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Multichannel seismic/weather/Zoological monitoring of the oceans

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Delays of seismic P waves are used to make scans or 3D images of the variations in seismic wave speed in the Earth's interior using the techniques of seismic tomography. Observations of such delays are ubiquitous on the continents but rare in oceanic regions. Free-drifting profiling floats that measure the temperature, salinity and current of the upper 2000 m of the ocean are used by physical oceanographers for continuous monitoring in the Argo program.
Recently, seismologists developed the idea to use such floats in order to compensate for the lack of seismic delay observations, especially in the southern hemisphere. In project Globalseis, financed by a grant from the European Research Council (ERC), we have built and tested a prototype of such a seismological sensor using an Apex float from Teledyne Webb Research, a Rafos hydrophone, and electronics developed in collaboration with Osean, a small engineering firm in France. 'MERMAID', for 'Mobile Earthquake Recorder in Marine Areas by Independent Divers' has concuded its final design stage and a fleet of 20 units is available off the shelf.
Two of these floats have been deployed in the Mediterranean sea between Nice and the island of Corsica late 2012, others will be deployed in 2013, in the South Indian Ocean and near Galapagos in the Pacific. Analysis of the first data will allow us to sharpen the wavelet-based algorithm parameters used to discriminate P-waves from the continuous input signal.
Ten significant events can be stored in internal memory during an average "parking depth" drift of 10 days at a chosen depth of up to 2 km. Events are classified by interest and when the memory is full, larger events replace minor events. At the end of the preprogrammed mission the float surface and transmit data (health logs and events) in Rudics mode by Iridium satellite network. A major event will force the float to ascent at surface and transmit in a short delay the corresponding recorded data as well as its GPS position.
A second, dual channel, prototype version of Mermaid using two dedicated hydrophones is designed to enlarge the band pass for acoustic signals with much higher frequency than seismic. Based on the same algorithm using wavelet transforms, Mermaid continuously analyzes acoustic signals to detect both major seismic events and weather phenomena such rain, drizzle, open sea and ice, or whale migration, during its drift phase. This extension to multi-purpose applications makes the Mermaid very attractive for the Argo program. In fact, Mermaids using passive low cost sensors form a very light and complementary solution that can be integrated with an Argo float; Mermaids listen during the passive drift while CTD data are taken during ascent and descent. Such multidisciplinary approach should allow seismologists to participate in international program such as Argo and obtain the dense ocean coverage needed to image the deep structure of the Earth.