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SOME FEATURES OF AN INVERTED V-TYPE EASTERLY WAVE OVER INDIAN SEAS

1. On day-to-day scale, the tropical region is surpassed by many weak disturbances which have an important effect on local weather. Of the various forms of these disturbances, commonest forms are the easterly waves that move within the trade winds. The classical model of the easterly wave was developed by Riehl(1954) who pictured it as a wave or trough of low pressure with a westward movement at an average speed of 10 to 15 knots per day. The facts, such as the relative feebleness of intensity, lack of uniform structure with manifestation of various forms, make the study of these weak disturbances difficult. However, by means of the techniques, like, compositing (Reed and Recker 1971), spectral analysis (Rosenthal 1960) and dynamical simulation (Holton 1971), good amount of work on the easterly waves has been documented.

1.1. Due to their movement over data sparse oceanic regions of low latitudes, only limited number of studies were reported regarding these waves over Indian region (Keshvamurthy 1971, Pant 1977). However, with the advent of satellites, the situation has improved. In the present study, some of the salient features of one such easterly wave over Indian Seas as seen by the satellite pictures are discussed.

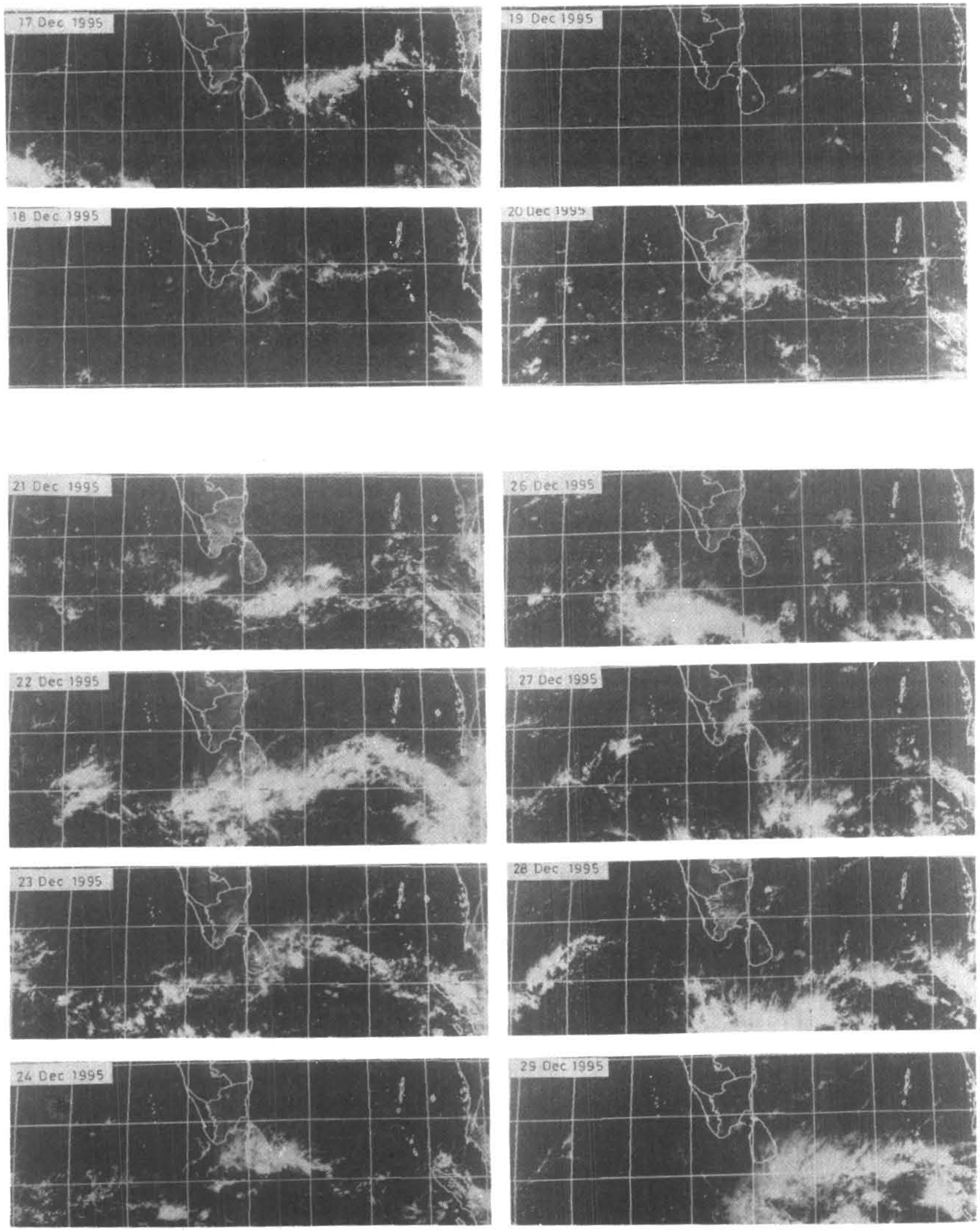
2. INSAT 1-D visible cloud pictures during the period 17-29 December 1995 and the bulletins of Indian Ocean and Southern Hemispheric Analysis Centre (INOSHAC), Pune during the period 10 - 14 December were used for the present study.

3. A series of 0600 UTC visible cloud images of INSAT 1-D during the period 17-29 December 1995 between equator to 15° N and 65°E to 100° E are shown in Figs.1(a&b). (Picture on 25th is not shown and on 19 th, 0300 UTC picture is shown). The pictures indicate the movement a pair of troughs associated with a sinusoidal wave in cloud pattern moving from east to west across the Indian Sea. In the cloud pattern the cloud bands are arranged in a series of upside down V's. When the pattern is well marked, an axis can be found which marks the apex of the V's and indicate the regions where the cloud bands change orientation.

East of this axis, bands are generally oriented from northwest to southeast. To the west of the axis the bands are oriented from southwest to northeast. Frank (1969) has reported similar type of cloud pattern associated with easterly waves and he labelled it as "Inverted V" pattern.

4. Some of the features of the present case easterly wave as observed from the Figs.1 (a&b) are given in the following paragraphs:

4.1. A depression was formed over South China Sea on 14 December 1995 centered near 8° N/108°E. Moving westward, this system weakened near east off Burma coast on 15th. Subsequently, a set of wave perturbations originated over Bay of Bengal on 17 December and 21 December respectively. The first wave, which was a short lived one originated over Bay of Bengal at about 92.5° E on 17 December and moved westwards. On 20 December it weakened and was observed at 87°E. Subsequently, on 21 December it merged with the cloud pattern associated with an another large amplitude trough observed at about 93°E. This



Figs.1(a&b). INSAT 1-D visible cloud pictures of 0600 UTC

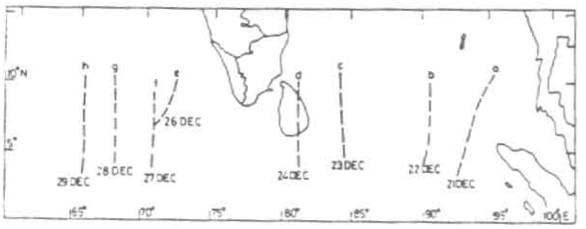


Fig.2. Approximate day-to-day longitudinal positions of the trough associated with the sinusoidal cloud pattern during 21-29 December 1995.

perturbation in the basic easterly flow moved across north Indian Ocean just south off Indian penninsula with reasonable day to day continuity till it weakened over Arabian Sea at 66° E on 29 December as shown in Figs. 1(a&b).

4.2. There are number of studies [Doraisamy Iyer (1936), Shaha *et al.* (1981)] which showed that the remnants of typoons and storms of west Pacific and South China Sea could trigger the Bay disturbances and act as predecessors to these systems. Thus the present case perturbations might have formed from the remnant of the depression that moved across the South China Sea just few days prior to their formation.

4.3. The organisation of the cloud associated with the system is on a synoptic scale covering an area of nearly 1000 km extending 5°N to 10°N. Though the inverted V's in the cloud bands are trackable throughout their movement across the north Indian Ocean, they were better organised between 85° E to 95°E. But as the cloud pattern moves westward, west of 85°E, they get weakened and loose intensity progressively. Such kind of temporary increase in cloudiness and further decrease in the intensity of the wave was observed by Frank (1969) in the westward movement of easterly waves over Atlantic.

The approximate day-to-day longitudinal positions of the trough associated with the sinusoidal cloud pattern during the period 21-29 December 1995 are given in Table 1 and schematically shown in Fig.2. From this, the approximate speed of the wave manifested by the movement of the trough are computed. From the table it can be seen that the wave moved across the north Indian Ocean with an average speed of about 8.2 knots ranging from 5 to 15 knots during the individual days of the study.

5. From the above discussion the following conclusions can be drawn:

(*i*) The observed easterly wave disturbance might be triggered by the remnant of depression which moved westward across the South China Sea.

(*ii*) The inverted V type of the cloud pattern associated with the observed easterly wave and speed of their movements over Indian seas are consistent with the early study.

(*iii*) Though there is a temporary increase in the intensity of the system between 85°E and 95°E, the system gets progressively weakened as it moves westward.

TABLE 1

Approximate day-to-day longitudinal positions of the trough associated with the sinusoidal cloud pattern during 21-29 December 1995

Date December 1995	Trough position (long.°E)	Phase speed (knots)
21	93.0	-
22	90.5	6.2
23	84.5	14.8
24	81.0	11.1
26	72.5	10.2
27	70.5	5.0
28	68.0	6.2
29	66.0	5.0
	Mean speed	: 8.3 Knots

(*iv*) Being on observed over data sparse oceanic region, the vertical structure of the system could not be studied. The satellite-derived parameters, such as, Outgoing Longwave Radiation (OLR), cloud motion vectors etc. alongwith the organised ship observation, may provide more information on such wave disturbances.

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