

MARINE METEOROLOGICAL CONSIDERATIONS FOR RATIONAL PLANNING AND MANAGEMENT OF COASTAL RESOURCES

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ABSTRACT

The coastal zone is an area of considerable economic potentials. However, it is the most fragile part of the marine environment and is subjected to many natural and man-made changes. The complex interaction of the different processes and forces that operate or act together in this environment, calls for the consideration of many marine meteorological parameters if there are to be rational planning and managements of the coastal resources.

Various marine meteorological data products, together with up-to-date forecasts on weather and sea conditions, are essential inputs for environmental assessment, monitoring, various coastal constructions and equipment designs. In addition, they serve for the prediction of the possible environmental impacts of human activities in the coastal zone.

The need for an inventory of marine meteorological informations related to coastal development and protection programmes, from the initial setting of plans to their eventual implementation and operation, is reviewed.

In recent years concern for preservation of the coastal ecosystem has caused a reappraisal of the value and resources of this environment. It is hard to underestimate the importance and the economic potentials of the coastal zone. The number of the possible uses of this zone is almost endless. As far as people is concerned the coastal zone is the most important region as about two-thirds of the World's population lives near the coasts. This huge concentration of people presents numerous problems for the coastal zone, which unfortunately is one of the more fragile parts of the marine environment (Clark, 1977).

The coastal zone sits at the interface between the two major environments of the Earth-land and ocean, and is subjected to the action of the atmosphere. The coastal water basin is controlled by different atmospheric, oceanic and terrestrial factors that influence the function of the ecosystem of which the basin is a part.

The most important atmospheric and oceanic forces that influence coastal

ecosystems are prevailing winds and waves, coastal currents, tidal action, surf and surges, persistent coastal upwelling, storms and massive oceanic currents and many other factors that vary from place to place along the coasts of the oceans and seas.

The combined influence of these forces results in the specific pattern of water circulation in the near shore zone and affects their exchange with the more offshore waters. In this manner nutrients, pollutants and any other material carried by rivers or discharged into the sea are eventually distributed offshore (Odum, 1976).

From another point of view, the geological features of the coastal zone are modified over time by dynamic weathering forces including climatic and oceanic forces. Estuaries, lagoons and delta areas, like many other parts of the coastal zone, are really only transient or temporary features. With time they will be destroyed either by cutback or build up of beaches. The most important atmospheric and oceanic factors responsible for erosion and deposition of beaches, as a natural phenomenon, are wind-waves, tides, long shore currents and storms. However, many of the problems of erosion and deposition in the near-shore region come basically from the building of coastal structures. This interferes with circulation of water and sediments and causes increased deposition in some locations and erosion elsewhere. Probably, human activities have had a more profound recent influences on coastal erosion and deposition (Ray, 1975).

Recognizing the economic importance of this zone, which is subjected to man-made and natural changes, many countries have been involved in different research and development programs for the protection of the coastal zone, and for sustainable utilization of its resources. It is to be noted that any preservation strategy of this area depends mainly on the evaluation of the environmental loads induced by the different atmospheric and oceanic forces. Different marine meteorological informations and data products are a prerequisite for estimation of these forces. These data products, together with others, constitute the bases for prediction of the expected changes, and are of primary concern for the protection plan.

Fundamental to any rational planning and management of the coastal resources is the knowledge of:

1. The system's nature; how it works and what is important and unimportant in changing it,
2. The linkages within the system; in order to predict how and why perturbations of one component will influence the other parts, and to evaluate short and long terms; near-in and far-away effects,
3. The extent to which any substance, processes and activity may affect the health of the environment and the various other uses.

A successful achievement of the goals of such programme requires the identification, measurement and analysis of the different parameters and processes that operate or react together in this highly dynamic environment. It should be emphasized that the coastal environment is not a series of isolated phenomena, instead it is a complex and interacting system. This calls for multidisciplinary considerations if there are to be rational resources planning and management. In this respect marine meteorological informations and data products are of vital importance for environmental understanding and monitoring and for coastal

resource assessments. Moreover, they are major inputs for modeling the coastal ecosystem and for the prediction of the possible environmental impact of the different activities. In addition, marine meteorological parameters are used for evaluating the loads induced on the equipments to be used, and for structural designs. As in the case of any maritime-related operations, in the coastal zone various types of technical services are intrinsic for the existing and anticipated activities. One of the most important services to be considered are weather and sea conditions. Up-to-date forecast on weather and sea conditions is of great value for preliminary assessment of operating schedules, for safety of personnel and protection of equipments.

From the above mentioned brief description, the vital need for an inventory of marine meteorological data, informations, and products related to coastal resources planning and management is self evident.

It should be noted that almost any increased use of the coastal zone and the application of new technology will have subsidiary effects. The challenge is to optimize the good, while either eliminate the bad effects or keeping them to a minimum. This cannot be achieved without special and often lengthy research. There are many other reasons to pursue genis research; these include the need for improvement of the existing tools, procedures and services needed for rational management and sustainable utilization of the coastal resources. A solid background of scientific knowledge and experience is needed in order to predict the future effects and to understand, as best as possible, the ramifications throughout the coastal environment of what ever action is taken.

Unfortunately such needs and understandings are not presently available for many countries. In most developing countries exploration and exploitation operations does not match in size the efforts being expended, and most utilization of the coastal resources is not sustainable (USAID, 1979).

In many developing countries there is an urgent need to review the technology and technical services required for the orderly development of any coastal activity and the adopted methodologies for determining the possible environmental impact of such activities.

A major constraint on the implementation of coastal development projects is the lack of the necessary environmental information base. It is to be stressed that actions based on inadequate knowledge of the coastal environment carry a grave risk.

The deficiency of representative data and adequate informations is attributed, mainly, either to the weakness of the data gathering capabilities and/or the lack of coordination among the various governmental agencies.

With respect to weather and sea condition services the situation, in most developing countries, is by no means satisfactory. These services should be involved with the establishment of networks in the coastal area for measuring the different marine physical and meteorological parameters required for assessment of the characteristics of the coastal environment. The existing coastal stations should extend their capabilities to meet these needs. The methods of data collection, processing, transmission, retrieval and distribution should be improved.

Another factor which may restrict the value of the available informations is the

lack of a coordinating mechanism, which integrates the efforts expanded by different scientific, technical and management authorities. To bridge gaps and to reduce duplications there are a definite need to establish a focal point for comprehensive data and information referral system (data and information services for coastal resources management). These services must be charged with acquiring, processing the different data from originators, and compiling them in forms useful to both management specialists and users community. In such way the most urgently required knowledge for rational planning and management of the coastal resources are generated more quickly.

In fact knowledgeable management of coastal resources, in its broadest sense, cannot be enhanced without strengthening our knowledge about the dynamic interrelationships that characterise this environment and its complexity.

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