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Letters to the Editor

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THE INTENSITY OF THE ANDHRA CYCLONE OF 1977

In a recent article Pant *et al.* (1980), while discussing about the intensity of the Andhra cyclone of 14-20 November 1977, concluded that the 'pressure departure from normal at the storm centre works out to be *minus* 65 mb' and that the maximum wind in association with the storm was 125 kt. The reasons cited by the authors for the above conclusions are that the estimated maximum wind speed as derived from satellite pictures on 18 and 19 November by the U.S. National Environmental Satellite Centre at Washington D.C. and the Joint Typhoon Warning Centre at Guam are 140 kt and 115 kt respectively. From these the authors arrived at the magnitude of maximum wind speed of 125 kt (an approximate mean of the above two figures) and the lowest pressure of 943 mb at the centre of the storm (on the basis of Fletcher's formula). The purpose of the present note is to examine the intensity of the cyclone based on observational evidence and on published literature and to find out the maximum pressure drop (one of the most important parameters for determining the intensity of a cyclone) in this case.

2. Mishra *et al.* (1979) showed that the intensity of the Andhra cyclone was T6 at 0350 GMT on 17 November, T7 at 0306 GMT on 18th and again T7 in the morning as well as evening on 19th. Thus the cyclone was progressively intensifying between 17th and 18th and retained its intensity (T7) till 19th evening when it crossed the Andhra coast. The fact that the cyclone intensified after 17th and reached its peak intensity on 18th and maintained it till 19th has also been accepted by Pant *et al.* (1980). Obviously the central pressure must have fallen much below 941 mb reported by the ship *Jagatswamini* in the evening of 17th (before 1200 GMT), and consequently the pressure drop must have increased on 18th, and the increased pressure drop continued till 19th evening.

3. In order to have a quantitative estimate of the pressure drop, in the absence of direct measurements, one has to take recourse to the T-number-pressure drop relationship for Indian seas (Mishra and Gupta 1976 — the only study available on the subject so far). According to this relationship T 7 corresponds to a pressure drop of 97 mb. This fact leads inevitably to the conclusion that the best possible estimate of the pressure drop of the Andhra cyclone of 1977 at its peak intensity on 18 and 19 November was 97 mb. Moreover, for this pressure drop the peak storm surge computed with the help of the nomograms prepared by Ghosh (1977) works out to 5.2 m, in excellent agreement with the observation for the above computation a few more parameters, *viz.*, radius of maximum winds, the angle of track of the cyclone relative to the coastline and speed of movement of the cyclone are required; these have been obtained from relevant radar observations and taken as 45 km, 90 deg. and 15 kmph respectively).

4. From the foregoing discussions it may appear that this was the most severe of all cyclones that crossed Andhra coast during the last hundred years. However, there was another cyclone of almost the same intensity affecting Andhra coast half a century ago. If one went by the magnitude of loss of life and property, the 1977 cyclone was doubtless the most devastating. But, as has already been stated, one of the most important meteorological parameters for measuring the intensity of a tropical cyclone is pressure drop (the other parameter, *viz.*, maximum wind-speed is influenced by thunderstorms and is, therefore, relatively more difficult to measure accurately). This parameter can be found out to a great degree of accuracy in the case of a very severe cyclone which crossed Andhra coast near Krishnapatnam, about 20 km southeast of Nellore at about 1800 IST on 1 November 1927. Hourly observations of pressure recorded at Nellore show that the lowest pressure of 925.8 mb was observed both at 1900 and 2000 IST. There was a lull in the storm for 10 or 15 minutes between 1900 and 1930 IST

when there was no rain or wind and the sky was clear. This means that the eye of the cyclone passed through Nellore during that period. By interpolation the lowest pressure of the cyclone works out to be 919 mb (India Met. Dep. 1927). The outermost closed isobar was 1010 mb. So the first anticyclonically turning isobar was 1012 mb. In other words the pressure drop was 93 mb which is almost of the same magnitude as the *estimated* pressure drop of the 1977 cyclone.

5. Thus it is seen that both the 1927 and 1977 cyclones were almost of the same intensity. One may therefore, ask why then there was so much loss of life and property in 1977. The answer to this question is that the devastations caused by the 1977 cyclone were mainly due to the storm surge of about 5 m. The magnitude of storm surge depends very much on the off shore bathymetry near the landfall point, all other parameters remaining the same, as has been shown by Ghosh (1977). The bathymetry near Nellore is much steeper than near Nizampatnam (the landfall point of the 1977 cyclone) and, therefore, the potential for storm surge at Nellore is about half of that at Nizampatnam, as can be seen from Fig. 3 (Ghosh 1977). Moreover, if the vector storm motion (which was about 120 deg./20 kmph) of Nellore cyclone is also taken into consideration, the storm surge estimate associated with it works out to only 2 m (information on the magnitude of realised storm surges is not available). Hence devastations in 1927, when 300 persons lost their lives, were very much less than those in 1977.

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The above discussion highlights the following facts :

(*i*) The pressure drop associated with the Andhra cyclone of 1977 was more than 90 mb and cyclones of such great intensity formed in the Bay of Bengal and struck east coast of India in the past [one is reminded of the False Point cyclone of 1885 of which the pressure drop was also slightly above 90 mb (Eliot 1890)].

(*ii*) Cyclones of almost the same intensity generate significantly different storm surges, even at locations close to each other, depending on coastal bathymetry and vector storm motion.

(*iii*) Of all the factors associated with a severe cyclone, storm surges have the highest potential for destruction of life and property.

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