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SEA BREEZE OBSERVATIONS AT BHUBANESWAR

Sea breeze was studied by several workers (Edinger 1963, Fosberg & Schroeder 1966, Kozo 1982) for various coasts in America, United Kingdom and Alaska. Simpson *et al.* (1977) observed sea breeze, occasionally penetrating even up to 100 km inland. Rao *et al.* (1984) studied this phenomenon at Madras which showed that the surface temperature fell by about 1.5° to 2.0° C while the relative humidity (RH) rose by 3 to 30% at the onset of sea breeze. Observation of such phenomena was also noticed at Bhubaneswar on a few occasions in summer.

Bhubaneswar is situated at 90 km west and 50 km north of the Bay of Bengal coast line. Besides Chilka lake exists southwestwards at 60 km. From the climatological data of Bhubaneswar summer is the period where predominantly southerly to south westerlies prevail. Out of the 15 events from March to June four conspicuous sea breeze events are studied in detail.

Fig. 1 shows the thermograms and hygrograms of 8 May and 5 June 1986 representing respective months. From the hygrogram of 8 May it is very clear that at 1625 IST there was a sudden increase in RH from 46 to 64% while the air temperature fell from 33.0° to 31.8° C. This type of sudden variations with change in the wind field are known to be associated with the onset of sea breeze.

Table 1 shows the changes in various meteorological parameters for the four events. The data taken from the autographic charts is shown at onset times. Besides this, variations in half-hourly values of current weather data around the onset time are also shown.

From Table 1 it is clear that these events occurring in the afternoon hours show a sudden enhancement of RH of more than 14% and fall of temperature of 1° C or more. The associated wind appeared to be increasing from 2 to 4 kt while the change in direction was of 20 to 40°. Since the wind data were not from autographic instruments, an exact measure of the wind enhancement was not available. The change in the wind direction did not show a definite sense of rotation such as either veering or backing of the wind. However, the general direction of the wind at the onset of the sea breeze was predominantly from south. From the RH data the maximum enhancement was about 25% while decrease in air temperature was of 2° C. The dew point also showed an increase of about 5.2° C as a peak value.

The above observations are very much similar to that of Rao *et al.* (1984) showing conspicuous increase in RH at the time of onset of sea breeze. Features of Mukherjee *et al.* (1985) observations of sudden change in wind at the time of onset is also noticeable in the present observations. Thus observations are giving a positive evidence of sea breeze at Bhubaneswar which is 50 km inland from the nearest coast line. The results of Simpson *et al.* (1977) monitoring sea breeze as much as 100 km inland is another evidence to support the present observation of deep inland penetration.

The onset times in three of the four events are around 1600 IST. Similar occurrences in the late afternoon hours were noticed in all the fifteen observations of summer 1986. However, possibilities for an early onset as reported on 5 June 1986 cannot be ruled out.

TABLE 1

Variation in meteorological data at the onset of sea breeze

Date of the event (1986)	Time of the event (IST)	Autographic data variation in		Time of obsn. (IST)	Current weather data			
		RH (%)	Temp. (°C)		Wind speed (kt)	Wind direction (°)	Temp. (°C)	Dew point temp. (°C)
8 May	1625	46-64 (18)	33.0-31.8 (1.2)	1630/1700	10-12 (2)	110-150 (40)	33.0-31.8 (1.2)	22.5-24.1 (1.6)
23 May	1635	36-58 (22)	37.5-35.5 (2.0)	1630/1700	06-10 (4)	230-200 (30)	37.0-35.8 (1.2)	20.8-24.8 (4.0)
4 June	1550	28-52 (24)	40.5-38.5 (2.0)	1600/1630	12-15 (3)	180-200 (20)	38.0-37.0 (1.0)	19.1-24.3 (5.2)
5 June	1245	30-44 (14)	40.5-39.5 (1.0)	1300/1330	06-10 (4)	200-180 (20)	39.6-38.2 (1.4)	21.6-23.1 (1.5)

(Figures in brackets show the changes in magnitude of the parameters)

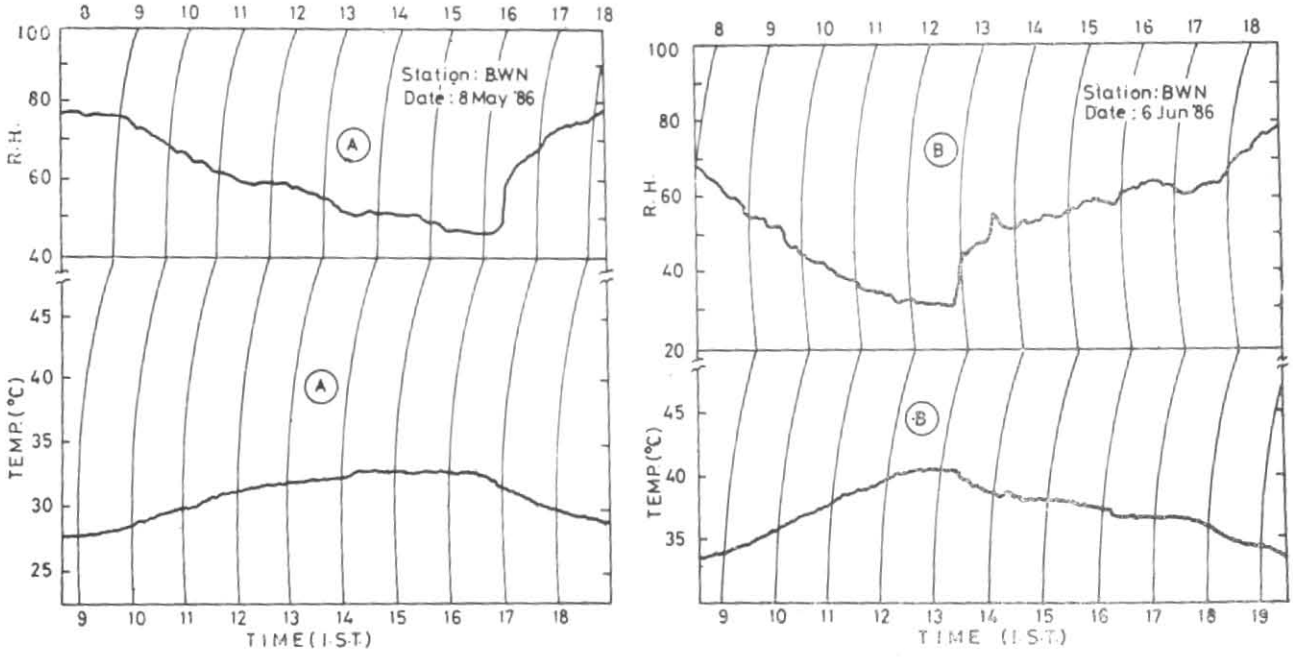

Fig. 1. Thermograms and hygrograms of 8 May and 5 June 1986

At the onset the wind speed rose up to 10-15 kt. A raise of 2 to 4 kt is always noticeable although the wind before the onset was moderate. The change in wind direction was both clockwise and anticlockwise. The backing of the wind may be due to heating of the land during the day. But the veering of wind may be due to a complex situation arising out of the presence of lake in the south-west.

From the above study it can be concluded that sea breeze can be observed at Bhubaneswar on a few occasions in summer as a conspicuous feature mainly as a southerly flow in the late afternoon hours. The increase in RH and temperature were more than 14% and 1° C respectively at the time of onset of sea breeze.

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