Geophysical Research Abstracts
Vol. 12, EGU2010-14267, 2010
EGU General Assembly 2010

Combining simultaneous seismic reflection and physical oceanographic observations of shelf-slope processes

Sandro Carniel (1), Jeffrey Book (2), Richard Hobbs (3), Warren Wood (2), Andrea Bergamasco (1), Katrin Schroeder (4), Giovanni Bortoluzzi (5), Hartmut Prandke (6), and Mauro Sclavo (1)

(1) CNR-ISMAR, Venice, Italy (sandro.carniel@ismar.cnr.it), (2) NRL, Stennis Space Center, USA, (3) Univ. of Durhan, UK, (4) CNR-ISMAR, La Spezia, (5) CNR-ISMAR, Bologna, (6) ISW, Germany

Understanding the Dense Shelf Water Cascades (DSWC) role in the oceans is regarded as one of the main drivers of oceanic margins; these dense water pools spill over the shelf edges, flow along topographic feature and mix with ambient waters, playing a crucial role in the Earth's long term climate.
During the international collaborative field experiment of Seismic Oceanography ADRIASEISMIC-09, carried out on board the CNR R/V Urania in the southern Adriatic Sea in the period March 3-16, 2009, a mix of classical and innovative sampling methods was tried in order to characterize the details of the North Adriatic Dense Water (NAdDW) mass structures and test the feasibility of the seismic approach in shallow basins.
Seismic Oceanography (SO) is particularly well suited for study of the dynamics of bottom-trapped water masses as compared to classic techniques because it measures the full water column at $\sim$10 m horizontal resolution, can acquire remotely and measurements are not hampered by a sloping bottom or concerns of instrument bottom impact, and it can operate successfully over the entire range from 100 m to 1000 m for tracking water-masses evolution down a slope (shown for the first time in this cruise).
During ADRIASEISMIC-09 we adopted SO techniques to follow the NAdDW masses flowing southward, testing this approach on a shallow basin with the use of a "light" seismic system that could be deployed quickly, using only two air-guns.
The resulting seismic sections were used to image thermal gradients at a scale of several meters, both vertically and horizontally.
However, since SO measurements alone are not sufficient to characterize such complex processes, the resulting seismic reflection data were combined with a series of physical oceanography measurements, e.g. classical CTDs, ADCP data, 232 XBT casts and –for the first time- also microstructure measurements acquired via free-falling profiler (101 casts), that allow to estimate how fast water masses are mixing.

Together, the direct oceanographic samplings provide a full range of vertical resolutions down to extremely fine detail (order of millimeters) to compliment the high lateral resolution of the seismic image.
The high quality data set collected demonstrated that SO campaigns can be carried out from oceanographic vessels of medium size with relatively light equipment, and that the seismic approach can be performed also in relatively shallow basins. This is an important finding, as the use of a large seismic vessel would have prohibited the kind of classic oceanography sampling that is characterizing any study of DSWC.

The seismic measurements allowed us to track a cold, thin bottom-boundary layer descending down the slope near Palagruza sill, demonstrating that these complex water pools require very high-resolution sampling near the bottom to be detected and successfully tracked in their intrusions and internal waves. Preliminary results therefore suggest that SO can provide a new and powerful tool for understanding the detailed horizontal structure of DSWC processes.