ACOUSTIC PARTICLE VELOCITY MEASUREMENTS NEAR A ROCKY SHORE OFF CABO FRIO ISLAND

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The Island of Cabo Frio is at the tip of the Cabo Frio cape, a landmark of the Brazilian coast situated 23 degrees south, between the tropical ocean and the southern temperate region. This cape is subject to, often strong, NE winds developing a significant upwelling phenomenon on its southward. Between the island and the mainland there is bay relatively protected from the southern ocean by a rocky shore that has only a narrow entrance, through which extremely cold water enters when upwelling occurs. For more than one year continuous sound recording has been performed near the rock shore (Xavier et al., 2018). From January 14 to 18, 2019, an experiment named BIOCOM19, involving acoustic transmissions across the bay was carried out. Together with other instrumentation an acoustic vector sensor was also installed near the shore with the objective of recording particle velocity. It is now well known that a large number of organisms are sensitive to particle motion, which differentiates itself from sound pressure, specially near acoustically hard surfaces or at close distance from acoustic sources. The recorder itself is based on a dual tri-axial accelerometer combined with an hydrophone (Mantouka et al., 2017) and was primarily developed for seismic imaging from on board autonomous vehicles (Santos et al., 2017 and Felisberto et al., 2019). During BIOCOM19 the recorder was attached to a rectangular pod positioned at about 8 m from the rock wall and at 7 m depth. The recorded data covers two full days and includes additional acoustic data along the water column and other environmental information such as temperature profiles both at the receiver site and along the transmission path across the bay. The data processed so far shows that together with sound pressure particle velocity is clearly sensitive to the biological signature identifiable in the area. A daily pattern can be observed between 1.5 and 5 kHz, during the periods without acoustic transmissions, as coming from the rocky wall. Particle motion is extremely difficult to interpret but seems to show a similar pattern, at least for the accelerometer that is placed towards the shore. This study supports the development of tools to identify and classify several bioacoustic signatures from benthic community.

Felisberto P., Santos P. and Jesus S.M., (2019) "Acoustic pressure and particle velocity for spatial filtering of bottom arrivals", IEEE Journal of Oceanic Engineering, vol 44, Issue 1, pp.179-192.

Mantouka A., Felisberto P., Santos P, Zabel F. Saleiro M, Jesus S.M. and Sebastião L., (2017) "Development and testing of a Dual Accelerometer Vector Sensor for AUV acoustic surveys", Sensors, vol 17(6), pp.1328.

Santos, P., Felisberto P., Zabel F., Jesus S.M. and Sebastião L., (2017) "Dual Accelerometer Vector Sensor mounted on an AUV – Experimental Results", Proc. of Meetings on Acoustics (POMA), Acoustical Society of America.

Xavier F.C., Silveira N.G., Netto E.B., Simões M.V. and Jesus S.M., (2018) "Soundscape of benthic fauna off Cabo Frio Island under upwelling regime", 2nd Oceanoise Asia Conference, Hokodate (Japan).