UNDERWATER SEISMOMETER VALIDATION

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Abstract - This work verifies and validates the calibration in a marine geophone by means of a hyperbaric chamber before and after the pressure underwater laboratory test. The objective is to characterise the transfer function according to the frequency of coupling between the geophone and the sediment. It is possible to observe the geophone coupling variations through the sediment after the test inside the water pressure at the equivalent of 200 metres depth.

I.INTRODUCTION

In marine seismic prospecting, the seismometer acquires the vibrations of the seabed. The waveforms can be artificially generated at an oceanographic vessel on board and registered by the OBS (Ocean Bottom Seismometer), which can record natural seismicity too. With appropriated mathematical algorithms, the cortical distribution can be deduced (speed, deepness); the geological properties of the rocks and constitutive layers can be studied as well. The OBS measures the refracted vibrations of the seabed by means of a geophone with three orthogonal sensors GS11 and frequency range from 0.1 to 100 Hz, in order to investigate the composition and stratification of oceanic subsoil.

II.MEASURES IN THE LAB

The initial test is to calibrate the geophone without sediment with a shaker table, put inside the hyperbaric chamber; moreover, in order to obtain its transfer function of voltage output according to vibration in m/s, at the end calibrate in the same conditions and orientations like a first calibration.

To characterise the underwater performance and the sediment interaction with the geophone we need a precise model to obtain the real answers.

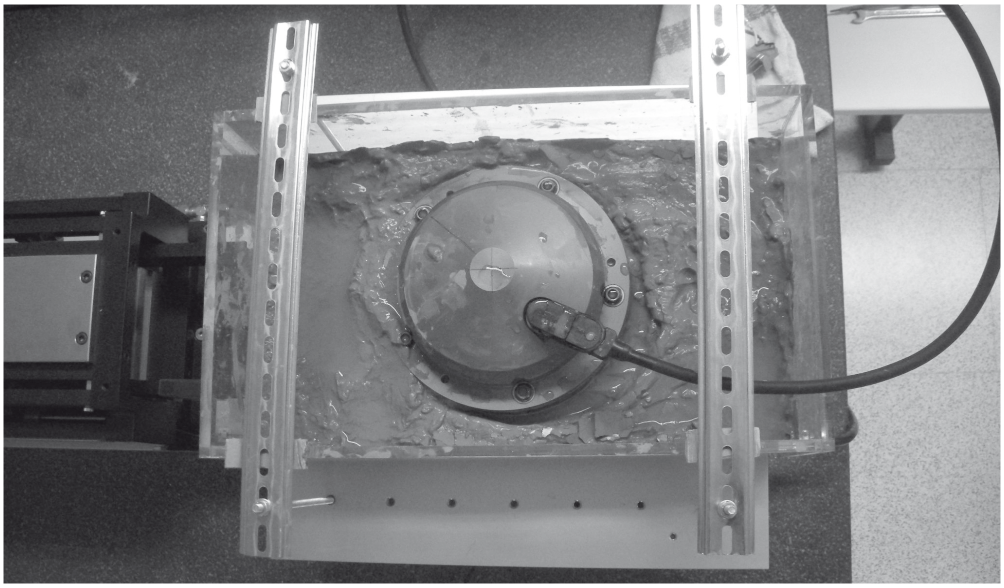

Fig.1 Sediment box and geophone in a shaker

The similar calibrations of geophone channels through the sediment on the shake table are tested (figure 1).The next process is to put the sediment box and the geophone inside the hyperbaric chamber at 20 atmospheres of water pressure to measure the output of the geophone sensors to know its performance, changes and response underwater at a depth of 200 meters.

The last process is to calibrate once more the sensors of the geophone through the sediment and compare it with the first calibrations both under the water and without water, in the exactly same conditions of the initial tests.

The second calibration results in the geophone channels get the similar sensibility transfer functions, which are compared in figure 2 and we can observe the same values and some change of frequency of maximum in the H2 channel sensibility.

III.RESULTS AND DISCUSSION

We can observe in figure 2 that the geophone supported the water pressure and worked correctly underwater thanks to airtight structure and its sensibility is the same after the underwater test. The sensibility is practically the same (±3%) when testing the sensor geophone, except at highest frequency due to a resonant effect in the shaker and its support structure.

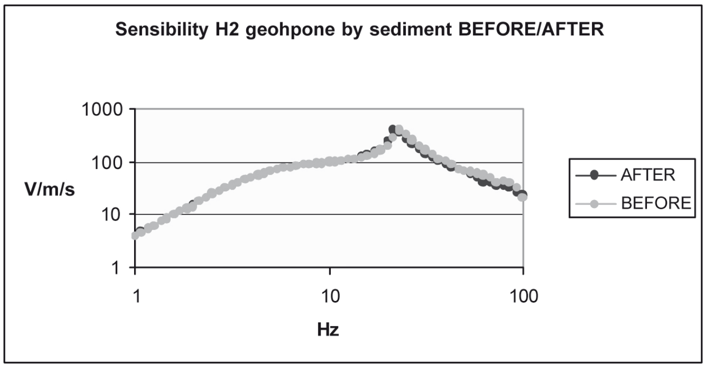

Fig.2 Compared sensibility H2 channel geophone by sediment

The results showed the good behaviour of the geophone designed structure and validates the design in the real test in underwater conditions that do not change the sensibility of the geophone and the coupling sensibility after extreme pressures such as oceanic trenches of 6000m.

ACKNOWLEDGMENTS

Special thanks to the project Signal Transmission in Light and Autonomous Underwater Sensors (CTM2004-04510-C03-00) funded by the Spanish Research and Technology Management Unit (DGICYT), as a continuation of the project New Generation of Light and Autonomous Underwater Sensors-SENSUAL (Ref:REN2000-1016-C02-01/02) which is a joint work between Technical University of Catalonia (UPC), Marine Technology Unit (UTM) and Technical University of Navarra (UPN) Tecnoterra Associated Unit.