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Unprecedented floods of August 1975 in Orissa

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ABSTRACT. Unprecedented floods occurred in the rivers *Baitarani* and *Brahmani* in the third week of August 1975. Except river *Mahanadi*, all major Orissa rivers were in spate due to the passage of two depressions through Orissa in quick succession. The rainfall in the latter case was very much accentuated by the trough and micro low pressure cell associated with the main system.

1, Introduction

A devastating flood occurred in the third week of August 1975 in all the major rivers of Orissa except river *Mahanadi*. It caused enormous destruction to agricultural fields and movable and immovable public and private properties in the down streams of rivers *Baitarani* and *Brahmani*.

All rivers except the *Mahanadi* reached record levels of 2 to 3 m above danger level during the period from 19 to 22 August 1975. The entire area of north Balasore including Jaleshwar and Bhograi and Bhadrak sub-divisions of Balasore district, part of Mayurbhanj district, Anandpur and Champua sub-divisions of Keonjhar district, entire coastal area of Cuttack district (Jaipur and Kendrapara sub-divisions) and some areas of Puri district were completely inundated. Severe floods occurred in the rivulets and streams of Kuchinda, Deogarh and Sadar sub-divisions of Sambalpur and Dhenkanal districts. Some towns like Pallahara and Duban of Dhenkanal district, Chandbali, Bhadrak, Jaleshwar of Balasore district and Pattamundai of Cuttack district experienced the worst flood and were severely inundated. Pallahara and Kamakhyanagar towns of Dhenkanal district were completely cut off from all sides.

2, Flood situation

The details of floods are as follows :

(a) *River Baitarani*

The river crossed the danger level of 19·202 m (63·00 ft) at Akhuapada in the noon hours of 19 August 1975 and recorded a peak value of 21·168 m (69·45 ft) at 2000 IST of same date. The river fell below the danger level in the morning hours of 21 August 1975. The corresponding river discharge at Bindi Railway Bridge site which is 8 km upstream from Akhuapada reached the peak value of 10478·67 cumecs measured at 2030 IST of 19th.

(b) *River Burhabalang*

The river crossed the danger mark of 4.420 m (14·50 ft) at Fuladi in the evening of 19 August 1975 and reached the peak value of 4·602 m (15·10 ft) on 20th and then it receded and fell below danger level in the morning hours of 21 August 1975. The peak discharge at National Highway No. 5 (NH 5) which is 4 km upstream of Fuladi was measured 1897·83 cumecs at 1815 IST of 19th.

(c) *River Brahmani*

The river crossed the danger level of 20·604 m (67·60 ft) at Jenapur Railway Bridge site in the early hours of 19th and reached the peak value of 23·500 m (77·10 ft) on 20 August by about 1000 IST and fell below the danger level in the morning hours of 24 August 1975. The maximum river discharge measured at Panposh 8286·06 cumecs at 0730 IST on 20th, at Talcher Railway Bridge site 18435·95 cumecs at 2330 hr of 19th and at Jenapur Express way 24,246·03 cumecs at 1030 hr on 20th.

(d) *River Subarnarekha*

The river crossed the danger level of 4·572 m (15·00 ft) at Rajghat at 1100 IST on 20 August and attained the peak value of 5.974 m (19·60 ft) at 1100 IST on 21 August. Thereafter river gradually receded and fell below danger level on 23 August 1975. The peak discharge at Rajghat was 7175·97 cumecs measured at 0630 IST on 21 August.

The discharge rates of the rivers at a few places are given in Table 1. The graphic representation of rainfall rates and discharge

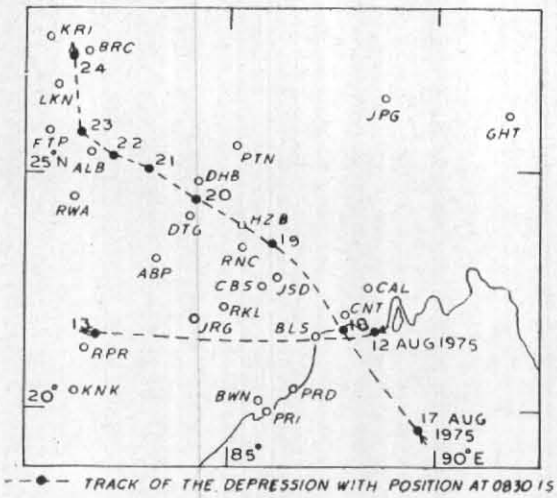

Fig. 1. Tracks of two successive depressions of August 1975

TABLE 1

River catchment	Discharge site	Date & time of observations in Aug 1975		Discharge rates (cumecs)
		Date	Time (IST)	
Baitarani	Bindi Railway Bridge	18	0700	867·93
		18	1200	1023·89
		18	1700	1321·47
		19	0700	4855·88
		19	1200	6618·12
		19	1700	7791·36
		19	2030	10478·67
		20	0700	6660·49
		20	1200	6117·75
		20	1700	5328·35
		21	0600	3836·09
		21	1200	3364·13
		21	1700	2821·37
Burhabalang	National Highway No. 5	18	7615	409·47
		18	1215	433·12
		19	0615	1122·32
		19	1215	1443·41
		19	1815	1897·83
		20	0615	2097·51
		20	1215	1646·32
		20	1815	1509·69
		21	0615	1220·95
		21	1215	978·16
		21	1815	873·76
Brahmani	Panposh	18	0730	1624·56
		18	1630	1572·22
		19	0730	1838·58
		19	1630	3153·51
		20	0730	8286·06
		20	1630	6276·87
		21	0730	4820·09
		21	1630	3721·57
	Talcher Railway Bridge	18	1600	4405·29
		19	0700	6968·42
Brahmani	Talchet Railway	19	1630	16360·00
		19	2300	18435·95
		20	0730	12381·31
		20	1630	9264·32
		21	0730	8971·52
		21	1600	7472·08
	Jenapur Express Way	18	0630	3883·13
		18	1230	3968·54
		18	1830	4366·44
		19	0630	7146·51
		19	1230	8224·49
		19	1900	12489·72
		20	0630	23252·44
		20	1030	24246·03
		20	1830	17680·48
		21	0630	11083·98
		21	1230	11150·74
		21	1830	11276·59
		22	0630	8590·97
		22	1230	7659·17
		22	1830	6804·79
Subarnarekha	Rajghat	18	0630	2053·62
		18	1230	1846·29
		18	1730	1887·53
		19	0630	2358·14
		19	1230	2836·14
		19	1730	3594·35
		20	0630	5211·59
		20	1230	6176·70
		20	1730	6661·62
		21	0630	7175·97
		21	1230	6240·29
		21	1730	5818·73
		22	0630	3500·26
		22	1230	3180·98
		22	1730	2880·69

rates of river *Brahmani* at Panposh, Talcher and Jenapur are shown in Fig. 7.

3, Synoptic situations and rainfall distributions

Two successive depressions passed over Orissa within a short period of time. A well marked low pressure area lay over northwest Bay and adjoining Gangetic West Bengal & Orissa on 12 August 1975 with its centre close to Sagar Island. It rapidly moved westward on 13th and lay as a depression over east Madhya Pradesh with its centre near Raipur. On 14th without any appreciable movement it weakened into a well marked low pressure area.

The system caused moderate to heavy rain in the catchments of rivers *Subarnarekha*, *Burhabalang*, *Baitarani* and *Brahmani*. The rivers were practically full and the basin soil was already saturated when another well marked low pressure area developed over north Bay on 16 August 1975. This subsequently concentrated into a depression and lay with centre within half a degree Lat. 19·5° N and Long. 89·5°E at 0830 IST of August 17th. It further intensified into a deep depression and moved northwestward and lay with its centre near Contai (West Bengal) at 0830 IST of 18 August 1975. The deep depression moved further northwestward and lay with centre between Dhanbad and Ranchi at 0830 IST of 19th. It then moved in a westnorthwesterly direction and lay with centre between Daltonganj and Dehri at 0830 IST of 20th. Then moving in a northwesterly direction it lay with centre near Varanasi at 0830 IST of 21st. The movement then became slow and it lay with centre about 50 km southeast of Allahabad at 0830 IST of 22 August 1975. The deep depression continued to move across Uttar Pradesh and weakened into a depression at 0830 IST of 24th and lay about 75 km northnortheast of Lucknow where it then rapidly weakened further and merged with the seasonal trough on the morning of 25th. The tracks of the two depressions are given in Fig. 1.

The daily 0830 synoptic charts (Figs. 2a to 2c) show that a secondary micro low pressure area lay northwest of Rourkela at 0830 IST of 18 August. It moved westward and lay north of Raigarh at 0830 IST on 19 August. The system rapidly moved westward and lay southwest of Pendra at 0830 IST on 20th and thereafter it weakened and became unimportant.

The deep depression gave heavy to very heavy rainfall over the catchments of Orissa rivers on 18th, 19th and 20th. The daily and cumulative

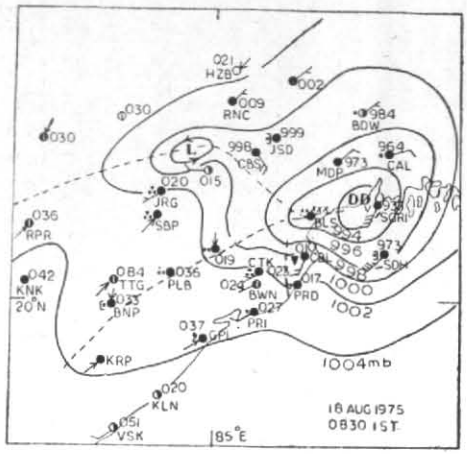

Fig. 2(a). Synoptic chart of 0830 IST on 18 Aug 1975

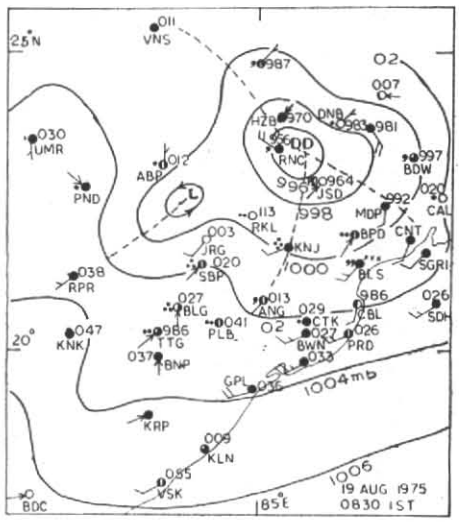

Fig. 2 (b). Synoptic chart of 0830 IST on 19 Aug 1975

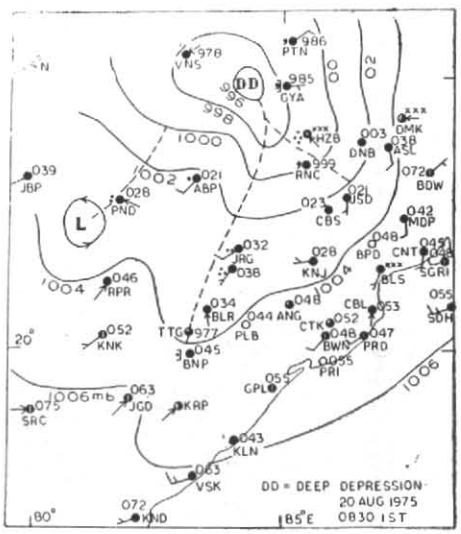

Fig. 2(c). Synoptic chart of 0830IST on 20 Aug 1975
DD—Deep depression.

TABLE 2

Individual and cumulative rainfall (mm) of 18-20 August 1975

	18 Aug	19 Aug	Two-day total	20 Aug	Three-day total
		Subarnarekha			
Ranchi	7·2	18·4	25·6	40·0	65·6
Tatanagar	30·2	29·6	59·8	112·8	172·6
Chaibasa	24·4			99·8	
Ghatshila	73·9	35·8	109·7	35·3	145·0
Bhargoda	24·9	191·2	216·1	15·3	231·4
Rajghat	17·5	110·2	127·7	5·0	132·7
		Burabalang			
Baripada	71·8	271·0	342·8	5·7	348·5
Kaptipada	1·5	123·4	124·9	17·3	142·2
Udla	23·0	170·0	193·0	20·0	213·0
Balasore	49·5	219·3	268·8	17·6	286·4
Nilgiri	21·6	187·0	208·6	8·0	216·6
		Baitarani			
Champua	40·9	198·9	239·8	31·7	271·0
Keonjhar	106·0	62·3	168·3	31·7	200·4
Swampatna	26·4	150·0	176·4	45·0	221·0
Karanjia	40·0	269·0	309·0	24·0	333.0
Anandpur	62·2	237·0	299·2	19·2	318·4
Thakurmunda	38·1	266·7	304·8	22·9	327·7
Akhupada	100·0	142·7	242·7	0·2	242·9
Jaipur	124·0	0·0		31·0	
Bhadrakh	82·2	239·0	321·2	·5	326·7
Chandbali	123·8	83·0	206·8	0·0	206·8
Ghatgaon	40·0	150·	190·0	14·0	204·0
		Brahmani			
Rourkela	35·8	21·0	56·8	89·9	146·7
Panposh	19·8	16·8	36·6	80·3	116·9
Bonaigarh	63·0	58·8	121·8	80·5	202·3
Deogarh	29·8	399·4	429·2	75·0	504·2
Pallahara	99·1	332·7	431·8	35·6	467·4
Chendipada	65·0	29·2	94·2	2·2	96·4
Talcher	103·0	85·0	188·0	22·0	210·0
Angul	44·2	80·4	124·6	15·8	140·4
Kamakhyana-gar	20·0	81·0	101·0	16·0	117·0
Dhenkanal	78·7	60·5	139·2	1·3	140·5
Sukhindakhas	17·8	167·2	185·0	19·7	204·7
Jenapur	104·8	132·5	237·3	2·2	239·2

	18Aug	19 Aug	Two-day total	20 Aug	Three-day total
		Mahanadi			
Kanker	18·6	21·6	40·2	1·4	41·6
Rajnandan-gaon	0·0	18·9	18·9	8·5	27·4
Drug	43·5	14·0	57·5	0·0	57·5
Raipur	6·2	1·2	7·4	24·6	32·0
Balodabazar	7·5	33·3	40·8	7·6	48·4
Bilaspur	0·0	12·8	12·8	44·8	57·6
Mungeli	8·2	0·6	8·8	12·8	21·6
Pendra	2·3	1·5	3·8	58·3	62·1
Baikuntpur	26·1	34·8	60·9	46·4	107·3
Katghora	8·6	8·4	16·4	180·6	197·0
Dhamtari	9·8	11·0	20·8	4·0	24·8
Saranghar	1·4	37·0	38·4	43·0	81·4
Champa	9·8	6·6	16·4	51·8	68·2
Raigarh	24·4	12·8	37·2	119·0	156·2
Sakti	6·4	5·2	11·6	91·2	102·8
Jharsuguda	4·0	28·7	32·7	257·8	290·5
Kuchinda	5·0	118·0	123·0	106·0	229·0
Sambalpur	15·6	48·2	63·8	55·8	119·6
Rairakhol	36·6	77·2	113·8	20·4	134·2
Ambabhona	29·2	14·2	43·4	45·7	89·1
Dangripalli	11·0	13·0	24·0	13·0	37·0
Sonepuraj	16·3	16·4	32·7	14·3	47·0
Titlagarh	1·2	2·0	3·2	2·2	5·4
Binka	25·0	19·3	44·3	10·5	54·8
Phulbani	23·0	10·6	33·6	2·8	36·4
Bhabanipat-na	22·7	32·0	54·7	18·4	73·1
Cuttack	103·7	85·2	188·9	0·0	188·9
Kendrapara	148·0	29·0	177·0	0·0	177·0
Bhubaneswar	63·1	45·2	108·3	0·0	108·3
Puri	56·0	9·2	65·2	0·0	65·2
Paradeep	110·6	35·4	146·0	0·0	146·0
Naraj	24·2	67·6	91·8	0·8	92·6
Nimapara	45·0	17·0	62·0	0·0	62·0
Brahmagiri	16·0	13·0	29·0	0·0	29·0
Erasama	131·0	43·0	174·0	0·0	174·0

TABLE 3

S. No.	River catchment	The aerial precipitation (cm)		
		18 Aug	19 Aug	20 Aug
1	Subarnarekha	3·1	9·0	5·8
2	Burhabalang	3·4	19·4	1·4
3	Baitarani	7·1	17·0	2·1
4	Brahmani	7·3	12·1	3·5
5	Upper Mahanadi	1·1	2·2	7·5
6	Lower Mahanadi	4·7	3·2	1·0

NOTE—The catchmentwise rainfall (cm) on 18, 19 and 20 August 1975 for major Orissa rivers as calculated by arithmetic mean

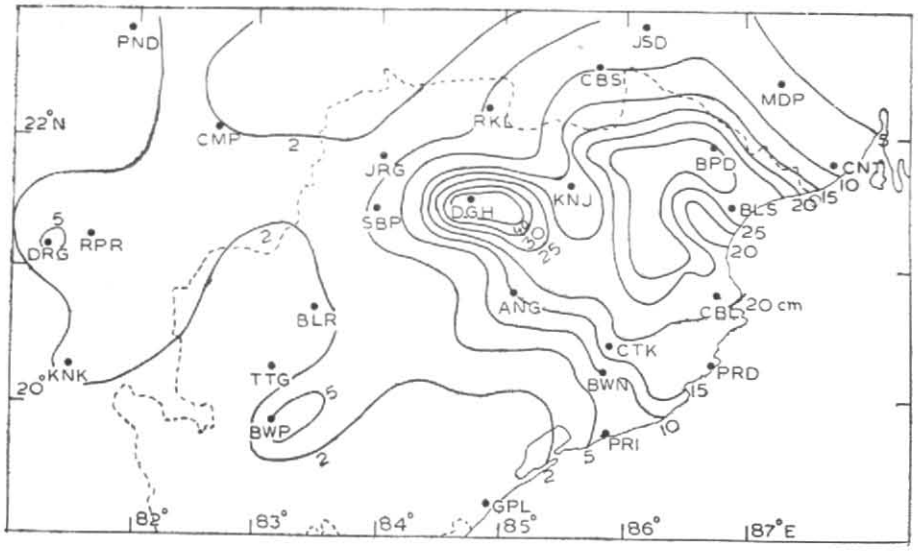

Fig. 3. Two-day cumulative rainfall for 18 & 19 August 1975

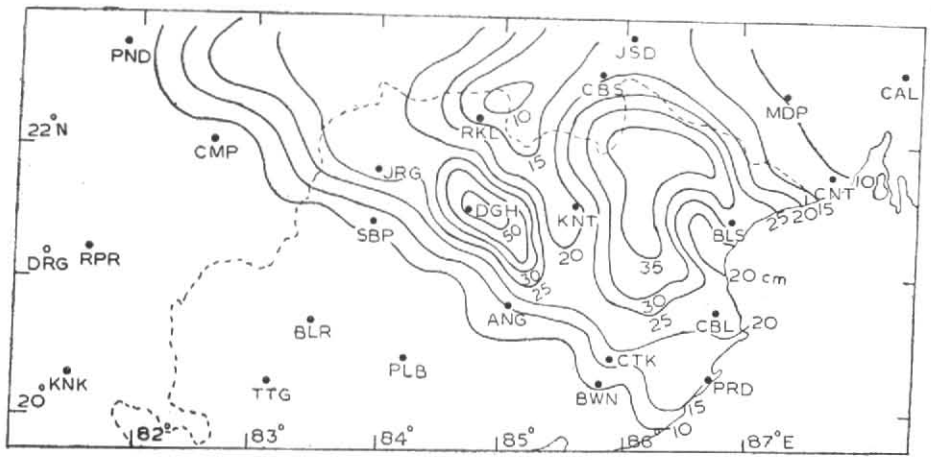

Fig. 4. Three-day cumulative rainfall for 18-20 August 1975

rainfall of individual stations on these dates are shown in Table 2. The catchment aerial precipitation as calculated by arithmetic means are given in Table 3.

It is observed from the isohyetal maps drawn on these days that there had been three maxima of rainfall in the isohyetal pattern of 18th. The first one of 15 cm rain lay over coastal areas of Cuttack district, the second one of 6 cm rain lay over northern parts of Mayurbhanj district and the third maximum of 10 cm rain lay over northern parts of Dhenkanal and adjoining parts of Sambalpur and Sundergarh and western parts of Keonjhar districts. On 19th the rainfall was more uniform and most heavy rain exceeding 25 cm occurred over eastern parts of Sambalpur and adjoining parts of Sundergarh and Dhenkanal districts with maximum core of 40 cm around Deogarh. Another maximum of 25 cm was over Mayurbhanj and adjoining parts of Keonjhar and Balasore districts. On 20 August the rainfall shifted northwestward and maximum of 25 cm lay over western parts of Sundergarh and adjoining parts of Sambalpur districts. The two days and three days cumulative rainfall (Figs. 3 & 4) show maxima of 40 cm and 50 cm respectively between Deogarh and Pallahara.

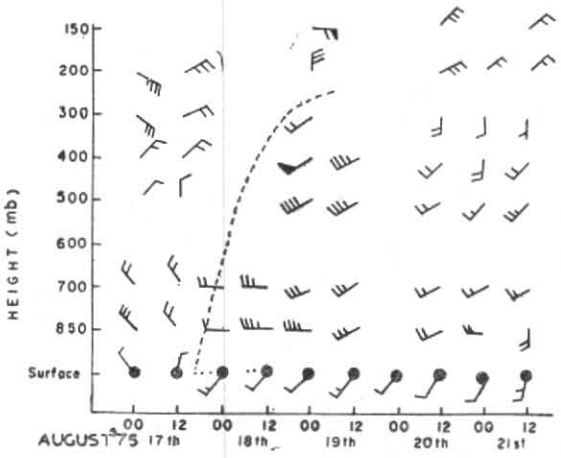

Fig. 5. Vertical time-section of Bhubaneswar

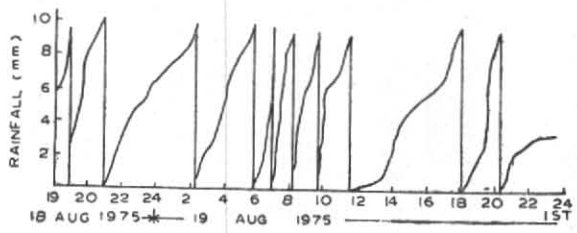

Fig. 6. Rainfall records of Bhubaneswar for 18 and 19 August 1975 during which the intensity was high

4. Discussion

It is seen from the old records since 1901 that heavy rain of the order of 33·27 cm in 24 hr on 19 August 1975 never occurred at Pallahara. This time the system was more active than any of the previous ones.

The highest 24-hr rainfall as can be seen from Table 2 occurred between 18 and 19 August 1975 in all the stations except for Ghatshila, Keonjhar, Talcher, Dhenkanal, Chandbali and the districts of Cuttack and Puri, where there had been more rain between 17 and 18 August 1975.

The isobaric pattern clearly justifies such distribution of rainfall in Keonjhar and Dhenkanal districts due to the formation of a secondary micro-low over the area which moved westward and lay northwest of Rourkela on 18th. Chandbali and other coastal stations also received heavy rain during 0830 hrs of 17th and 18th because of a trough extending from the centre of the deep depression towards west and passing through Balasore, Angul and Phulbani (Fig. 2 a). The heavy rain over Mayurbhanj was directly attributed to the main system. During the transit of the secondary micro-system from 18th to 19th position, it gave very heavy rainfall in the western parts of Dhenkanal and adjoining parts of Keonjhar districts. It is seen that the trough line shifted to the new position on 19th (Fig. 2 b) and passed through Chaibasa and Angul. Hence Mayurbhanj district continued to receive heavy rainfall.

The micro system thereafter became unimportant and the main system moved far away and hence no appreciable rain occurred in these areas after 0830 IST of 20 August 1975 (Fig. 2 c).

The activity of the trough line (Ghosh and Veeraraghavan 1975) can also be verified if the vertical time section of Bhubaneswar upper wind is examined with respect to the self-recording raingauge chart of the place. The vertical time section chart (Fig. 5) shows that the vertical trough line was passing over Bhubaneswar between about 1400 GMT (1930 IST) of 17th and 1500 GMT (2030 IST) of 18th. The self-recording chart (Fig. 6) shows that the chief rainfall occurred between 0630 and 1000 IST of 18th over Bhubaneswar with maximum intensities of 1·4 cm, 2·0

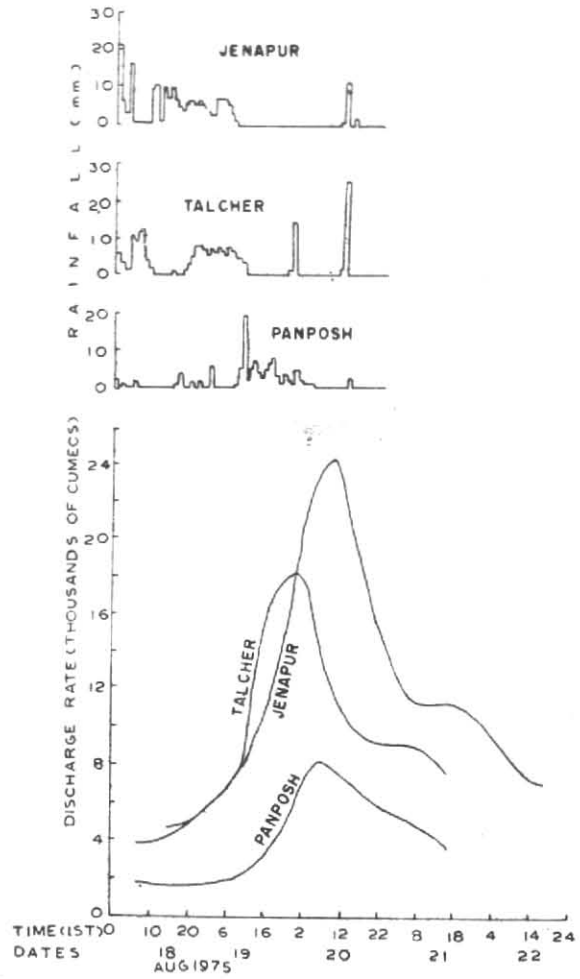

Fig. 7. Discharge and rainfall curves at Jenapur, Talcher and Panposh

cm and 1·8 cm between 0645 and 0730, 0830 and 0845 and 0945 and 1000 IST respectively. The rain generally started by 1830 IST of 17th and continued upto 2200 IST of 18th. Beyond these periods there had been negligible rain. It is, therefore, seen that rain at Bhubaneswar occurred exactly during the period when the vertical trough line was passing through the station. It is seen that though the main system was strong its activity was confined to a limited area but the activity was intensified by the presence of micro-lows associated with the major system.

5, Conclusion

It may, therefore, be confirmed that severe floods can occur when two disturbances move across the same area in quick succession (Dhar and Ghosh 1972) but it is seen from the present study that the micro systems associated with the main disturbances are also equally responsible to cause severe floods in Orissa.

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