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Searching for conditions of observation of subduction seismogenic zone transients on Ocean Bottom Seismometers deployed at the Lesser Antilles submerged fore-arc

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In the frame of the European Union « THALES WAS RIGHT » and French ANR CATTELL SUBSISMANTI funding, an unprecedented array of 80 OBS, Ocean Bottom Seismometers of Géoazur Nice, INSU/IPGP Paris, IfM-GEOMAR Kiel, AWI Bremerhaven could gathered. They have been deployed for continuous recording over four months on the fore-arc domain of the Lesser Antilles subduction zone offshore Martinique, Dominica, Guadeloupe and Antigua Islands, by scientific cruises of N/O ATALANTE, F/S M. A. MERIAN and N/O ANTEA.

One of the aims of this OBS array was the feasibility study of detecting at sea-bottom the seismological part of recently discovered phenomena such as NVT non-volcanic tremors and LP, for Long-Period events. The ability of detecting such transient signals is of importance, since they are possibly related to potential mega-thrust earthquakes and their preparation zone.
At the Lesser Antilles subduction zone, the fore-arc domain overlying the seismogenic part of the interplate is located offshore, covered by as much as 4000 m of water. In this case, transient signals can be accessible only from OBS observations. Hence, there is a major difference, in the sense of the instrumental and logistical effort, with the subductions under NW US-Canada and under Central Japan where these signals have been discovered. There, the subduction zones have an emerged fore-arc that has allowed the chance discovery of those phenomena by regular instrument maintained routinely on land.

Over 20 of the instruments were BB-OBS, with broadband seismic sensors, possibly the largest such gathering at the time of the experiment among the OBS types. Among those broadband OBS designed or used by different Institutions, there were at least three different seismometer brands and acoustical sensors, as well as different mechanical mounting and technical solutions for coupling them to ground. This did not facilitate data recovery and processing, but on the other hand, as planned by interweaving the different instruments deployments, it provided diverse views, as through different glasses. This ultimately proved valuable to help extract the harder facts from their diverse appearances when seen through different instruments and in different types of sites.
After analyzing the data for spurious and instrument-related peculiarities, and possible interpretation pitfalls, it remains that the noise level shows an overwhelming influence of the marine domain due to both its own sources, hydrosphere motions, and to meteorological-climatological actions. As well, the response of the laterally variable fore-arc basin on top of which measurements have to be made is much adverse to quality recording, with respect to seismological observatories on land which can be buried deep into basement rocks. The study of this noise itself may allow us to initiate a discussion of the interactions of the oceanic and atmospheric processes with the Solid Earth.

Transients at depth in the subduction zone have been tentatively discussed in terms of its seismogenic evolution. If such transient events would indeed have a component over a very broad spectral range from NVT to LP and ULP events as it has been suggested very recently in Japan (Ide et al., 2008), the conditions and the best observation windows in which they can be best searched for are now documented for ocean bottom recording in the case of the Lesser Antilles subduction zone.