic phase of the April 2016 Pedernales earthquake, highlighted a much more complex slip behavior in this area than previously thought. Indeed, it was observed a slip behavior mixing seismic and aseismic mode. The aseismic slip behavior is now thought to be linked to the presence of fluid enriched parts on the plate interface. Indeed, fluids are thought to play a major role on active fault slip mode, and thus on earthquake genesis; however, observations of fluids that can be directly linked to slip behavior are lacking. The Ecuadorian margin provide a unique opportunity to investigate the role of fluids by seismic, heat flow and geochemical observations.
In February-March 2020, a team composed of researchers from France, Germany and Ecuador will perform a 3D oceanographic experiment on the Pedernales earthquake region on board the French R/V Atalante. This experiment will use methods such as FWI, 3D shots and earthquakes tomography and 3D ambient noise imaging, to approach the relationship between 3D structure, fluids and variations in slip behavior ranging from seismic to aseismic.

We will:

- Image the roughness of the plate interface down to the 2016 Pedernales earthquake rupture zone
- Image the 3D geometrical and structural variations
- Obtain the 3D seismic velocity structure for both P- and S-waves , and their temporal variation
- Derive zones of fluids along the interface, as well as in the overriding and downgoing plate
- Accurately locate seismicity with respect to the imaged structures

To do so, refraction data will be acquired on 3 2D-lines of densely spaced OBS (being spaced from 1 to 2 km), in- and outside the 2016 Pedernales earthquake rupture zone, jointly with multi-channel seismic reflection. In addition, a 3D OBS network reinforced with a dense network of permanent and temporary land stations, will stay from 12 to 18 months to record earthquakes and potential slow slip episodes.