CHAPTER 1
INTRODUCTION

Information on wave climate is of paramount importance for the planning and execution of ocean engineering projects and for the proper management of the coastal zone. The morphodynamics of the littoral zone is controlled by the wave climate, as waves are the principal source of input energy into this zone (Komar, 1976). To design various structures and plan their construction a clear picture of the maximum wave forcing and wave climate should be available. There is a fairly sharp optimum cost of design for coastal structures (Fig. 1.1). Without a fairly good estimate of wave conditions, it would be nearly impossible to come close to this optimum and the cost would unnecessarily increase (Ploeg, 1968). Since most of the coastal or marine structures are designed for a long life time, long-term wave data is essential to account for the variability of waves during their life time. Of late, the wave data requirements have gone up further as ocean waves have been accepted as a potential alternate renewable source of electrical energy.

Three different methods are being followed at present for obtaining information on waves:

(i) The ship-based visual observations have been a major source of wave information till recently. This method
DESIGN CRITERION

Fig. 1.1 Schematic relationship between Cost and Design Criteria of marine structures

(after Ploeg, 1968)
has the limitations owing to the inaccuracies inherent in visual observations and uncertainties in the schedule of observations. As ships generally avoid storms, the wave climate derived through this method will not represent rough sea conditions.

(ii) Another source of wave data is wave hindcasting, which is done by making use of pressure/wind data obtained from weather stations and ship observations. The accuracy of such a hindcast/forecast depends on the density of data points and the models employed.

(iii) The third source of wave information is recorded wave data, which is the most reliable one. For the measurement of waves different types of surface, subsurface and above surface wave recording systems are used.

The recorded wave data, though most reliable, has the main constraint of being very expensive. Generally, the wave recording is made in deep water to represent a given coast. However, for coastal engineering applications shallow water data is required. Unlike the deep water wave climate, the shallow water wave climate exhibits much spatial variations (Baba et al., 1987). For coastal engineering applications the deep water data is reduced to shallow water conditions using some presently available computational methods, which are sometimes felt to be insufficient for obtaining reliable...
design wave parameters. Hence, the wave recordings are to be made at different coastal points to obtain a reliable picture. The recording of waves at each and every coastal point will be exorbitantly expensive in view of the man power and facilities required.

The above problem can be solved in a cost-effective manner by improving the computational methods so that they can reliably predict the shallow water waves from a knowledge of the deep water wave data. This deep water wave data input may be instrumentally recorded data or ship observations or hindcast data, depending on the level of accuracy desired. This method of approach is particularly advisable, when coastal wave data over an extensive area for a long duration is required.

Thus the problem is essentially one of understanding the wave transformation processes at the coastal area of interest and formulation of suitable numerical models for the prediction of wave transformation. There has been a thrust on the development of wave transformation models which can compute the shallow water wave parameters with reasonable accuracy and many models are available in literature (Dobson, 1967; Coleman and Wright, 1971; Treloar, 1986 etc.). An essential pre-condition in the applicability of such models is their evaluation in the field and their
further modifications based on it. The number of such field verifications is comparatively few when compared to the number of models available.

Evaluation of the available models in the coastal waters of Kerala or other parts of Indian coasts is very much lacking. Similarly, studies on wave transformation based on synchronised wave measurements in deep and shallow waters are not reported. Such studies are essential in arriving at wave transformation models suitable for our coasts.

This thesis embodies results of investigation carried out with the following objectives:

(i) A study of the wave transformation along the Kerala coast by making synchronised measurements of deep and shallow water waves.

(ii) A study of the applicability of a few numerical models for prediction of shallow water wave heights and wave spectra off the Kerala Coast and incorporation of necessary modifications wherever required.

(iii) Suggestion of suitable shallow water wave prediction models based on the evaluation with measured wave data.

Since the accuracy of predicted wave directions by different models have been validated in real world
situations (Bryant, 1979), the present investigation concentrates on the transformation of wave height and spectra only.