STRONG INTERNAL OSCILLATIONS FOUND IN THE CENTRAL SOUTH ADRIATIC PIT

M. Morovic [1]*, G. Beg Paklar [1], B. Grbec [1], I. Vilibic [1], D. Lucic [2] and F. Matic [1]
[1] Institute of Oceanography and Fisheries (IOF), Split, Croatia - morovic@izor.hr
[2] Institute for Marine and Coastal Research, University of Dubrovnik, Dubrovnik, Croatia

Abstract
The MEDUZA cruises in the south Adriatic Sea have acquired a number of oceanographic data in the deep South Adriatic Pit in summer 2003. Temperature, salinity and dissolved oxygen concentrations, together with transmission, pigments and optical parameters, were measured by two multiprobes in 6-h intervals during several days. Strong quasi-diurnal fluctuations of isothermal depths were observed, being in phase with local sea level, thus indicating internal waves as important phenomenon during this cruise.
Keywords: Adriatic Sea, Temperature, Circulation Models, Stratification

Although the general oceanography of the South Adriatic Pit is well studied in the past, the lack of high-resolution measurements prevented the investigations of a variety of processes that occur on the hourly timescales. Measurements in the frame of MEDUZA experiment tried to overpass that problem, at least over a local scale, as a large amount of data has been acquired at a single station (Figure 1) in short time intervals (approximately every 6 hours) between 23 and 28 July 2003. The deep sea CTD (Idronaut) multiprobe sampled the whole water column (1200m) once a day, while other measurements were performed with SBE25 multiprobe, reaching a maximum depth of 300m.

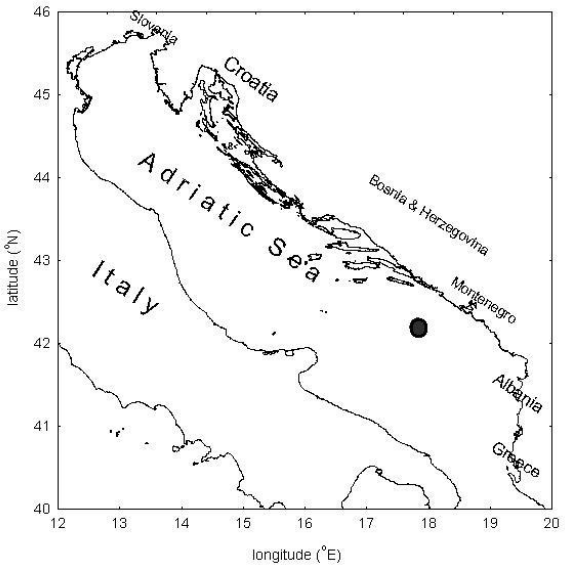

Fig. 1. Location of measurement station in the South Adriatic Pit

The cruise started with calm and clear weather, but at the fourth day strong SE wind and high waves prevented measurements for 36 hours, after which the fair conditions continued. Summer conditions in July 2003 were extremely warm and dry [1] with anomalously high air temperatures and low precipitation and runoff discharges. Surface sea temperatures were exceptionally high, reaching 27°C. Salinity was generally high in the whole water column. Thermocline was strongly developed at several tens of meters as expected. Below the thermocline, isothermal layers fluctuated unexpectedly strongly (10 m or even more) between the measurements (Figure 2).

As lower salinity waters have resided above the thermocline, the pycnocline was strengthened by the haline effect. The fluctuations of the pycnocline have a clear resemblance to the internal waves. The type of internal waves is hard to obtain as the measurements were too short, sparely for capturing such waves. However, the sea level fluctuations observed at the Bari and Dubrovnik tide gauges were in phase with the fluctuations. Also, high vertical oscillations in thermal structure were observed especially in deep layers (up to 120 m), pointing to the internal tides as a process that generated the oscillations.

The observed fluctuations were strong in the deep layers and attenuated towards the surface. Previously, strong isopycnal oscillations on diurnal and semi-diurnal periods has been found along the South Adriatic Pit northwest perimeter [2], being resonantly amplified by the topography [3]. However, the diurnal oscillations are found to be excited by the diurnal oscillations of see breeze winds during some of strong pycnocline oscillations [3], found to be as much as important as the tidal force. Therefore, both forces should be included in assessing the origin of the oscillations found in the deep South Adriatic Pit through targeted numerical modelling studies.

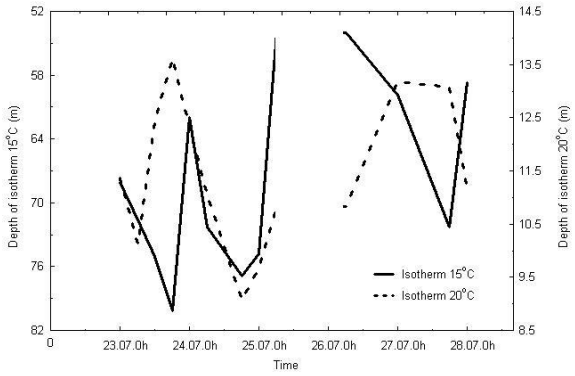

Fig. 2. Vertical oscillation of isotherms

These vertical fluctuations in the water column impacted a variety of properties from temperature and light transmission to chlorophyll maximum. Changes in optical parameters are known to be caused by depth rearrangement of phytoplankton throughout the day, but the physical processes may be quite important as well. This also applies to the observed daily vertical migration of zooplankton species found to be also remarkable [4], some of these presumably related to physical processes too.

References
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