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A 80 OBS and 30 Land 3-component seismometers array encompassing the 280 km segment of the Lesser Antilles subduction megathrust seismogenic zone: view of current seismicity

Mireille Laigle (1), Martine Sapin (1), Mario Ruiz (2), Jordi Diaz (3), Edi Kissling (4), Philippe Charvis (2), Ernst Flueh (5), and Alfred Hirn (1)

(1) Institut de Physique du Globe - UMR 7154, Seismoloy, PARIS, France (laigle@ipgp.fr), (2) Géoazur, Université de Nice Sophia-Antipolis, Observatoire de la Côte d'Azur, INSU-CNRS, IRD, Villefranche-sur-Mer, France , (3) CSIC Institut Jaume Almera, Barcelona, Spain , (4) ETH Zurich Department of Earth Sciences, Institute of Geophysics, Zurich, Switzerland, (5) IFM-GEOMAR, Leibniz Institute for Marine Science, Kiel, Germany

An extensive onshore and offshore seismic station array in the Lesser Antilles subduction zone allows to monitor microearthquake activity for a period of 4 months in a region previously outside of reach for detailed observation.

Such a network has been possible thanks to a cluster of 3 seismic surveys (TRAIL - F/S Merian, SISMANTILLE-SII - N/O Atalante, and OBSANTILLES - N/O Antea) for deploying and recovering the instruments from several pools (Geoazur, INSU-IPGP, IFM-GEOMAR, AWI). It has been followed by an additional deployment of the 28 GeoAzur OBSs (OBSANTILLES - N/O Antea) during 5 months in the south-western half. These operations have been carried out for the seismic investigation of the Antilles megathrust seismogenic zone in the framework of the THALES WAS RIGHT european project, and with also the financial support of the french ANR Catastrophes Telluriques et Tsunamis (SUBSISMANTI) and by the EU SALVADOR Programme of IFM-GEOMAR. Onshore, 30 3-components land stations (CSIC Barcelone, IPG Paris, INSU-RLBM and -LITHOSCOPE) have been temporarily deployed. The deep seismic structure of the whole area has been investigated during these seismic surveys by wide-angle reflection and refraction seismics recorded by these instruments as well as multi-channel reflection seismic imaging (MCS) along a dense grid of crossing profiles at the OBS positions providing excellent velocity information for the upper plate.

Both the location and the interpretation of the recorded earthquake activity require constraints on the deep seismic structure, which will be discussed with respect to the 3D geometry of the interplate boundary and oceanic Moho, as well as those of the forearc basement and Moho. Preliminary locations have been obtained within a simple 1D velocity model by taking into account corrections for the variable thickness of the mud- and sediments layers beneath each OBS. The latter are estimated for both P- and S-waves to compensate for the huge structural heterogeneity on the arrival times and their effects will be discussed in map and along vertical cross-sections aligned with the seismic profiles.

A first order result is that the previously unsampled seaward region remains aseismic through the whole period of observation. Another main result, at least in a model not yet accounting for deep structural heterogeneity, is that the seismicity is principally located deeper than the contact between the forearc crust and the subducting oceanic crust as derived from the refraction-reflection approaches in the general project, and in both plates.

Data are being prepared for a joint inversion of earthquake locations, shot first arrival times and 3D heterogeneity.