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Wave statistics around the Indian coast based on ship observed data

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Wave characteristics around the Indian coast are discussed based on the ship reported waves compiled over 19 y (1968-1986). Ship reported wave data have been compared with instrumentally measured waves at 2 locations (Kakinada on the east coast and Bombay High on the west coast). The ship reported waves are slightly higher than the measured waves off Kakinada. At Bombay High, no significant variation is found from May to October, but the ship reported waves are higher than the measured waves during the rest of the year. Waves are higher during the southwest monsoon (June-September) all around the Indian coast, with highest intensity of wave activity occurring off northern part of the west coast, and off southern most part of the peninsular India. Wave activity is consistently high off the peninsular tip throughout the year.

Information on wind waves is extremely important for projects related to coastal and offshore development. Ocean waves are highly random in nature, and longer the duration of observation, more realistic would be the estimation of design parameters such as significant wave heights of 50 or 100 y return period. India, having about 7000 km long coastline, lacks much in long-term data on measured waves. Non-directional time series data on wave heights and periods, measured by wave rider buoys are available for a limited location and duration[1-3]. Knowledge of the directional distribution of waves is essential in assessing the nearshore sediment transport, as well as in identifying the potential sites for wave power plants. In the midst of meagre instrumentally recorded wave data, ship reported waves can form a supporting source, wherein, in addition to wave height and period, wave direction can also be reckoned[4-6]. In the present study, the ship reported waves around the Indian coast have been compiled and the wave statistics of different regions are discussed. The ship reported waves are compared with measured waves at 2 locations to study their reliability for application.

Methods

India Meteorological Department documents the daily sea weather reports over the Indian region are classified as zone II-A by the World Meteorological Organisation (Fig. 1). Sea weather reports contain visual information on the sea and the swell wave characteristics reported separately by the ships passing in the seas around India. Since the sea waves are reported without the information on direction and are very low in number (< 2% of total), they are excluded from the present study, and only the swell wave data are considered. The study region is divided into 10 grids, each of size 5° latitude and 5° longitude (Fig. 1). The Indian Daily Weather Reports[7] published for a period of 19 y (1968-1986) were retrieved and the swell information was compiled. Number of visual wave observations (N) reported for each grid are indicated in Fig. 1. Ship reported data pertain to deep water waves. The visual estimate of wave height and period by a trained observer normally conforms to the significant wave height (H_s) and zero crossing wave period (T_z). The direct use of visually observed wave height as significant wave height is justified for most of the engineering

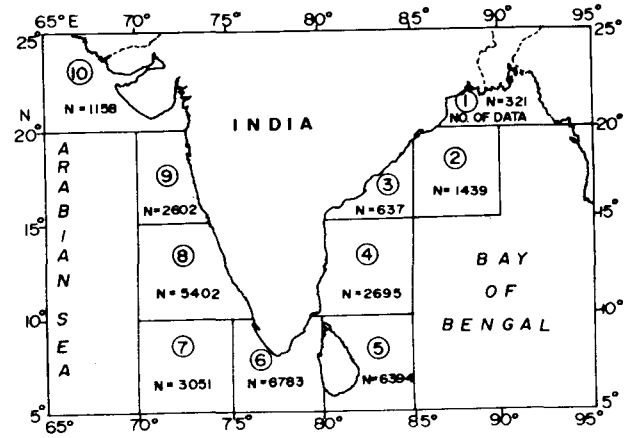

Fig. 1—Location map

applications[8]. In the .present study, ship reported visual wave heights are considered as significant wave height (H_s) and wave periods corresponding to zero crossing wave period (T_z).

For comparison, 1 y wave data measured at 2 locations, using Datawell wave rider buoys from June 1983 to May 1984, were used. Wave measurements made off Kakinada in 90 m water depth and at Bombay High in 70 m water depth were used as the wave data pertaining to grids 3 and 9, respectively. Waves were recorded for 20 min duration at 3 h intervals and each record was analysed for the significant wave height and zero crossing wave period using Tucker's method[9].

Table 1—Variation of wave height and period during different seasons

[A = SW monsoon (June-Sept.), B = NE monsoon (Oct.-Jan.), C = Fair-weather (Feb.-May)]

Grid No	Predominant wave height (m)			Predominant wave period (sec)		
	A	B	C	A	B	C
1	1-3	1	1-2	5-8	5	5-8
2	1-3	1	0.5-1.5	5-8	5-7	5-6
3	1-2.5	1	0.5-1	5-8	5-7	5-6
4	1-2.5	1-1.5	0.5-1	5-8	5-7	5-6
5	1-3	1-2	1-1.5	5-8	5-8	5-8
6	1.5-3	1-1.5	1-1.5	5-8	5-8	5-7
7	1-3	1-1.5	0.5-1.5	5-8	5-7	5-6
8	1-3	1	0.5-1.5	5-8	5-6	5-6
9	1.5-3	1	0.5-1.5	5-8	5-6	5-7
10	1.5-3	0.5-1	0.5-1	5-8	5-6	5-6

Results and Discussion

Monthwise percentage frequency of occurrence of wave height and period were presented in the form of the wave roses earlier[10].

Distribution of wave height—The predominant occurrence of wave heights during different seasons is shown in Table 1. It indicates that the wave characteristics around the Indian coast are governed by the season with persistence of high waves during the SW monsoon period (June-September) and occurrence of consistently low waves during the rest of the year. Wave height is higher all around the Indian coast during SW monsoon indicating dominance of 1-3 m in grids 1, 2, 5, 7 and 8; 1-2.5 m in grids 3 and 4; and 1.5-3 m in grids 6, 9 and 10. A lesser influence can be noticed during the NE monsoon (October-January) with wave heights ranging mostly around 1 m in grids 1, 2, 3, 8 and 9, 0.5-1 m in grid 10; 1-1.5 m in grids, 4, 6 and 7; and 1-2m in grid 5. The fair-weather period (February-May) shows that the most frequent wave heights remain in around 0.5-1.5 m in grids 2, 7, 8 and 9; 0.5-1.0 m in grids 3, 4 and 10; 1-1.5 m in grids 5 and 6 and 1-2 m in grid 1. Waves are comparatively higher throughout the year, off the peninsular tip at Kanya Kumari (grid 6).

Distribution of wave period—Wave periods predominantly vary between 5-8 sec all around the coast during SW monsoon (Table 1). During NE monsoon, predominant wave period is 5 sec in grid 1; 5-6 sec in grids 8, 9 and 10; 5-7 sec in grids 2, 3, 4 and 7; and 5-8 sec in grids 5 and 6. It frequently persisted between 5-6 sec in grids 2, 3, 4, 7, 8 and 10; 5-7 sec in grids 6 and 9; and 5-8 sec in grids 1 and 5 from February to May.

Joint distribution of wave height and period—Joint distribution of wave height and period for 3 seasons for each grid is shown from Tables 2 to 11. The wave power is proportional to H^2T (H = wave height, T = wave period). It is found that in grid 1, from June to August, the wave power is predominantly from the sector between south and southwest. In grids 2 to 4, it is predominantly contributed from the sector between south and southwest from June to August, and from the sector between northeast and southeast from November to February. In grids 5 to 7, the wave power is predominantly from the sector between south and west directions from June to August. From December to February, it is contributed from the sector between north and east. Wave power in grids 8 to 10 is predominantly contributed from the sector between southwest and northwest from June to August. Wave power is higher during the southwest monsoon with the occurrence of about 55% of the annual total wave power in grids 1 to 5 and about 65% in grids 6 to 10. During the northeast monsoon, it is about 15% in grids 6 to 10 and about 25% in grids 1 to 5. The fair-weather period is relatively calm contributing only about 20% of the total wavepower in all grids.

Comparison—The wave rider buoy data off Kakinada show that the wave heights mostly varied between 1 and 2.5 m during May to September, between 0.5 and 1.5 m during October to January and between 0.1 and 1m during February to April. The zero crossing wave periods mostly varied between 5 and 9 seconds during the study period. The wave rider data off Bombay High show that the wave heights mostly varied between 0.1 and 1.5 m in January, 0.5 and 2 m in February, 0.5 and 1 m in March to May and November, 1 and 4 m from July to August, 1 and 2 m in September, and 0.5 and 1.5 m in October and December. The zero crossing wave periods mostly varied between 6 and 9 sec during the study period.

Table 2—Joint distribution of wave height and period at grid 1 for years 1968-1986

Wave height (m)	Wave period (sec)									
	5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 11										
0.5	5	2	1	2	.	.	.	.	.	1
1.0	5	2	1	2	1	2	1	.	.	1
1.5	6		5	5	2	1	1	.	.	.
2.0	3	5	.	3	3	3	2	.	.	2
2.5	1	2	3	2	.	1	.	.	2	1
3.0	1	2	.	1	.	.	.	2	.	.
3.5	1	2	.	.	.	.	.	.	.	.
4.5		1	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 3										
0.5	2	.	1	4	.	.	1	1	.	.
1.0	6	2	3	1	.	2	.	.	1	.
1.5	9	2	2	.	1	.	.	.	2	.
2.0	2	6	4	4	.	.	1	.	1	2
2.5	.	2	1	.	1	.	1	.	.	2
3.0	2	1	4	3	1	.	.	2	.	1
3.5	1	.	.	2	1	2	.	1	.	.
4.0	.	1	.	1	3	2	.	1	1	.
Northeast monsoon (Oct.-Jan.) calm (%) = 17										
0.5	12	2	.	.	.	.	.	.	2	1
1.0	17	2	5	2	3	.	5	.	1	.
1.5	12	2	1	.	3	.	.	2	.	.
2.0	.	.	.	.	.	2	.	.	.	.
2.5	.	.	.	.	.	2	.	1	.	.
3.0	2	2	.	.	1	.	.	.	.	.
4.0	.	.	.	.	.	.	.	.	.	1

Table 3—Joint distribution of wave height and period at grid 2 for years 1968-1986

Wave height (m)	Wave period (sec)									
	5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 6										
0.5	10	3	1	1	1	.	.	1	2	2
1.0	13	4	1	2	1	1	1	.	2	3
1.5	8	3	4	2	1	1	.	1	1	1
2.0	2	3	2	1	.	.	1	1	.	.
2.5	1	2	.	2	.	.	.	.	.	.
3.0	1	1	1	1	.	.	.	.	.	.
3.5	.	.	1	.	.	1	.	.	.	.
4.0	.	.	1	.	.	.	.	.	.	.
4.5	.	.	.	1	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 2										
0.5	2	.	.	1	1	.	1	1	.	.
1.0	4	2	2	2	1	1	.	.	.	1
1.5	5	3	2	3	.	2	.	.	1	1
2.0	5	4	2	2	.	2	1	.	.	.
2.5	.	2	3	5	1	2	.	.	1	1
3.0	1	2	3	5	2	1	1	.	1	.
3.5	.	2	1	2	2	2	.	.	.	1
4.0	.	.	1	1	.	2	.	.	.	.
4.5	.	.	.	1	.	.	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 6										
0.5	10	2	1	.	1	1	.	2	1	1
1.0	12	6	4	2	.	1	1	1	1	2
1.5	8	3	3	2	1	1	.	1	.	1
2.0	2	2	2	.	.	1	.	.	1	1
2.5	1	2	1	1	.	1	.	.	.	1
3.0	1	1	.	.	.	.	.	.	.	1
3.5	1	.	.	1	.	.	.	.	.	.
4.0	.	.	1	.	.	.	.	.	.	1
4.5	.	1	.	1	.	.	.	.	.	.

Table 4—Joint distribution of wave height and period at grid 3 for years 1968-1986

Wave height (m)	Wave period (sec)									
	5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 8										
0.5	10	3	1	.	.	2	1	1	.	2
1.0	18	8	1	.	2	1	1	1	1	3
1.5	6	2	2	1	.	1	.	1	1	.
2.0	3	2	1	2	.	2	1	.	.	2
2.5	1	3	1	2	.	.	.	.	.	.
3.0	.	.	.	1	.	.	.	.	.	.
4.5	.	.	.	.	1	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 4										
0.5	2	.	.	2	.	.	1	1	.	.
1.0	4	2	1	2	2	1	.	2	1	.
1.5	2	3	3	3	1	1	1	.	1	.
2.0	6	5	2	4	1	.	1	1	.	1
2.5	4	4	3	4	.	2	.	.	1	.
3.0	1	1	2	2	1	1	.	.	.	1
3.5	1	.	.	.	1	.	.	.	.	.
4.0	2	.	1	.	.	2	.	.	.	.
4.5	.	.	1	1	.	.	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 8										
0.5	5	3	2	1	.	1	.	1	1	1
1.0	13	6	4	1	.	2	.	2	2	3
1.5	8	3	1	2	.	1	1	.	2	.
2.0	2	2	3	.	.	.	1	.	.	3
2.5	1	1	1	1	1	.	.	.	.	.
3.0	.	1	2	2	.	.	.	.	.	.
4.0	1	1	.	.	.	.	.	.	.	.
4.5	1	.	.	.	.	.	.	.	.	.

Table 5—Joint distribution of wave height and period at grid 4 for years 1968-1986

Wave height (m)	Wave period (sec)									
	5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 8										
0.5	11	3	.	1	.	3	.	1	2	2
1.0	11	5	2	1	1	1	1	2	2	1
1.5	6	4	2	1	.	1	.	1	1	1
2.0	3	3	1	1	1	.	.	1	2	1
2.5	1	2	1	1	.	1	.	.	.	.
3.0	.	1	.	1	1	.	.	.	.	.
3.5	1	1	1	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 2										
0.5	2	1	1	.	.	1	1	1	.	.
1.0	7	4	1	2	.	2	.	1	2	1
1.5	7	4	2	2	1	1	1	1	1	1
2.0	6	5	2	3	1	2	1	.	.	2
2.5	2	3	2	2	.	2	1	.	.	1
3.0	2	2	2	1	1	1	.	.	.	.
3.5	.	.	1	1	1	.	.	.	.	.
4.0	.	.	1	.	.	.	.	.	.	.
4.5	.	.	.	1	.	1	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 5										
0.5	5	1	1	1	.	.	.	1	1	1
1.0	10	3	3	2	.	.	.	1	1	2
1.5	7	6	2	3	.	1	1	.	.	2
2.0	5	5	3	1	1	1	.	.	.	.
2.5	1	2	2	1	1	1	1	.	.	.
3.0	.	1	2	2	.	1	.	.	.	.
3.5	.	1	1	1	.	.	.	.	.	.
4.0	1	1	1	.	.	.	.	.	.	.
4.5	1	1	.	.	.	.	.	.	.	.

Table 6—Joint distribution of wave height and period at grid 5 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 3										
0.5	6	2	1	1	.	1	1	.	2	.
1.0	9	5	3	2	1	2	.	1	1	2
1.5	6	5	4	3	1	1	1	1	1	1
2.0	3	3	3	3	1	.	.	1	1	1
2.5	1	2	1	2	1	1	.	.	.	.
3.0	1	1	1	1	1	.	.	.	.	.
3.5	.	.	1	1	.	.	.	.	.	.
4.0	1	.	.	.	.	.	.	.	.	.
4.5	1	.	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 1										
0.5	1	1	1	.	.	1	.	.	.	.
1.0	3	2	1	1	1	.	.	1	.	1
1.5	5	4	2	2	1	.	1	.	1	1
2.0	6	5	4	4	1	2	1	.	.	1
2.5	3	4	4	3	1	2	1	.	.	1
3.0	2	3	3	2	1	1	1	.	1	.
3.5	1	1	1	1	1	1	.	.	.	.
4.0	1	1	1	1	.	.	.	.	.	.
4.5	.	.	.	1	.	.	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 3										
0.5	3	2	1	1	.	1	.	.	.	1
1.0	9	4	3	1	.	1	.	1	1	2
1.5	7	7	5	3	1	2	1	.	.	1
2.0	5	5	4	3	1	2	1	.	.	.
2.5	1	2	2	2	1	.	1	.	.	.
3.0	1	1	1	1	1	1	.	.	.	.
3.5	.	1	1	.	.	.	.	.	.	.
4.0	1	.	.	.	.	.	.	.	.	.

Table 7—Joint distribution of wave height and period at grid 6 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 5										
0.5	8	2	1	1	1	1	1	.	1	1
1.0	11	5	4	2	1	2	1	1	1	2
1.5	7	5	3	2	1	2	.	1	1	1
2.0	3	3	2	2	1	.	.	1	.	1
2.5	1	1	1	1	.	1	1	.	.	.
3.0	.	.	1	.	1	1	.	.	.	.
3.5	1	.	1	.	.	.	.	.	.	.
4.0	1	.	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 2										
0.5	1	.	.	1	.	1	.	.	.	.
1.0	3	1	1	1	1	1	.	1	.	1
1.5	4	3	2	2	1	1	.	.	.	1
2.0	5	5	4	3	1	2	1	.	.	1
2.5	2	3	2	1	1	1	1	.	.	1
3.0	3	4	3	4	1	1	1	.	.	.
3.5	.	1	1	1	1	.	.	.	.	.
4.0	1	2	1	1	1	1	1	.	.	.
4.5	1	1	2	1	1	1	1	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 5										
0.5	5	1	1	1	.	1	.	1	.	1
1.0	11	4	2	3	1	2	.	1	.	2
1.5	9	6	3	3	2	2	1	.	.	1
2.0	5	4	4	2	.	1	.	.	.	1
2.5	2	2	1	2	1	.	.	.	.	.
3.0	1	1	1	1	.	.	.	.	.	.
3.5	1	1	.	.	.	.	.	.	.	.

Table 8—Joint distribution of wave height and period at grid 7 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 8										
0.5	8	4	1	1	1	2	1	.	1	1
1.0	14	6	2	3	1	2	1	1	.	2
1.5	5	6	3	2	1	1	1	.	.	.
2.0	3	3	2	1	1	1	.	1	.	1
2.5	.	.	1	.	.	1	1	.	.	.
3.0	1	1	.	.	.	.	.	.	.	.
3.5	1	.	.	.	.	.	.	.	.	.
4.0	1	1	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 3										
0.5	1	.	.	1	1	.	.	.	.	.
1.0	2	3	1	2	.	1	.	.	1	1
1.5	3	3	2	2	1	1	.	.	.	1
2.0	5	3	4	3	1	1	1	.	.	1
2.5	2	3	4	2	1	.	.	.	.	.
3.0	3	2	4	2	1	1	2	.	.	.
3.5	.	2	1	1	.	2	1	.	.	.
4.0	1	2	2	2	1	1	.	.	.	.
4.5	1	1	1	2	1	1	1	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 5										
0.5	7	2	2	1	1	1	.	.	1	2
1.0	13	5	3	3	1	2	.	1	1	2
1.5	8	5	3	2	1	.	.	.	1	2
2.0	6	4	2	2	.	1	.	.	.	1
2.5	.	1	1	.	1	1	.	.	.	.
3.0	1	1	1	1	.	.	.	.	.	.
3.5	1	.	.	.	.	.	.	.	.	.

Table 9—Joint distribution of wave height and period at grid 8 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 6										
0.5	10	3	1	1	1	.	1	1	1	1
1.0	17	6	4	3	1	1	1	1	1	3
1.5	7	5	3	2	1	1	.	1	.	1
2.0	3	3	1	2	1	.	.	.	.	.
2.5		1	1	1	.	.	.	.	.	.
3.0	1	1	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 1										
0.5	2	1	.	1	1	.	.	.	.	.
1.0	4	3	1	2	.	1	1	.	.	1
1.5	4	3	2	2	1	1	.	.	.	1
2.0	4	5	4	3	1	1	1	.	.	1
2.5	2	3	3	2	1	.	.	.	.	.
3.0	2	3	3	4	1	1	1	.	.	.
3.5	1	2	2	2	1	1	1	.	.	.
4.0	1	1	1	2	2	1	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 6										
0.5	10	3	1	1	1	1	2	.	1	3
1.0	17	7	3	3	1	1	1	1	1	3
1.5	6	6	3	2	1	.	1	.	1	.
2.0	3	2	2	1	1	.	.	.	.	.
2.5	1	1	1	.	.	.	.	.	.	.
3.0	1	.	.	.	.	.	.	.	.	.

Table 10—Joint distribution of wave height and period at grid 9 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 6										
0.5	13	1	1	.	1	.	.	1	2	1
1.0	15	7	3	1	.	1	.	2	1	2
1.5	12	5	3	1	1	1	.	1	.	.
2.0	4	3	3	1	1	.	.	.	.	.
2.5	.	1	1	1	.	.	.	.	.	.
3.0	1	1	.	.	.	.	.	.	.	.
3.5	1	.	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 2										
0.5	2	1	1	1	1	1	.	.	.	.
1.0	3	2	1	1	.	.	.	.	1	1
1.5	4	2	3	1	1	.	1	.	.	1
2.0	3	3	3	3	1	1	1	.	.	1
2.5	2	3	2	3	1	1	1	.	.	.
3.0	1	4	4	3	2	1	1	.	.	.
3.5	1	1	1	2	1	1	1	1	.	.
4.0	.	2	2	2	1	2	.	.	.	.
4.5	1	.	1	2	1	1	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 10										
0.5	11	4	2	1	1	.	1	.	1	2
1.0	19	5	3	1	.	1	.	1	1	3
1.5	9	4	2	2	1	.	.	.	.	2
2.0	4	2	1	1	1	.	.	.	.	.
2.5	.	1	1	1	.	.	.	.	.	.
3.0	1	.	.	.	.	.	.	.	.	.

Table 11—Joint distribution of wave height and period at grid 10 for years 1968-1986

Wave height (m)	Wave period (sec) 5	6	7	8	9	10	11	12	13	14
Fair-weather (Feb.-May) calm (%) = 9										
0.5	14	2	1	1	.	1	.	1	1	2
1.0	15	5	3	1	.	1	.	1	1	1
1.5	9	4	2	1	.	.	.	.	1	1
2.0	5	1	1	1	1	.	.	.	.	1
2.5	3	1	1	1	.	.	.	.	.	.
3.0	1	1	.	.	.	.	.	.	.	.
3.5	1	.	.	.	.	.	.	.	1	.
4.0	1	.	.	.	.	.	.	.	.	.
4.5	1	.	.	.	.	.	.	.	.	.
Southwest monsoon (June-Sept.) calm (%) = 1										
0.5	1	2	1	.	.	.	.	.	.	.
1.0	3	3	2	.	.	.	.	1	1	1
1.5	6	3	3	2	.	.	1	1	.	2
2.0	2	5	3	3	2	1	1	.	.	1
2.5	3	5	1	2	2	1	.	.	.	.
3.0	3	3	3	4	1	1	1	.	.	.
3.5	.	2	1	2	.	1	2	1	.	.
4.0	1	1	.	1	2	.	.	.	.	.
4.5	.	1	1	.	.	.	.	.	.	.
Northeast monsoon (Oct.-Jan.) calm (%) = 5										
0.5	20	3	1	2	1	1	1	.	1	2
1.0	16	4	2	2	2	.	.	2	1	3
1.5	9	2	2	1	.	.	.	1	1	1
2.0	2	1	1	1	.	.	.	.	.	.
2.5	1	1	1	1	.	.	1	.	.	.
3.5	1	.	1	.	.	.	.	.	.	.
4.5	.	.	.	1	.	.	.	.	.	.

The histograms representing monthly the percentage distribution of significant wave heights measured off Kakinada and the ship reported waves of grid 3 (Fig. 2) show that, though the distribution of wave height over the months are identical, the ship reported waves tend to fall slightly on higher range of wave heights. Similar histograms (Fig. 3) for Bombay High show no significant variation in the wave

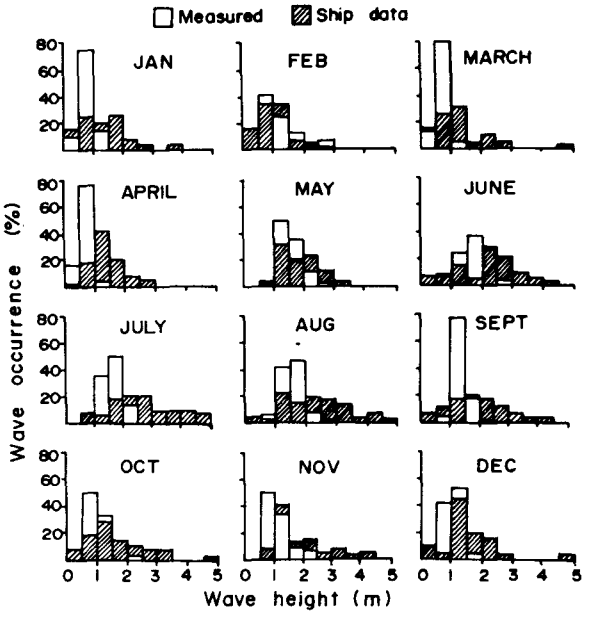

Fig. 2—Comparison of ship reported waves of grid 3 and the measured waves off Kakinada

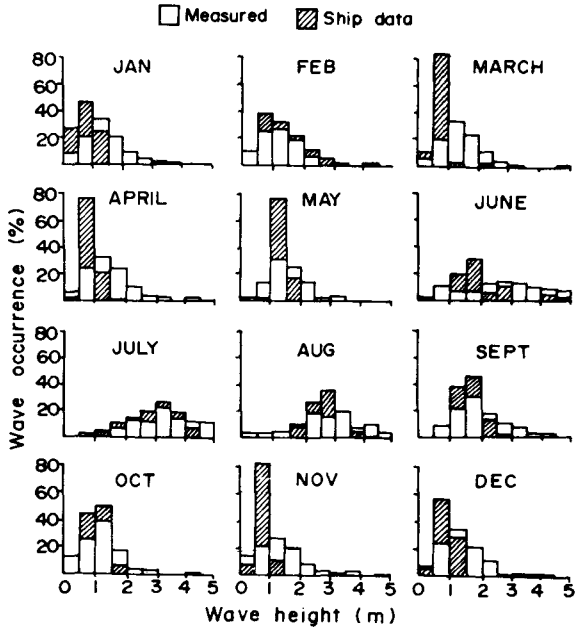

Fig. 3—Comparison of ship reported waves of grid 9 and the measured waves at Bombay High

heights from May to October, but the ship reported waves are slightly higher than the measured waves during the rest of the year.

While assessing such comparison, it is to be borne in mind that the ship data are treated as the deep water waves, whereas the waves measured off Kakinada and at Bomaby High are at depths of 90 and 70 m respectively. It means only the waves propagating towards the coast will be recorded at these depths. No cyclone or severe storms occurred during the period of instrumental wave measurement, which is otherwise common in these regions. As the ships tend to avoid the areas of foul weather, the ship data are liable to be biased over fair weather.

As the information on instrumentally measured wave data around the Indian coast is very limited, the ship observed data compiled for a longer period could advantageously be used for coastal engineering studies. Further, the ship reported wave data provide a very useful source of the directional wave information.

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