The influence of wave refraction due to bottom topography on the distribution of wave energy along the coastline of the lagoon of Venice

by

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One of the most important causes for the modifications induced on a coastline is the dissipation of the energy carried by the wind wave field approaching it. The wind waves, in their propagation from the generation area towards the shore, are modified by the bottom topography which affects not only wave heights but also distorst the wave fronts. This distortion in shallow water leads to regions of concentration of wave energy along the coastline.

In this paper these effects are analyzed in detail, considering single monochromatic waves composing a typical wave spectrum of the Adriatic Sea, for the periods of 6-7-8-9 seconds and the two directions of 110° and 130°.

For each refraction diagram a histogram has been constructed, representing the percentual energy distribution for unit coastal lenght in the region of interest.

Fig. from 1 to 6 represent the various histograms showing quite clearly high peaks of energy concentration that correspond very well to the costal regions most affected — and therefore damaged — during particular meteorological conditions — namely of South-East prevailing winds — that produce swell waves of the overmentioned periods and directions.

These results have encouraged us to pursue a more comprehensive approach to the problem, considering also the meteorological energy input along the ray, thus facing the problem of a linear forecasting model. In this sense, we have modified our previous simple approach as to get a model that can be tested by experimental data.

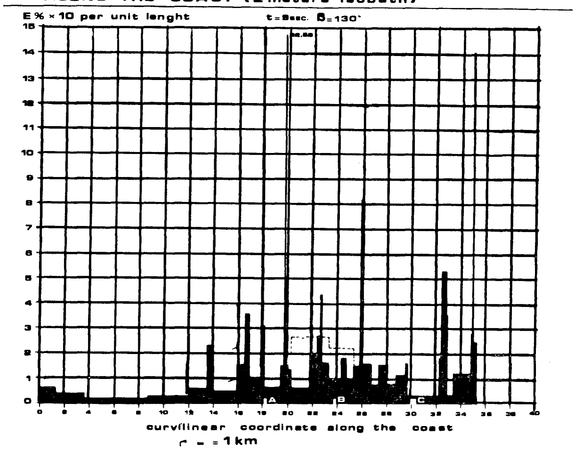
The fundamental equation is the one governing the balance of the spectral energy density function, that includes local variation, energy advection, refraction and shoaling plus a source function incorporating wave growth due to wind, and wave energy dissipation due to breaking and bottom friction.

Starting from the governing energy equation, as depending on frequency, time and spatial corodinates, one has the possibility to construct an energy spectrum in a whatever point, thus immediately comparable to the corresponding experimental spectrum.

For what regards the experimental measuring system, we present the contribution of two colleagues of ours as appendix to the paper.

Rapp. Comm. int. Mer Médit., **22**, 5, pp. 31-33, 6 fig. (1973).

HISTOGRAM OF PERCENTUAL ENERGY DISTRIBUTION ALONG THE COAST (2 meters isobath)



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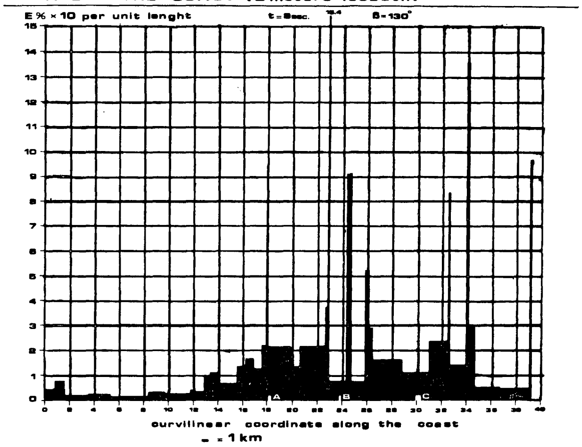

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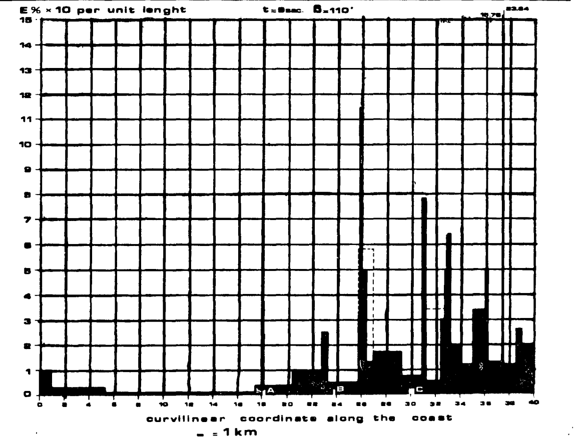

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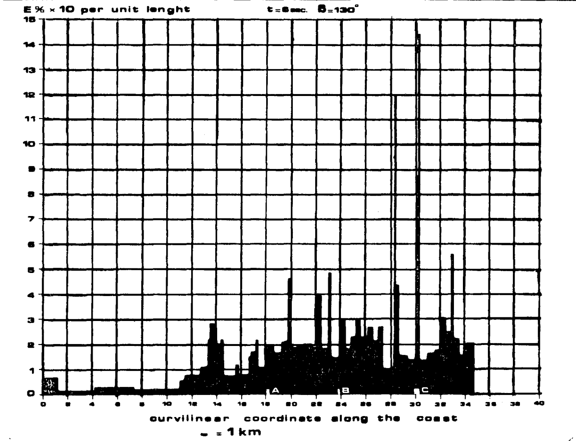

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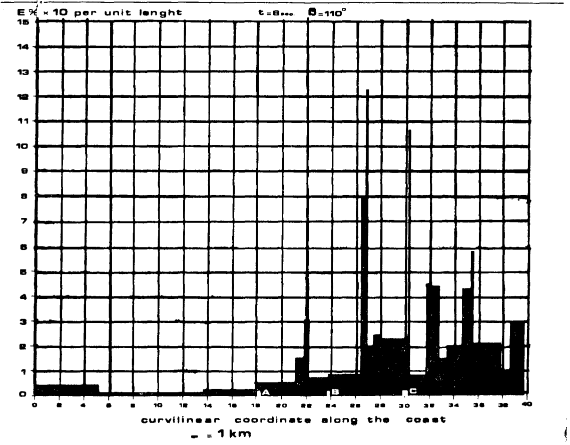

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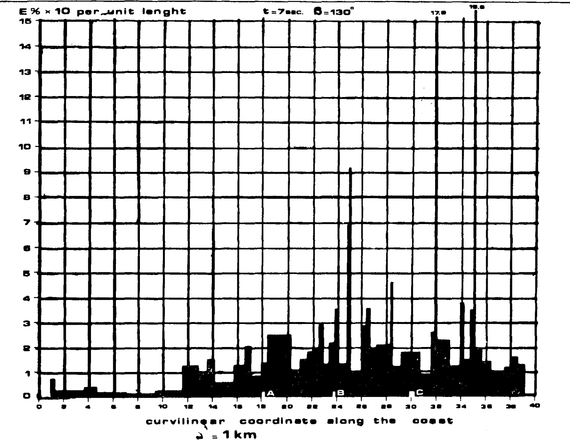

Appendix

Telemeasuring system for wind waves by S. Vazzoler and F. Costa

The system is constituted of three essential parts : the sensor, the proper telemeasuring system, the recording system.

1. The sensor is constituted by a resistence variation transducer (wave staff). The wave staff is constructed on a plastic (PVC) jacketed, high strength steel cable vertically suspended, with a spyrally wound resistence NI-CR wire wrapped over its length and imbedded flush with the insulation surface.

Water height, changing along the staff length, causes instantaneous variations in its resistance through the shorting effect of salt water.

2. The telemeasuring system consists of a base station and five remote stations. The base station has a two tones encoding signal generator that can be activated manually from the frontal panel of the apparatus through a pushing button : one of the two simultaneously transmitted tones is common to all the five remote stations, the other is individually selected from canal-switch selector with five positions, also situated on the base station. At each position a particular remote station corresponds.

3. The recording system.

When the selected remote station transmits, at the base station one can set the frequency variation proportional to the wave amplitude. This signal is therefore at disposal for a recording that can be done on different supports, according to the kind of the use of the data one needs.

a. Analogical record, made on the graph paper of an analogical recorder with adjustable ranges and speeds such as to permit an easy reading of the parameter.

b. Digital record, made in numerical form using an electronic counter reading the exit frequency of the base station and driving a digital recorder with a suitable bynary code.

c. Puncher. It can be punched on a 8 bands punched tape (7 bit ASCII) using an electronic counter and puncher with suitable specifications so that the sampling frequency permits a correct data analysis. The last recording system permits the use of the computer HP 2115 A on line with a suitable software, and then the recording a 9 bands digital magnetic tape which can run on the great computers.

4. The choice for analogic transmission system has several reasons :

a. the minimum cost of the system.

b. connected with point (a) it is convenient to transform the analogic data into digital ones at the base station simplifying the system.

c. use is made of a frequency modulation transmission and this guarantees the requested precision in the recorded data.