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Swell observations on Soviet research vessels during Monsoon Experiment (Monex) 1977: Part III — Bay of Bengal

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सार — बंगाल की खाड़ी में अगस्त 1977 में मानेक्स–77 के प्रयोगों की तृतीय अवस्था में सोवियत अनुसंधान पोत द्वारा एकत्रित महातरंग प्रेक्षणों का विश्लेषण किया गया है। समय एवं आकाशीय चरों का अध्ययन किया गया है। तथा ऊर्जा स्पैक्ट्रम (वर्णक्रम) का परिकलन किया है। बंगाल की खाड़ी में महातरंगों में कुछ लक्षण, अरब सागर में प्रेक्षित महातरंगों के लक्षणों से विपरीत पाए गए।

ABSTRACT. The swell observations collected on board the Soviet research vessels during the third phase of Monex 77 expeditions over Bay of Bengal in August 1977 have been analysed. Time and space variations have been studied and the energy spectra derived. Some of the swell characteristics were found to be in contrast to what have been observed over Arabian Sea.

1. Introduction

In the earlier contribution under two parts the analysis of swell observations taken on board Soviet research ships during Monsoon Experiment 1977 over the equatorial region and Arabian Sea was presented. The observations were collected in three phases. The first two phases were to study the onset and wellset conditions of monsoon over Arabian Sea while the third phase was to study the conditions during monsoon over the Bay of Bengal in August 1977. The swell observations collected in third phase were analysed and the results are presented here.

Mukherjee and Sivaramarkrishnan (1978) found that the swell characteristics in Arabian Sea during monsoon are more steady. Four idealised patterns from which the swells over Arabian Sea can be derived for any day were also given after the study (Mukherjee and Sivaramakrishnan 1980). Hence it is of interest to see the behaviour of swells over the Bay of Bengal during monsoon.

2. Data

Four ships *Okean, Pribhoy, Sokalsky* and *Academic Shirshov* moved from about Lat. 5 deg. N towards north during 7 to 11 August. They formed a polygon (Fig. 1) and remained stationary in the position during 11 to 19 August. Subsequently they were moving in head Bay (north of Lat. 20 deg. N) for two days and then dispersed out. Data collected during 7th to 11th was used to investigate any latitudinal variation present. One ship (*UMAY*) was moving along Long. 91 deg. E, one (*UNAC*) along Long. 87 deg. E and two along Long. 89 deg. E. A preliminary analysis established that there was no longitudinal variation at all within the interval of 4 degrees on any day. The data collected from the polygonal position were used to see the time variation and the general characteristics for swells for the central Bay.

3. Synoptic situation

During 7th to 11th monsoon was generally moderate to strong in the whole Bay. Monsoon was moderate in the Bay to the north of Lat.

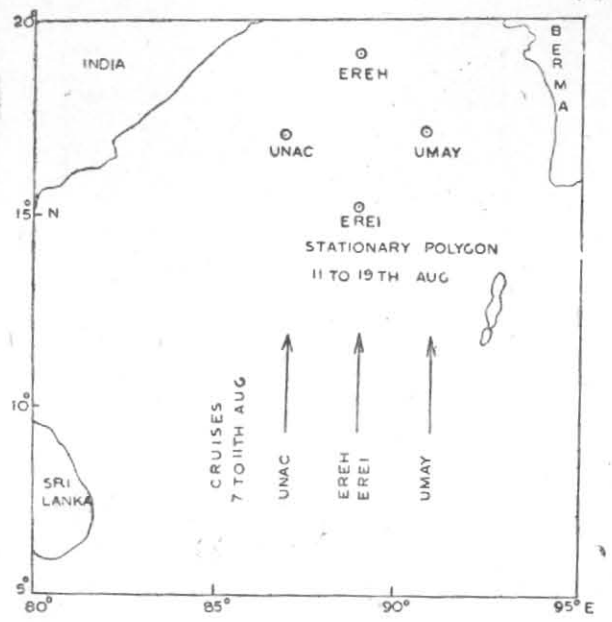

Fig. 1

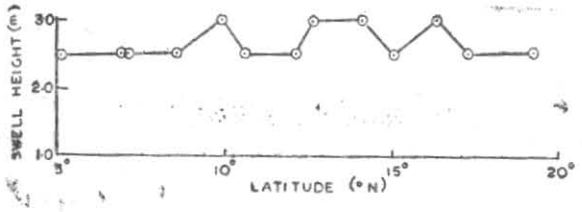

Fig. 2. Height of swells in Bay of Bengal

14 deg. N during 12 to 17 August. A trough of low pressure lay over northeast Bay on 18 August and became a depression on 19th morning with centre near about Lat. 19.5 deg. N/Long. 91 deg. E. This became deep depression with centre at Lat. 19 deg. N/Long. 89 deg. E at 03 GMT of 20th. Moving west it crossed Orissa coast by 21st evening.

4. Results and discussion

4.1. *Space variation*

Fig. 2 gives the swell heights observed at different latitudes. As there was no appreciable change in monsoon activity between Lat. 7 deg. N and 20 deg. N during these five days, the values may be taken to represent space variation. It can be seen that there is no space variation practically. The values were 3 ± 0.5 metres. The periods observed were mostly 7 or 8 seconds and occasionally 11 seconds. The directions observed were 200 or 210 deg. upto about Lat. 10 deg N. The same was 240/250 deg. to the north of it. Thus there is a southerly component effect in south Bay (Bay upto about 10 deg. N) which vanishes to the north of it in central Bay.

4.2. *Data from stationary polygon position*

The data collected by the ships from the stationary polygon position were analysed. The height of swell was about 3 ± 0.5 metres during 11 to 18 August 1977. The average of swell heights observed on 19 August was 4 m. As said earlier the formation of a depression in head

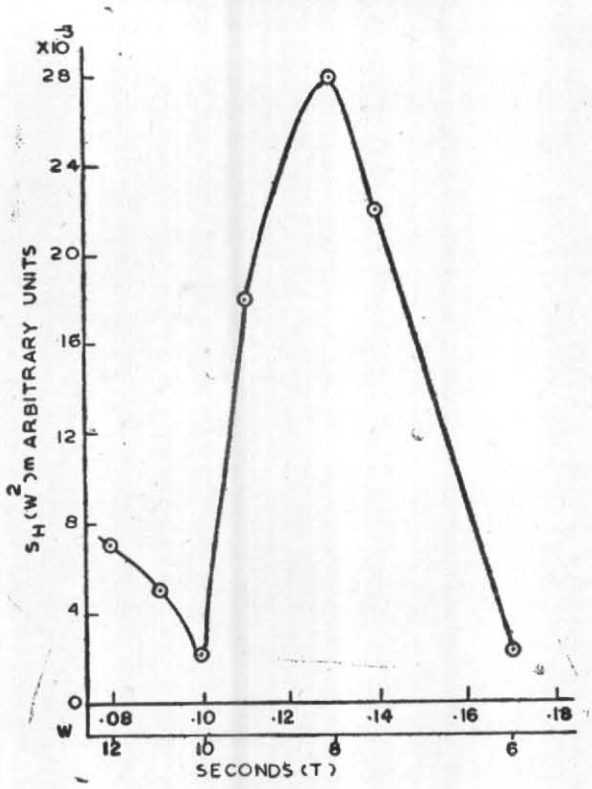

Fig. 3. Energy spectra

Bay may be the cause for this increase in height [The average swell height reported on 12 - 19 August 1977 at stationary polygon were 2.5, 2.8, 3.3, 3.3, 3.5, 3.3, 3.3 and 4.0 m respectively].

Coming to the direction of swells, on 75 per cent of occasions it was southwesterly (210 deg. to 240 deg.) while the rest was southerly. The significant point to note is the complete absence of directions other than south and southwest. The percentage steadiness for swells worked out to be 94 per cent while that for the wind was 99 per cent. The swells over Arabian Sea have greater percentage steadiness than winds (Sivaramakrishnan 1978).

4.3. *Energy spectra*

Following Breitschneider, the energy spectra for the swell observation from stationary polygon position was computed. Accordingly

$$S_H(w^2) = H^2(T)/N\,\bar{H}^2\,(T^2/2\pi)$$

where,

$H^2(T)$=Sum of squares of wave height corresponding to particular period 'T'.

$\bar{H}^2$=Mean square height of all observations

N=Total number of observations.

Fig. 3 presents the picture. A strong peak is seen at 8 seconds period. In fact in about 30 per cent of total occasions this period was observed.

4.4. *Swells in Head Bay*

As we rarely use to get observations from head Bay about swell, observations collected during 20, 21 and 22 August between Long. 88 to 91 deg. E and at Lat. 20/21 deg. N were analysed. The average height observed was 3.8 metres and the period was 7 or 8 seconds. While southeasterly swells formed about 37 per cent, easterlies formed 43 per cent and the rest directions constituted 20 per cent. But it must be remembered here that the effect of monsoon depression during 19th to 21st might have had a great influence on these swells.

5. Conclusions

There does not seem to be any appreciable latitudinal variation in swell heights in the Bay of Bengal between Lats. 7 deg. and 20 deg. N. In central Bay southwesterly swells formed 75 per cent of total observations. The southerly component in swells is more in south Bay (Bay upto Lat. 10 deg. N). The percentage steadiness of swells is a little less than that for surface winds which is in contrast to what has been observed for Arabian Sea. The energy spectra shows a peak at 8 seconds period.

References

Mukherjee, A. K. and Sivaramakrishan, T. R., 1978, Proc. of EMPIO Symp. NPOL, Cochin.

Mukherjee, A. K. and Sivaramakrishnan, T. R., 1980, Prepubl. Sci. Rep. No. 1/1980. India Met. Dep.

Sivaramakrishnan, T. R., 1978, Ph. D. Thesis (Physics), Bombay University.