Experimental investigation of some wave spectral parameters transformation in the Coastal Zone

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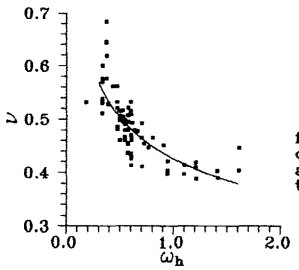
The scope of this work is to analyse experimental data on wind waves in the surf zone, in order to establish the variation of the spectral parameters on which the distribution of wave height depends. All data used here have been gathered in "WAVE'90" near-shore experiment, conducted at the Institute of Oceanology of Bulgarian Academy of Sciences.

Sea surface elevation has been measured at eleven fixed locations with a depth of 18m to 1.3m. Data have been sampled each 0.165s in a 15min period every 3 hours, coresponding to the first stages of two storms. Although there are broken waves in shallower water records, all series have been analyzed in the same manner.

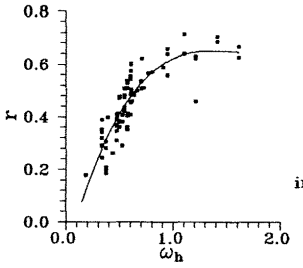
TAYFUN (1990) shows that wave heights density in deep water depends on the parameter $r(\tau) = (R^2 + R2)^{1/2}\ m_o^{-1}$, where $R(\tau)$ and $R(\tau)$ are an autocorrelation function and its Hilbert transformation, m_o is rms surface elevation and τ is the half value of the mean wave period.

For narrow spectrum LONGUET-HIGGINS (1984) has obtained an aproximate relation between r and υ, where υ is the dimensionless bandwidth parameter. Analysing $r(\tau)$ transformation we are able to investigate the transformation of distribution of wind wave heights. Experimental researches of $r(\tau)$ transformation in the coastal zone are unknown to us.

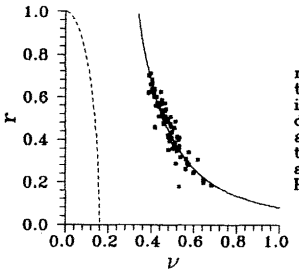
The above spectral characteristics are calculated for 71 recordings of elevation. Variation of r and υ is obtained in dependence of $\omega_h = \omega_p\ (h/g)^{1/2}$, where ω_p is the spectral peak frequency, h is the depth and g is the gravitational acceleration. The figures bellow demonstrate that the parameter υ becomes great and $r(\tau)$ becomes less with decreasing of the ω_h.There is a strong dependence between r and υ.



Experimental data for ν as a function of ω_h for both broken and unbroken waves in the coastal zone.



Transformation of r in the coastal zone.



Experimental data for r as a function of ν for the spectra of wind waves in the coastal zone. The dashed curve respresents asymptote $r=(1-4\pi^2\nu^2)^{1/2}$ for the narrow processes – according to Longuet-Higgins (1984).

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Field studies of subduction phenomenon in the Black Sea

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Until recently, it was considered that cold intermediate waters of the Black Sea are formed due to winter convection on the shallow northeast and northwest shelfs of the basin. Field Studies during early 80-th provided evidence for the fact that cold waters are formed also over the domes of cyclonic gyres in the central part of the basin (OVCHINIKOV & POPOV, 1984; LATUN & YASTREB, 1986).

In 1991-92, several cruises were conducted in the northern part of the Black Sea in order to study the process of CIW formation and of their further transformation. In March, there were three regions, sources of CIW that could be distinguished due to the properties of the cold layer. At the N-W, water temperatures were about 5. 5 x C and E was less then 14. 0 due to low salinities. Waters with minimum temperatures (about 5.0 x C), starting from Kerch strait, formed a thin stripe along the coast of the Crimea.

Over the domes of cyclonic gyres, minimum temperatures were about 6.1-6.3 x C (lower temperatures were observed in the east). Density of these waters reached 14.6 E units due to high salinities Thus, the final CIL is formed by waters with different properties due to subduction.

Waters were well ventilated down to 14.5 E interface in cyclonic gyres and on the left side of the Rim current. In anticyclonic feature, west off the Crimea, newly generated waters reached only 14.3 E interface. In this pattern, the traces of the former CIL were observed within the main pycnocline. Temperatures of this former CIW were about 7.5-7.6 x C and dissolved oxygen concentrations reached 5.0 m/l. Comparing these results with autumn data, we obtain an estimate of CIW transformation and the rate of downwelling (the rate of subduction) in the observed anticyclonicpattern (about 10 m per month).