Observation of internal waves in the middle Adriatic Sea

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From 13 to 30 August 1990 Aanderaa thermistor chain TR-7 and two current meters RCM 7 were moored near Lastovo island in the Middle Adriatic Sea at station L-4 (φ = 42° 45.2' N, λ = 17° 08.8'E d = 95 m). Thermistors were at 15, 21, 27, 33, 39, 45, 51, 57, 63, 69 and 75m depth, while current meters at 10 and 80 m. Measurement interval was 5 minutes.

Vertical profiles of temperature, density and Brunt-Vaisala frequency obtained from CTD measurement at the beginning of the measurement period are shown in Fig. 1. A strong thermocline was present between 12 and 22 m as well as pycnocline and Brunt-Vaisala frequency peak. These experimental data are similar to the theoretical assumptions done for discussion of internal waves at the boundary between two fluids of different density (MUNK, 1981). During the measurement period two strong wind episodes were recorded (the first lasting about a day and the second about 3 days).

Power spectra calculated from temperature and current data indicated high internal wave dynamics. Temperature sensor at 10 m depth was for the first 10 days near the top of the thermocline and then, owing to the lowering of the thermocline, in the mixed layer. Wind force generated inertial oscillations (period 16.7 hours) so that the peak at inertial frequency dominated in temperature power spectrum. Furthermore, there are peaks at 9.9, 6.4, 4.7 and 4.2 hour periods of the same order of energy. Approaching from 4.2 hours period to Brunt-Vaisala period the energy of the oscillations becomes significantly smaller.

Similar spectrum shape was obtained for 21 m depth (in the middle of thermocline). Important difference occurred only at inertial frequency where energy at 21 m depth is about ten times higher than at 10 m. At the bottom of the thermocline (33 m), a tidal peak (24 hours) was observed with other peaks. Magnitude of tidal energy is near the inertial one. The shapes of the spectra from 33 m to the bottom were similar to the spectrum at 33 m depth, but with smaller energy. At 45 m depth tidal energy exceeds the inertial one.

Comparing current spectrum at 10 m depth with theoretical Garrett-Munk spectrum (1972, 1975) for deep ocean, the similarity can be seen i.e. experimental spectrum follows ω^{-2} slope for internal wave frequency band (ω is frequency). The higher discrepancy between theoretical and experimental spectra was detected in low internal wave frequency band (periods between 16.7 hours and 4 hours) what can be explained by near-surface proximity of strong sources of internal waves, especially winds and surface waves (ROTH *et al.*, 1981).

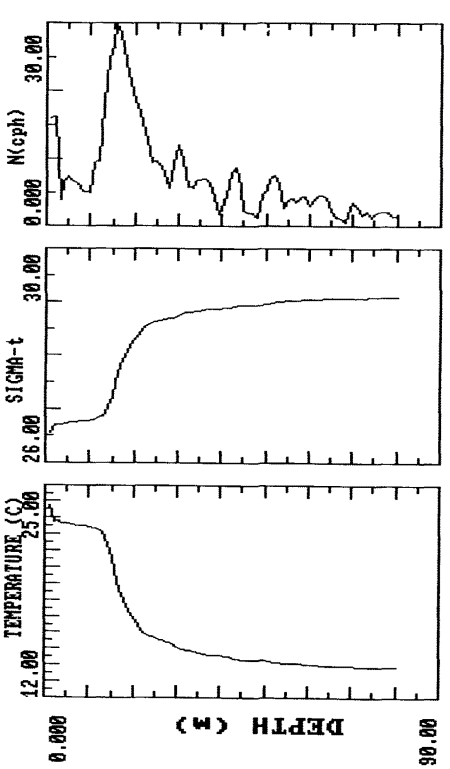

FIG. 1. Vertical profile of temperature, density and Brunt-Vaisala frequency N on August 13, 1990, station L-4.

REFERENCES

GARRETT C. & MUNK W., 1972.- Space-time scales of internal waves. Geophysical Fluid Dynamics, 2, 225-264.

GARRETT C. & MUNK W., 1975.- Space-time scales of internal waves: a progress report. *Journal of Geophysical Research*, 80, 291-297.

MUNK W., 1981.- Internal waves and small scale processes. Evolution of Physical oceanography, C. Wunsch Ed.,The MIT Press, 264-291.

ROTH M.W., BRISCOE M.G. & McCOMAS C.H., 1981.- Internal waves in the upper ocean, *Journal of Physical oceanography*, 11, 1234-1247.

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