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Ocean Bottom Seismometers technology: current state and future outlook

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The beginning of 2000s was marked by a significant progress in the development and use of self-pop-up sea-bottom seismic recorders (Ocean Bottom Seismometers). In Russia it was a novel solution developed by the Russian Academy of Sciences Experimental Design Bureau of Oceanological Engineering. This recorder and its clones have been widely used not only for the Earth crust studies, but also for investigations of sub-basalt structures and gas hydrate exploration.

And what has happened over the last 10 years? Let us look closely at the second generation of ocean bottom stations developed by Geonodal Solutions (GNS) as an illustration of the next step forward in the sea-bottom acquisition technology.

First of all, hardware components have changed dramatically. The electronic components became much smaller, accordingly, the power consumption and electronic self-noise were dropped down significantly. This enabled development of compact station 330 mm in diameter instead of previous 450mm. The weight fell by half, while the autonomy increased up to 90 days due to both decreased energy consumption and increased capacity of the batteries.

The dynamic range of recorded seismic data has expended as a result of decreased set noise and the application of 24-bit A/D converters. The instruments dimensions have been reduced, power consumption decreased, clock accuracy was significantly improved. At the same time, development of advanced time reference algorithms enabled to retain instrument accuracy around 1 ms during all the autonomous recording period.

The high-speed wireless data transfer technology offered a chance to develop “maintenance-free” station throughout its operation time. The station can be re-used at the different sea bottom locations without unsealing of the deep-water container for data download, battery re-charge, clock synchronization. This noticeably reduces the labor efforts of the personnel working with the stations. This is critically important in field conditions, since it minimizes working time, hence cuts the costs related to the expensive ship time.

One of the major factors of success is the development of a reliable pop-up mechanism, which includes not only unfailing hydro-acoustic communication, but also a reliable disconnector, both electrochemical and mechanical that could be used in salt and sweet waters. The extensive operational experience helped us to determine the reasons for non-emersion of the stations. The main problem was a sucking of instruments by muddy bottom sediments, and a simple spring assembly can release the station from the anchor with high probability

Secondly, the newly developed software provides the great opportunity to reduce considerably the processing and interpretation time cycle. The calculation of forward kinematic problems can be performed on the notebook in seconds. Visualization tools render color images of gathers with various processing parameters.

All mentioned above are proved by real data acquired by GNS during active and passive seismic surveys in deep and shallow waters. GNS has the pool of 65 OBS for large scale crustal 2D/3D active or passive experiments in any part World Ocean.