SEDIMENT TRANSPORT BY WIND WAVE INDUCED CURRENT ALONG THE ADRIATIC COASTLINE

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Abstract

It is known that wind generated waves, while approaching the coast, cause the material of the bottom to move and go into suspension. Moreover, the breaking waves induce a littoral current capable of carrying the suspended material along the coast.

Starting from these basic considerations we have studied the transport of sediments due to waves during the summer and fall of 1978. The attention has been focused on the Adriatic coast from the Po Delta to Cattolica. The section has been divided in several subareas. For each of these the sediment movement has been evaluated daily during the low energy conditions in summer and during fall storms. The daily budget in each area, integrated over the period of study, indicates the coastal evolution and the areas of erosion and accretion depending on the wave prevalent direction.

Résumé

Cette comunication présente l'étude du transport des sediments du fond en proximité de la côte Adriatique entre le delta du Pô et Cattolica. En particulier on a analysé le transport induit par les differentes conditions metéorologique qui se sont passées lors de l'été e de l'automne du 1978. La zone à l'étude a été partagée dans des zones plus petites. Pour chaque des lesquelles on a évalué le deplacement journalier des sediments soit en conditions de calme d'été que de tempête de l'automne. Le balan journalier de chaque petite zone, integré sur toute la périod étudié, a permis de definir les zones dans lesquelles le processus d'érosion ou de sedimentation, dû à la direction prévalente des vagues, est le plus evident.

Wind blowing over the sea causes waves to grow: the longer the time and the stronger the wind, the higher the waves. From the area of generation, traveling across the sea, and approaching the coast, waves begin to feel the presence of the bottom. A number of phenomena arise:

refraction, shoaling, breaking. In particular the movement of water particles close to the bottom causes the upper sediment layers to go into suspension. The volume of sand lifted up is strongly connected with the amount of energy present in the sea. The energy and momentum lost by waves at breaking can be split into two components perpendicular and parallel to the shore. The parallel component is found again in the littoral current produced by the wave breaking. By combining the lift up of sediments and the wave induced littoral current, it is possible to quantify the amount of sand moved along the coast. As a consequence it is possible to identify the zones where the processes of erosion or accretion are more evident.

We have applied the previous principles along the Italian coastline from the Po outlet down to Cattolica to study the transport of sediment in particular sea conditions. Starting with a model for forecasting sea state, we have evaluated the wave conditions at 17 points chosen in the former area. The wave conditions were given as two and mono dimensional spectrum, significant wave height (Fig. 1), main direction and peak frequency.

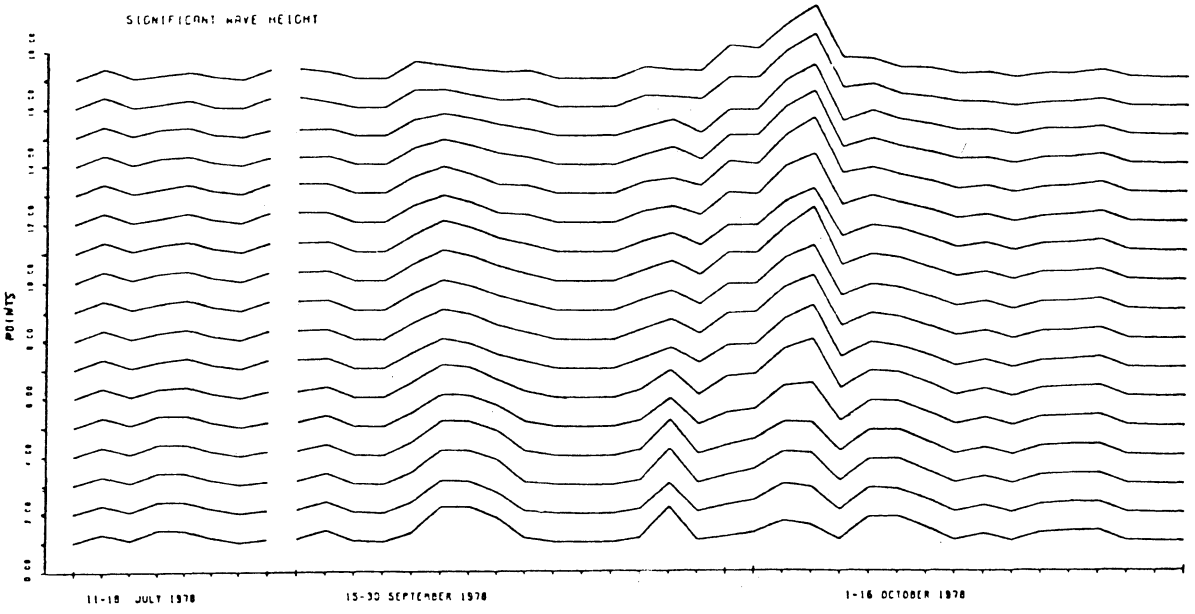

Figure 1

These conditions have been evaluated daily during two months in the summer and fall of 1978. Summer has been chosen because of the particular conditions of low energy, while the beginning of fall 1978 was characterized by a series of intense storms with different directions of propagation. Knowing the wave conditions, particularly the wave height and main direction, it has been possible to evaluate the momentum loss due to breaking and the consequent longshore current (Fig. 2).

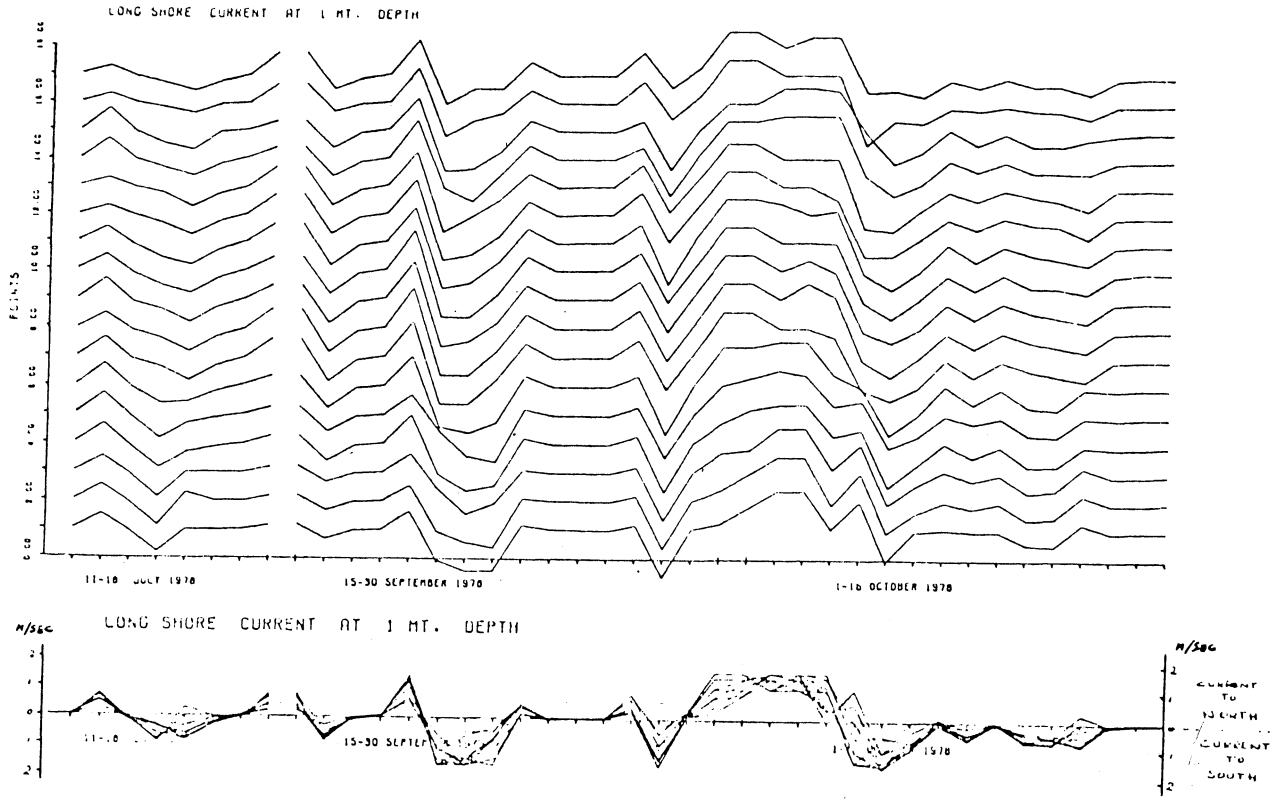

Figure 2

Applying the theory by Komar and Inman, we have evaluated the amount of sediments crossing the section perpendicular at each of the 17 locations. Then we estimated the daily budget of sand transported through each area between two consecutive points. Finally an integration over

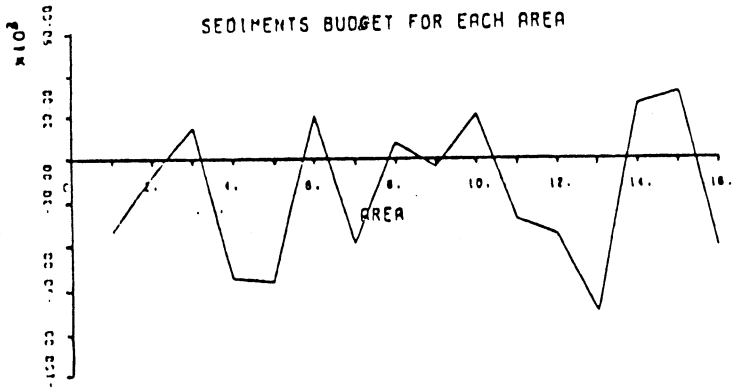

Figure 3

the whole period of study has lead to the determination of the areas of accretion and sedimentation (Fig. 3).