WAVE CLIMATE OFF VALIATHURA, TRIVANDRUM

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ABSTRACT

Continuous wave data collected off Valiathura (Trivandrum) is presented in the form of percentage exceedance of significant wave height ($H_s$), percentage occurrence of zero crossing period ($T_z$), scatter diagram of $H_s$ and $T_z$ and percentage occurrence of spectral width parameter $\xi$. Daily maximum $H_s$ ranged from 0.4 to 4.2 m and the period between 5 and 15 sec. Spectral width parameter varied between 0.6 and 1.0. Limitations in the use of this parameter are outlined. The wave climate data is grouped into rough season (May to October) and fair weather season (November to April).

Key-words: Wave climate, Trivandrum Coast.

INTRODUCTION

Even though extensive measured wave data is available for most of the oceans and seas, the data available for the seas around India is still scanty. For the west coast of India, wave measurements are reported by Dattatri (1973); Sundararamam, Varkey, Vijayarajan, John and Joseph (1974); Swamy, Varma, Pylee, Raju and Chandramohan (1979); Das, Varkey and Raju (1979); Gadre and Kanetkar (1981). However, wave data based on a continuous year round measurement has been reported only off Mangalore in the first two works cited above. Considering this limitation an attempt was made to measure year round continuous wave data off Valiathura on the south-west coast of India (Fig. 1) during 1981. The distribution of the different wave parameters are reported herein. An attempt to group the wave climate using the distributions of the basic wave parameters is also made.

MATERIALS AND METHODS

Wave records were collected using a pressure sensor fixed at seaward end of the pier at Valiathura (Sivadas, 1981 and Baba, Kurian, Thomas, Hameed, Prasannakumar and Harish, 1983). The average water depth at the point of installation was 5.5 m and the transducer remained at 3 m below the mean water level. Records of 15 to 30 min duration at 0600, 0900, 1200, 1500 and 1800 hrs were taken daily. A total of 577 such records were used for the present study. Pressure attenuation correction was applied to wave heights following Dattatri (1973). The analysis and presentation of the wave data was done as recommended by Tucker (1963), Draper (1966) and Silvester (1974). Wave direction was observed at the end of the pier using a Brunton compass.

The wave measurements were temporarily stopped in mid-June due to high breakers (upto 6 m), which occurred for about three days damaging the
recording system. During the non-recording period from 13th June to 26th August and 15th September to 12th October visual observations were made. For this, corresponding to each recording interval 33 higher waves occurring during a 10–15 min interval at the point of installation were measured using a lead weight and a graduated rope and their average value was calculated. The average period of 10 successive waves was taken as the representative period. A comparison of visual observations with simultaneous recorded information showed satisfactory correlation between the two (Fig. 2). Some departure of the visual values for higher wave heights may be due to the limitations in their estimation and the scatter in the case of periods may be due to the difference in the number of waves considered in the visual and recorded data. One hundred and ninety-six such visual observations were made covering the

![Fig. 2. Comparison of visual and recorded wave heights and periods.](image)
entire non-recording period and the representative height and period were estimated in the above described manner.

Thus the results of a total of 773 individual observations covering a complete year are reported in this paper.

RESULTS AND DISCUSSION

Monthly variations in the wave climate: The waves were generally high from May to October while they were low during the rest of the year (Fig. 3). During November to April the maximum $H_s$ was 2.8 m, which was in December. From January to March the $H_s$ did not exceed 1.5 m. During December and April only 20 to 25% of the time the value of $H_s$ exceeded 1.5 m. From May to October the significant wave heights were always > 1 m and the highest $H_s$ (4.2 m) was recorded in June. A decrease in wave height was observed in July when only 27% were above 2 m. During August-October, for 50% of the time the wave height exceeded 2 m.

The percentage occurrence of zero-crossing periods ($T_z$) is given in Fig. 4. Waves with $T_z$ of 6-9 sec were predominant during April, May and June. A shift towards higher $T_z$ was noticed since August with the approach of long swells. Waves with $T_z > 10$ sec were predominant during February, October and December.

The scatter diagrams with wave steepness curves (calculated for the depth of recording, as per report Anon, 1977) superimposed on them are presented in Fig. 5. Waves with very low steepness values were observed during January-March and November-December. There was a slight increase in the steepness value in April. From then onwards the waves were becoming steeper and by June with the onset of south-west monsoon very high waves with periods around 9 sec were observed. During this month the steepness ranged

![Figure 3. Monthly percentage exceedance of $H_s$.]
between 0.03 and 0.07. Some of the highest waves were breaking at the observation point. From July to October the steepness ranged between 0.03 and 0.05 when longer swell waves were observed.

For the entire period of one year the value of the spectral width parameter varied between 0.6 and 1.0 (Fig. 6). The higher values normally indicate the dominance of sea or storm waves. These do not correspond to the picture revealed from the scatter diagram (Fig. 5), where periodic dominance of sea and swell waves were noticeable. This may be due to the dependence of the spectral width parameter on the type of depth of installation of the recorder (Harris, 1972) and also may be on its sensitivity. Also Holmes (1982) reports that in general for all sensitive records along the coastal waters, irrespective of the type of recorder, the value of the spectral width parameter generally falls between 0.7 and 1.0. And hence this parameter cannot give any additional information regarding the wide or narrow bandedness of the spectra or sea and swell dominance in the present case. Similar observations have been made by various authors (Goda, 1974; Holmes, 1982) for other coasts in different climatic regions.

During the monsoon period, particularly between May and August, the predominant nearshore wave direction was between WSW and WNW with a few exceptions when the waves were from SW. During September-May the predominant nearshore wave direction was between S and SW.

**Grouping of wave climate**: The wave climate of the west coast of India has been divided into monsoon and fair weather by different workers. Dattatri
Fig. 5. Monthly scatter diagrams of $H_s$ and $T_z$.

Fig. 6. Monthly percentage occurrence of spectral width parameter.
Fig. 7. Rough and fair weather wave climate grouping (A) percentage exceedance of $H_S$, (B) percentage occurrence of $T_z$, (C) scatter diagram of $H_S$ and $T_z$.

(1973) included June–September under monsoon and the rest of the year under fair weather season. Sundaramam, Varkey, Vijayarajan, John and Joseph (1974) observed a very narrow spectrum during November to April and a wider spectrum for the rest of the year. Swamy, Varma, Pylee, Raju and Chandramohan (1979) observed a spectrum of narrow band (10-13 sec.) and high energy ($H_S$ exceeding 1 m) from May to September. Summarising all the wave data available for the Lakshadweep Sea and the west coast of India, Das, Varkey and Raju (1979) reported that the height, period and directional characteristics were largely the same from October to May and similarly from June to September and the transition months appeared to be May and October.

From the present study it is found that the percentage exceedance curves for the significant wave height fall into two groups, viz. November–April and May–October. In the latter group the only exception is June, which
is due to the occurrence of peak monsoon waves during this month. A similar grouping can be observed in the case of $T_z$ also. From the scatter diagram the grouping becomes more evident. While all the periods and the corresponding heights fall within the curves representing steepness of 0.02 and 0.07 for May–October, they occur mainly between 0.01 and 0.02 for the rest of the period. The wave climate data is grouped into the rough season (May to October) and fair weather season (November to April) and presented in Fig. 7.

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REFERENCES


