ON THE QUASI-EQUILIBRIUM RELATIONSHIP FOR WIND WAVES IN THE NORTH ADRIATIC

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In this paper the quasi-equilibrium relation for wind waves was examined using the data from the North Adriatic. The results were compared with some previous empirical findings.

Dans ce travail on a examiné la relation du quasi-équilibre de la houle dans l'Adriatique du Nord. La relation obtenue a été comparée avec les résultats précédents.

In order to examine the quasi-equlibrium relation between non-dimensionalized energy and peak frequency in the North Adriatic for typical wave generating winds, ten situations with NE and seven situations with SE wind were chosen. The episodes had duration of maximum two days during which the wind direction remained constant while the speed changed to a considerable extent. It was shown from the air-water temperature differences that the atmospheric boundary layer was highly unstable during most of the NE wind episodes while it was either stable or close to neutral during the SE wind events.

Only the data with the nondimensionalized peak frequency higher or equal to 0.13 were used to fit to a power-law relationship betweer the nondimensionalized variance and peak frequency.

When the variables from all episodes were combined as indicated, fifty-six pairs for NE wind and forty-seven for SE wind were formed. The linear regression was calculated assuming that non-dimensionalized peak frequency had been measured perfectly.

A simple regression for the NE wind led to:

$$\mathcal{E} = 1{\cdot}718 \times 10^{-5}\, \nu^{-3{\cdot}265}$$

while for the SE wind the following relation was obtained:

$$\mathcal{E} = 2{\cdot}163 \times 10^{-5}\, \nu^{-2{\cdot}985}$$

In Fig. 1 the obtained relations were compared with the relations by Hasselmann et al.(1976) and by Liu and Ross (1978) for the unstable atmosphere. The energy for the given frequency is higher than that obtained by the presented relations.

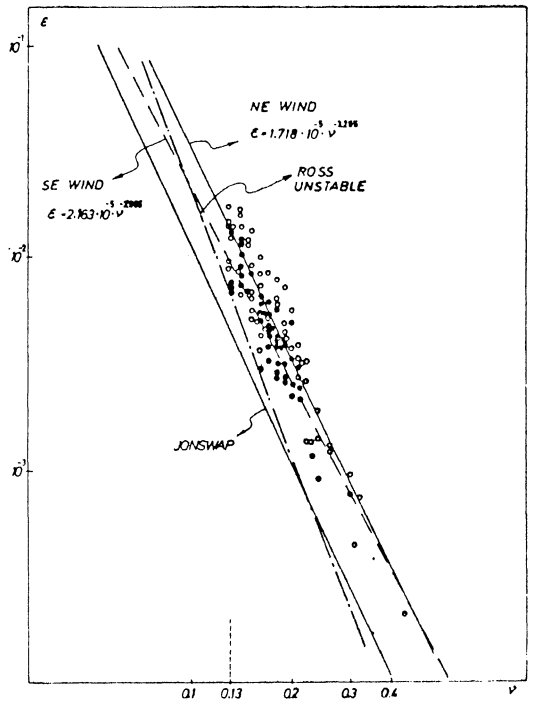

Fig. 1.: Nondimensionalized variance-peak frequency relationship

The slope of the regression line for the NE wind is equal to the slope obtained by Hasselmann, what can be explained by the fact the waves generated by the NE wind in the Adriatic are in fetch limited conditions like the waves analysed by Hasselmann et al. (1976). On the other hand, the slope of the regression line for the SE wind is the same as the slope obtained by Allender et al. (1983) in the duration-limited conditions. This confirms the fact that waves generated by the SE wind in the Adriatic are in duration-limited conditions as the fetch dimensions are large for this wind direction.

The fact that the slope of the regression line for the NE wind is significantly different from the value for the unstable atmosphere obtained by Liu and Ross (1978) shows that the atmospheric stability has a minor influence on the quasi-equilibrium relationship between the energy and peak frequency in the North Adriatic. On the other hand, the obtained results confirms the importance of fetch dimensions.

References:

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