

556.166

**A CASE STUDY OF HEAVY FLOOD IN RIVER
KEN DURING SEPTEMBER 1992**

1. Floods are recurring annual feature of rivers. Almost in every flood season considerable damage is caused to lives and properties. During September 1992, unprecedented heavy flood occurred in the Ken river, same has been studied. Fig. 1 shows the catchment area of

the Ken river. It has got its origin in north-western slopes of Kaimur hills in Satna district of M.P. The Ken river flowing generally in northerly direction and joins the Yamuna river near Chillaghat, after travelling a distance of about 360 km, having a drainage area of 28,224 sq km. Banda is the most important town on its right bank. The flood plains lie down stream of Banda. The high incidence flood in these areas are due to the combined effect of physiographical and meteorological conditions (Chaudhary *et al.* 1978). The major tributaries of the Ken

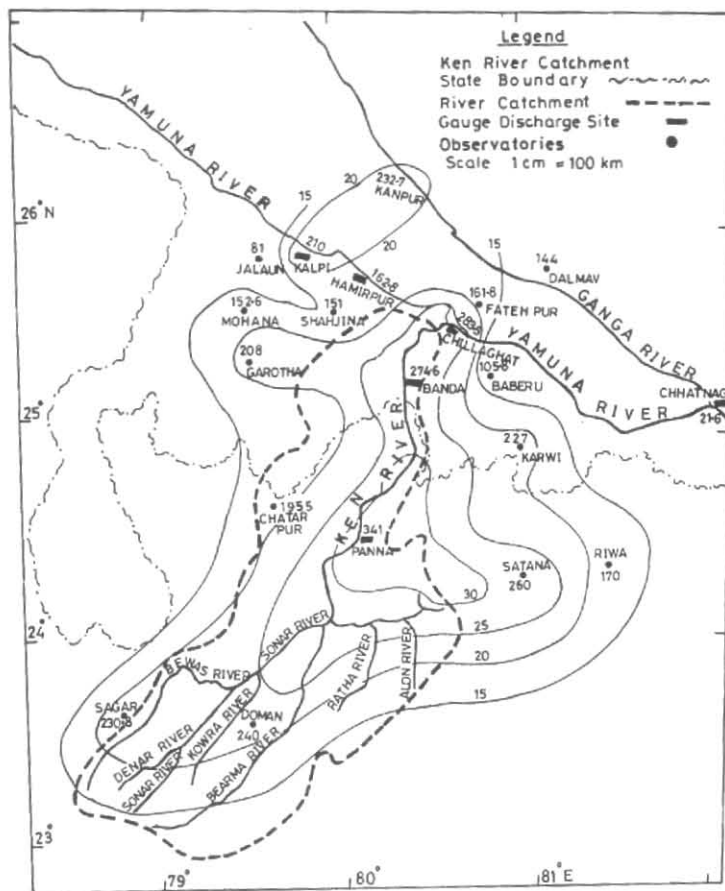


Fig. 1. Locator map of the river Ken and its catchment. Rainfall plotted in mm and Isohytal pattern drawn in centimeter of cumulative rainfall for the period 11 to 14 September 1992

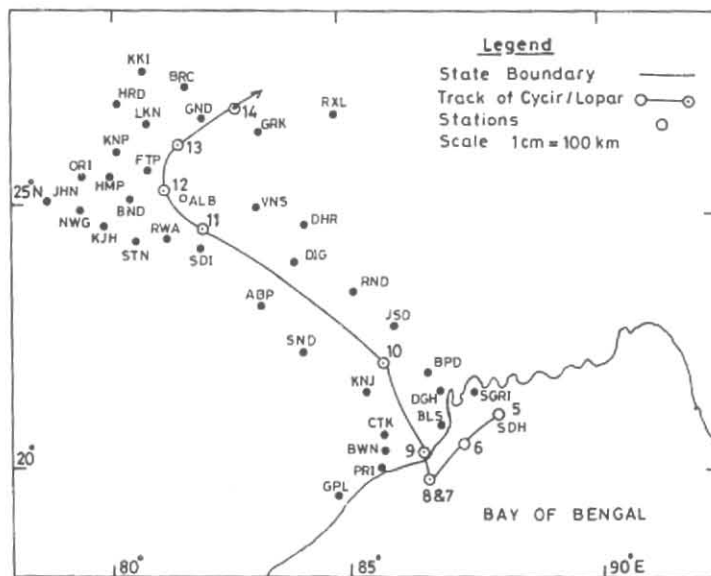
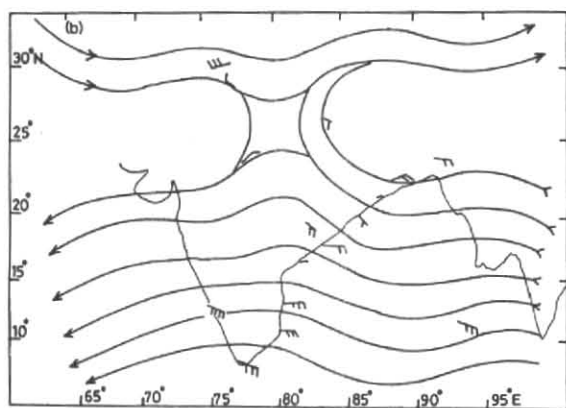
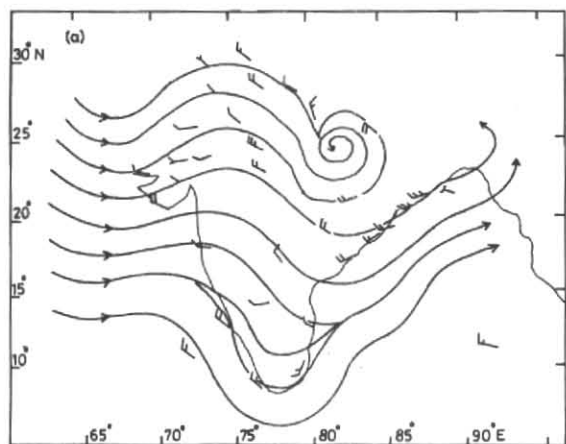
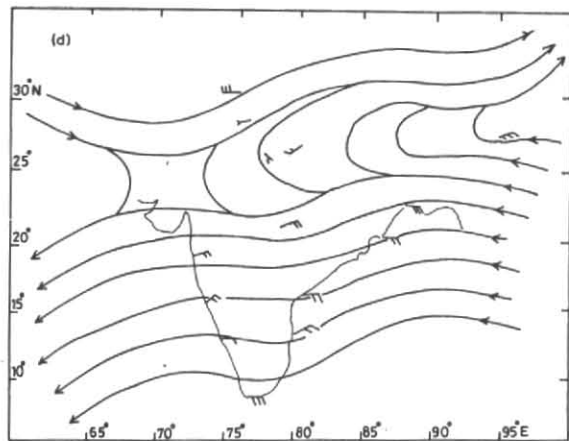
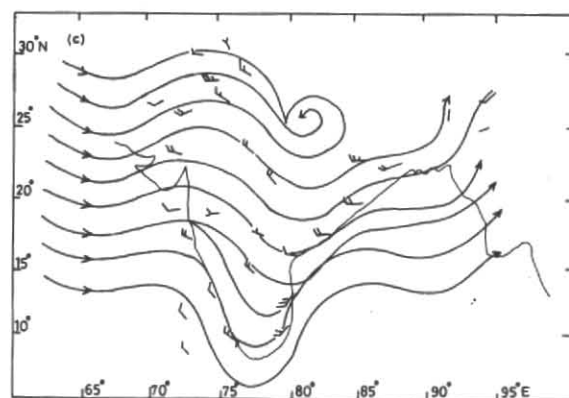


Fig. 2. Track of cyclonic circulation/low pressure area from 5 to 14 September 1992



Figs. 3(a&b). (a) 0.9 km analysis at 1200 UTC of 12 September 1992 and (b) 250 hPa analysis at 1200 UTC of 12 September 1992



Figs. 3(c&d). (a) 0.9 km analysis at 1200 UTC of 13 September 1992 and (b) 250 hPa analysis at 0000 UTC of 13 September 1992

river are the Sonar, the Bearma, the Patha and the Alon of the M.P. state. An important contributory factor for floods in these rivers is relative flatness of their basin slopes, resulting in inefficient drainage of storm discharge through the stream channels. Meteorologically the catchment of these rivers lie in a rainbelt that receives moderate to heavy rainfall in monsoon season, *i.e.* June to September, due to movement of monsoon trough, north westward moving lows or depression from the Bay of Bengal and moving westerly trough towards eastwards (Biswas *et al.* 1984 and Apte *et al.* 1992).

2. During monsoon season of 1992, there was no flood in the Ganga basin except in the Ken river catchment in September 1992. Fig. 2. Shows the path of the system that originated in head Bay area and moved towards the Ken river basin. On 5 & 6 September 1992 an

upper air cyclonic circulation was lying over north-west Bay of Bengal and adjoining area, on 7 and it lay over north-west Bay and adjoining area. It persisted there upto 9 morning and crossed Orissa coast and lay over north-east M.P. and adjoining Orissa and Bihar plateau on 10 with upper air cyclonic circulation extending upto mid tropospheric level. It moved in a north-westerly direction and lay over north-east M.P. and adjoining south-east U.P. with its central area near Riwa on 11, moving northnorth-west wards, it lay over south-east U.P. and adjoining north-east M.P., with its central position near north-east of Banda on 12. It recurved on 13 and lay over east U.P. with its central position south-east of Lucknow. It further moved north-east wards and lay over north-east U.P. with its central position near Gonda on 14. It became unimportant on 15 Figs. 3(a-d) depicts the upper air charts for the same dates. The convergence associated

TABLE 1

Daily rainfall/danger level/water level

S. No.	Name of Stn.	Rainfall (mm)					Danger level (m)	Water level (m)			
		Dates						Dates			
		11Sep	12 Sep	13 Sep	14 Sep	Total		11 Sep	12 Sep	13 Sep	14 Sep
1	Sagar	30.8	140.0	060.0	-	230.0	-	-	-	-	-
2	Domah	50.0	150.0	040.0	-	240.0	-	-	-	-	-
3	Riwa	80.0	060.0	030.0	-	170.0	-	-	-	-	-
4	Satna	-	070.0	130.0	060.0	260.0	-	-	-	-	-
5	Panna	33.0	244.0	064.0	000.0	341.0	-	-	-	-	-
6	Chhatarpur	83.3	108.4	003.6	000.0	195.3	-	-	-	-	-
7	Karwi	18.0	067.0	142.0	-	227.0	-	-	-	-	-
8	Baberu	02.2	002.6	084.4	017.6	106.8	-	-	-	-	-
9	Banda	03.6	046.0	194.0	031.0	274.6	104.0	98.55	104.88	111.38	113.28
10	Chillaghat	20.5	107.4	057.8	097.8	283.5	100.0	92.15	093.80	097.32	101.44
11	Fatehpur	21.4	064.6	000.0	075.8	161.8	-	-	-	-	-
12	Garotha	82.0	097.0	024.0	005.0	208.0	-	-	-	-	-
13	Mohana	18.0	093.4	033.0	008.2	152.6	-	-	-	-	-
14	Shahjina	00.0	016.0	072.0	063.0	151.0	-	-	-	-	-
15	Hamirpur	02.0	036.0	064.8	060.0	162.8	-	-	-	-	-
16	Jalaun	-	062.0	-	019.0	081.0	-	-	-	-	-
17	Kalpi	23.4	049.8	055.6	081.6	210.4	-	-	-	-	-
18	Kanpur FM	20.4	057.4	046.4	108.5	232.7	-	-	-	-	-
19	Dalmau	25.5	022.8	061.6	034.2	144.0	-	-	-	-	-
20	Chhatnag	06.0	007.0	004.4	004.2	021.6	-	-	-	-	-

Note: Highest flood levels at Banda 113.28 m on 14 September 1992 at 16 pm & 110.85 m on 6 September 1978, at Chillaghat 105.16 m on 6 September 1978 at 18 pm

with vertical lift of moisture laden air on 12,13 and 14 September around cyclonic circulation region in lower level was found to be superimposed by high level divergence. The value of convergence at 900 m.a.s.l. for the area Lucknow, Nagpur and Gorakhpur on 12 September 1992 at 1200 UTC was found to be 4.57515×10^{-5} / sec and divergence at 250 hPa on the same area and at the same time was found to be 0.25725×10^{-5} / sec. Similarly convergence and divergence on 13 September, 1992 at 0000 UTC was found to be 1.28625×10^{-5} / sec and 0.25725×10^{-5} / sec and 14 September on 0000 UTC 3.6015×10^{-5} / sec respectively. These are calculated by Bellamy's Grid method. Calculations have shown that these values of convergence and divergence are significantly high for causing heavy rain storm. During the north-west ward movement of low pressure area

close to Ken catchment and then recurving north-eastwards with strong low level convergence and high level divergence, yielded heavy to very heavy precipitation.

3. It is mentioned earlier, heavy rainfall occurred in the Ken river catchment from 11 to 14 September, 1992. In Fig. 1, cumulative rainfall for the period 11 to 14 September, 1992 has been plotted. It is clearly shows that the rain storm centre was closed to Panna station, which lies in the centre of the Ken river catchment. Figs. 4 & 5 depicts rainfall *vis-a-vis* gauge level of Banda and Chillaghat gauge discharge (G/D) sites. Table 1 shows daily rainfall/danger level/water level and highest flood levels at G/D site Banda & Chillaghat. It can be seen that the Ken river was flowing much below danger level

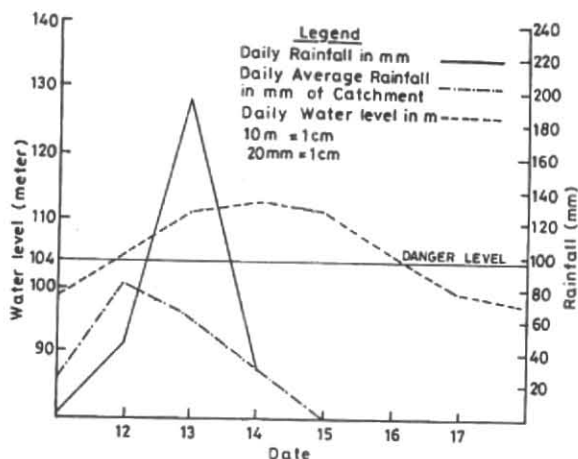


Fig. 4. Water level, daily rainfall at gauge-discharge site Banda

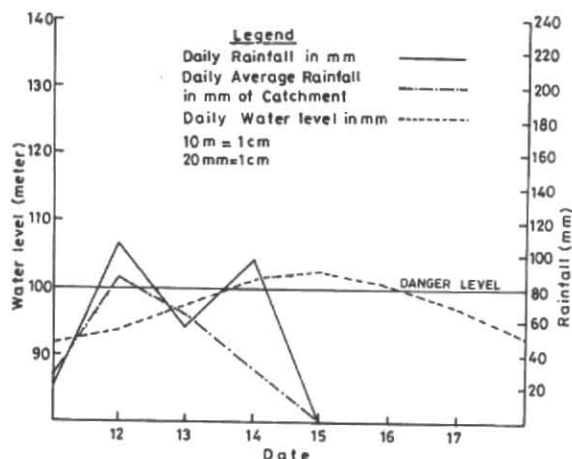


Fig. 5. Water level, daily rainfall at gauge-discharge site Chillghat

before the occurrence of rainstorm. However, it started rising after 11 September crossed the danger level (104.0 meters) on 12 and reached to the peak level (113.28 meters) on 14, showing that peak level was 9.24 meters above danger level at Banda. The Ken river started receding at Banda with effect from 15 September. The Ken river which was flowing below danger level at Chhatnag upto 11, started rising afterwards crossing the danger level (100.0 meters) on 14 September and reached to the peak level (101.44 meters) on 15 September. This clearly matches with the downflow from Banda. The Ken river basin is rocky and slopy, due to that there is quick run-off into the river, Flood fury was further aggravated because the Yamuna river was already in flood and was flowing above danger level that obstructed the flood flow of Ken into the Yamuna. It is observed that in monsoon season whenever meteorological systems approaches from the Bay of Bengal towards the plains of Uttar Pradesh and starts recurring these systems, produce heavy precipitation over the plains of U.P.

(a) During southwest monsoon season, low pressure areas/depressions moving northwestwards from Bay of Bengal start recurring after they reach the plains of Uttar Pradesh. On this process the river basins of this region get heavy to very heavy precipitation. Hence should be carefully watched.

(b) Meteorological systems lying over Ken river area, having good convergence in lower troposphere and divergence in upper troposphere give copious rains.

Author's are thankful to Dr. R.K. Dube, Dy. Director General of Meteorology, Regional Meteorological Centre, New Delhi, Shri Bhukan La1, Dy. Director General of Meteorology (Hydrology), New Delhi and Shri R.C. Dubey, Director, M.C. Lucknow for offering valuable suggestion and to Mr. Amit Chaudhary, L.D.C. for typing the script.

References

- Apte, N.Y., Das, A.K. and Ram, L.C., 1992, "Trough in low level monsoon westerlies and associated rainfall over Teesta Catchment," *Mausam*, 43, 2, 216-218.
- Biswas, B. and Bhadram, C.V.V., 1984, "A study of major rainstorm of Teesta basin", *Mausam*, 35, 2, 187-190.
- Chaudhary, A.K., Prasad, P. and Prasad, K., 1981, "An analytical study of severe floods of July 1978 in Bagmati and Adhwara group of rivers, *Mausam*, 32, 4, 405-410.

R. K. VERMA
MANNU RAM
L. C. RAM

Meteorological Centre, Lucknow, India
25 April 1996, Modified 16 March 2001