

## Microseisms associated with the intense cyclone in the Bay of Bengal during September 1959

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**ABSTRACT.** The East-West component microseisms recorded at the Indian Naval Physical Laboratory, Cochin during the September 1959 cyclone in the Bay of Bengal, have been studied. A new technique of analysing the data using the band-pass filter has been adopted. This method makes it possible to separate out the local short-period microseisms and distant storm microseisms. Intensity of 2-5 seconds microseisms shows good correlation with the formation, intensification and movement of the cyclone.

The three-component microseismic station at the Indian Naval Physical Laboratory has been in operation for the past three years, and more or less continuous data are available during this period. But there has always been a predominance of short-period microseisms (below 2 seconds) which have usually masked the longer period waves of weaker intensity. A preliminary study of data collected so far points out that the short-period microseisms are of purely local origin and there is strong reason to suspect that local winds are responsible for their generation.

The seismographs were reset recently and tuned to 5 seconds natural period with a view to increasing their sensitivity for longer period storm microseisms. A detailed recalibration of the instruments is in progress.

This modification has already borne fruit as evidenced by the microseisms recorded during the September cyclone in the Bay of Bengal. The local winds were also in the region of 10-15 knots and the recorded microseisms appeared to be a mixture of long- and short-periods (Fig. 1). It was felt that this was due to a combination of distant

and local effects. It is obvious that the conventional method of visual estimation of amplitudes from the records is not suitable for separating the microseisms of two causes. Hence a filtering technique was adopted.

A Krohn-Hite band-pass filter was connected to the output of the electronic amplifier of the seismograph and the filtered signal recorded. The filter was set to ranges 1-2, 2-3, 3-4 and 4-5 seconds. Five minutes recording was done for each setting of the filter and the amplitude estimated by averaging all the highest waves in every centimetre of the record (The recording speed was 1.4 mm sec<sup>-1</sup>). The sampling was done once every day at 1400 hrs during the active period. The sudden rise in microseismic activity associated with the storm came as quite a surprise, while the instrument was in the process of being reset and recalibrated. Hence it was not possible to analyse all the three components. Only the East-West component has been studied for the full duration of the storm.

The results are plotted in Fig. 2. In Fig. 2(a) is shown the spectrum and in Fig. 2(b) the amplitude of each band



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Fig. 1. Sample microseismic record (E-W Component) taken on 29 September 1959 at 2230 IST

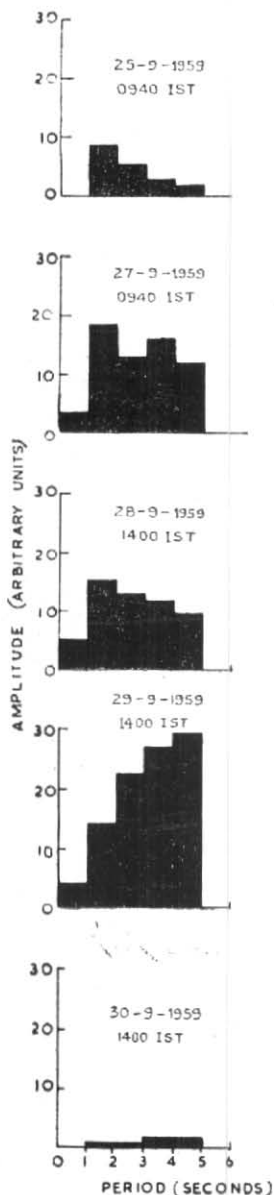


Fig. 2(a)

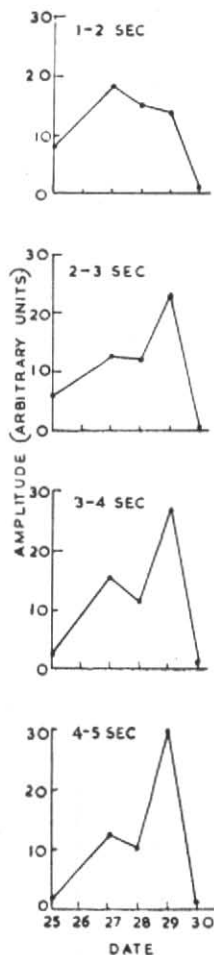


Fig. 2(b)

plotted with time (No correction has been applied for the response characteristics of the seismograph).

It is seen that a general rise in microseismic activity has been noticed from 25 September 1959. This coincides with the beginning of unsettled conditions in the Bay. A very steep rise in the 2-3, 3-4 and 4-5 seconds bands has been noticed from 28 September onwards. In Fig. 3 is shown the synoptic situation at 0830 hrs from this date. It is clear that the increased activity could be attributed to the intensification of the depression into an intense cyclonic storm. It may be seen that the 1-2 second microseisms do not show such rise, giving further evidence as to their local origin. The microseismic activity decreases sharply from 1400 hrs on 29 September and is almost background by 1400 hrs on 30 September. It is seen from Fig. 3 that between 0830 hrs of 30 September and 0830 hrs of 1 October, the cyclone has crossed over to the coast and started weakening, showing good correlation with the recorded microseismic activity.

Thus it is seen, that properly tackled, microseismic data could give valuable information regarding formation, intensification and movement of oceanic storms.

Incidentally these observations also demonstrate the sudden increase in microseismic amplitudes when the circular winds of the storm reach shallow water (high intensity on 29 September) as predicted by the theory recently advanced by J.N. Nanda and communicated to the next General Assembly of the IUGG.

(a) Microseismic spectra

(b) Variation of amplitude with time for various period bands

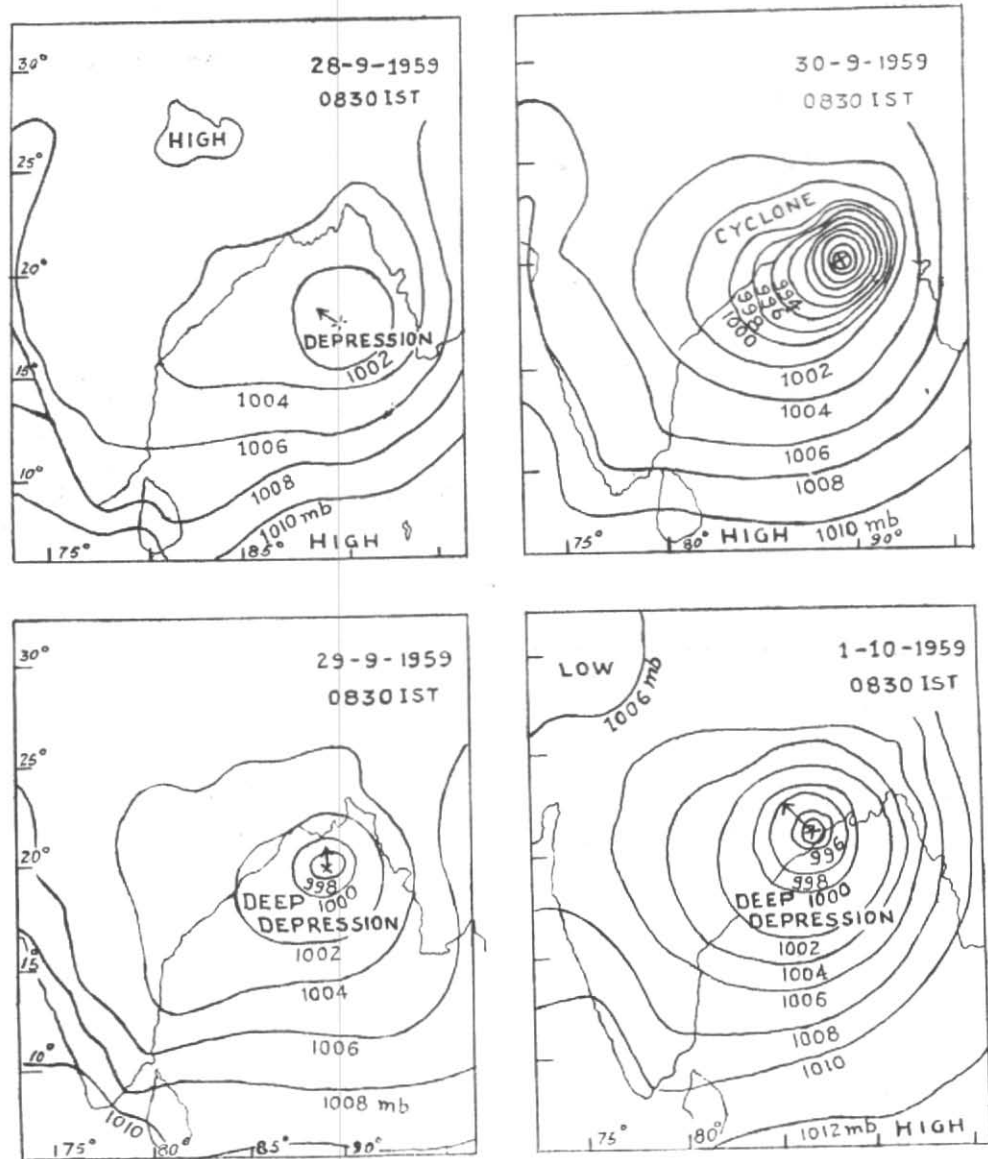


Fig. 3. Synoptic situation on 28, 29, 30 September and on 1 October 1959 at 0830 IST