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ANTICYCLONIC TORNADO NEAR RAIPUR IN SOUTHEAST MADHYA PRADESH

Tornadoes are not uncommon in Indian subcontinent. Gupta and Ghosh (1982) have listed reported cases of 35 tornadoes during the period 1876 to 1978. Majority of these tornadoes occurred in pre-monsoon months (March to May) but 5 cases reported to have occurred during monsoon months. However, so far there is no report of occurrence of tornado over southeast Madhya Pradesh.

A tornado occurred at about 1130 IST on 21 August 1990 near a village Pendra in Garyaband district about 95 km SSE of Raipur in southeast Madhya Pradesh. Village Pendra is located near the meeting place of two rivers *Peiry* and *Sendur*. The tornado caused considerable damage to forest trees in a stretch of about 10 km in length and about 50 m in width.

2. *Track of tornado*—The tornado originated near village Pendra on the eastern side of river *Sendur* which is about 70 to 100 m wide and is a rainy seasonal river. Then it moved in a southwesterly direction, crossed the river and traversed over the forest area of north Nagari division of the forests and after covering a path of about 10 km southsouthwest, weakened (Fig. 1).

3. *Details of damage*—The tornado originated at a place where open fields and only a few village houses are located so it did not cause any damage to the houses. Only a few trees on the eastern side of *Sendur* river were uprooted or broken. However, after entering into the thick forest area to the west of *Sendur* river, considerable number of trees were affected on a stretch of about 10 km length and about 20 to 50 m width. According to forest department at Dugli in Dhamtari district about 17,000 trees were affected by the tornado.

4. *Nature of tornado*—The affected area was inspected by going to the spot and photographs of fallen and affected trees were taken.

Fig. 2 shows 3 photographs taken from 3 different directions from point A marked in Fig. 1.

The orientation of the forest road is from southwest to northeast. Fig. 2(a) is a photograph taken facing NW. It will be noticed that the trees on the northwest side of the forest road have fallen towards northeast direction, indicating that the strong winds were from

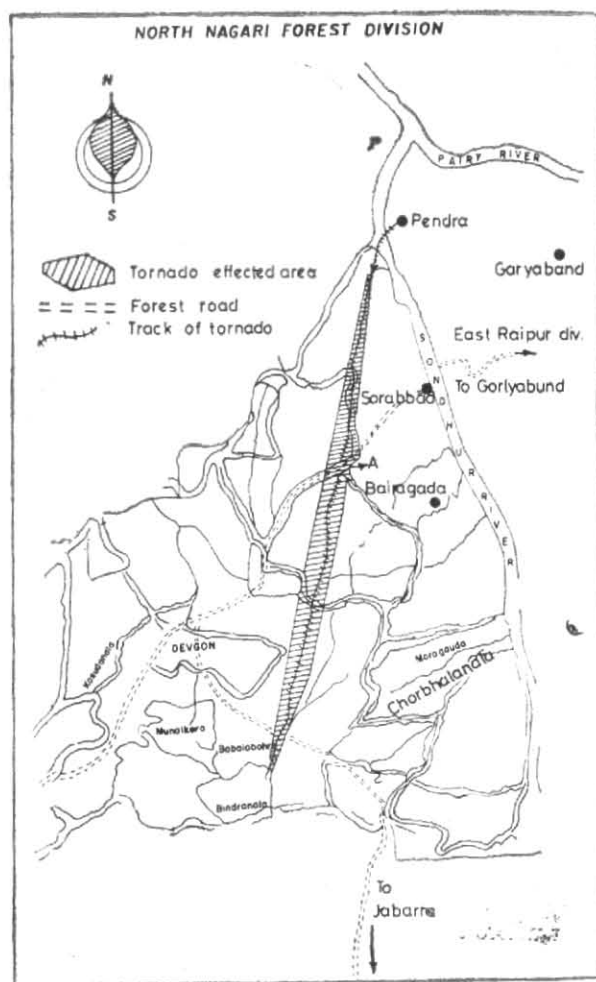
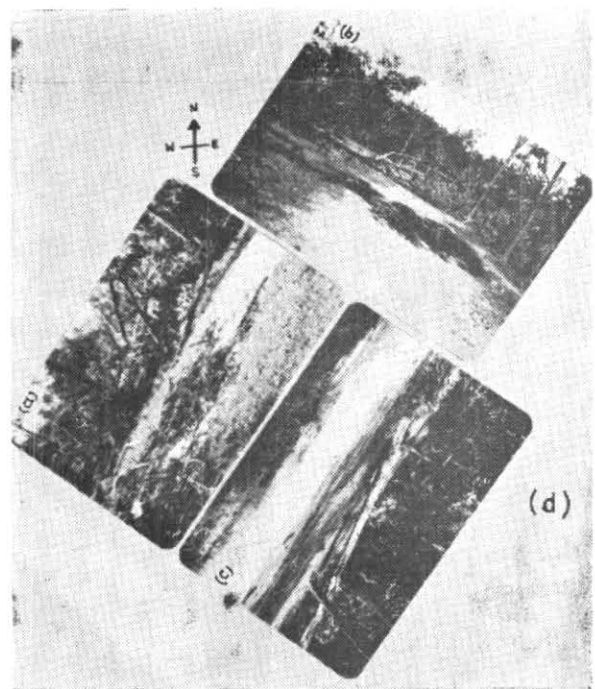
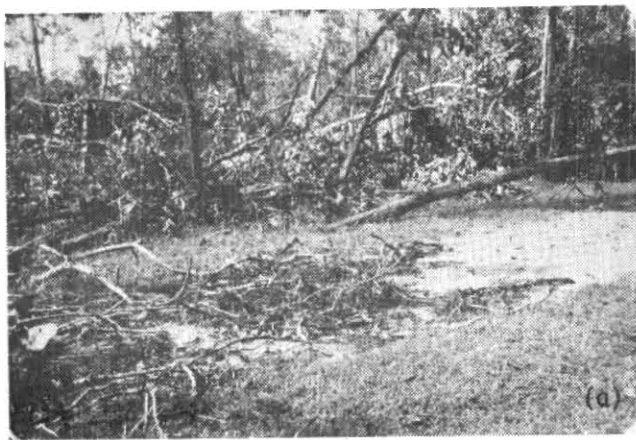


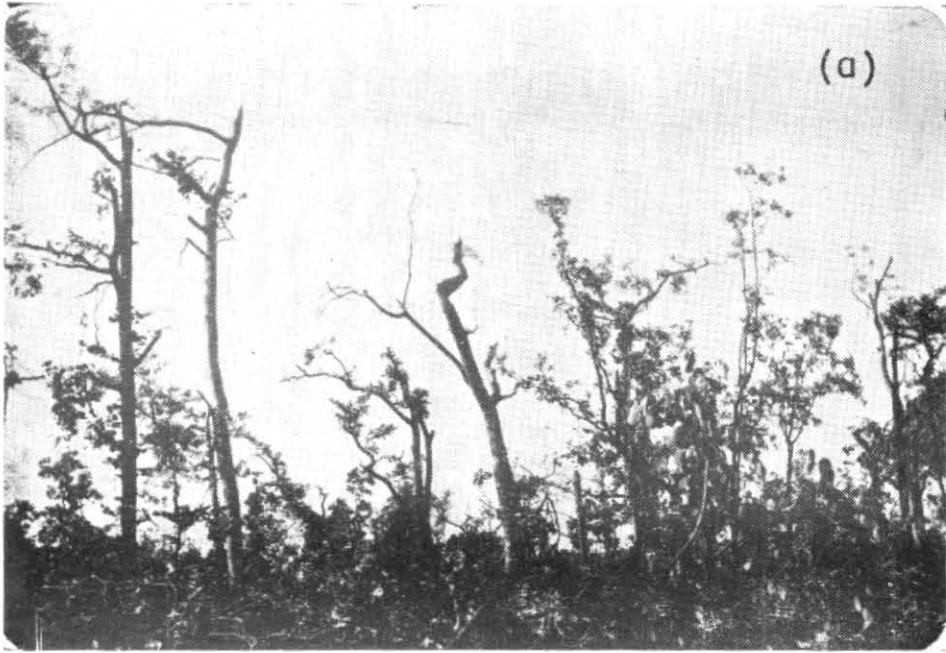
Fig. 1. Track of tornado

southwest. Next photograph [Fig. 2 (b)] taken facing towards northeast indicates the trees fell in southeast direction thus indicating the strong winds from a northwesterly direction. The third photograph [Fig. 2(c)] taken facing southeast shows the trees fallen towards southwest indicating strong wind from northeast. Fig. 2(d) is a combined photograph of Figs. 2 (a-c). From these photographs it is inferred that the tornado had an anticyclonic vortex. Occurrence of such anticyclonic tornadoes has been studied by Fujita (1977) in USA. Fujita (1977) has listed 29 anticyclonic tornadoes during 27-years period 1950-1976. Perhaps, this is the first case of an anticyclonic tornado reported in India.

Figs. 3 (a & b) show the photographs of the trees whose tops had been blown off by the tornado. A forest guard who witnessed the event and disclosed that the tree top branches which broke did not fall down but were seen flying in the cloud mass and rotating in it and were carried away. Thus, the broken tree tops had



Figs. 2 (a-d). Photographs of fallen trees facing towards : (a) NW, (b) NE, (c) SE, and (d) Combined photograph of (a, b, c)



Figs. 3 (a & b). Photographs showing blow off tops of trees

not fallen down but had been sucked away and no part was seen on the ground near the trees. Inspection of the damaged area revealed that there was a typical type of damage to the trees, big branches were torn off, some weaker trees were uprooted. The other neighbouring trees were not affected at all by the tornado. The tornado track, thus, could be easily followed by the damage caused to the trees. Based on the damage to the trees TORRO intensity scale described by Asnani (1985) this tornado can be classified as moderate tornado with Fujita scale F2.

The path length as estimated by the forest department is about 10 km and corresponding Pearson number $PL=2$. The width of the damage path ranged from 20 m at the start and end points and about 50 m at the middle portion thus average width would be 30 m and corresponding Pearson number $PW=1$. Thus, on the FPP scale the tornado will have F2P2P1.

According to eye witnesses a dark mass of cloud was seen hovering in the sky and all other small cloud masses were merging into it. It was associated with loud whirling sound and bright light as if from a fire. After some time black smoky extension was seen descending from it. It moved gradually in a zig-zag way, rotating and changing its course. The trees that came on its way were being uprooted and falling. When it passed over the river *Sendur* the water of the river rose to about 5-7 m and the sandy bottom was visible. It moved further southwest and entered the north Nagari forest area.

A forest guard on duty narrated that he had heard a loud whirling noise from the north. He saw a thick black cloud mass in the sky which was moving southwards and he heard the trees fall. He ran away to a safe place and observed. When the cloud mass approached nearer he saw a smoky column, extending from the cloud mass which was rotating fast and slowly moving towards south. As it moved from north to south the trees were either being uprooted or the tree tops being twisted or broken. He further said that the broken tree top branches did not fall down but were carried away by the rotating column of cloud. When asked he confirmed that there was no smell of smoke at the place over which the smoky column swept.

5. *Synoptic situation*—A depression was lying near Paradip about 500 km ESE of the tornado site. The upper air chart of 0000 UTC of the day indicates a

strong convergence zone at 0.9 km and 1.5 km asl along 82° E longitude in the westnorthwest direction of the depression. The tornado site is also located along 82° E longitude.

It was raining at the site at the time of the occurrence of tornado and the nearest observatory located at Raipur had also reported rain at 0600 UTC.

The thermodynamic aspects of the case could not be studied due to non-availability of the observations of the near by RS stations at Pendra Road and Jagdalpur on that day. Nagpur 0000 UTC sounding, however, on that day indicated 2 to 3° C fall in temperature in middle levels. Upper level winds did not indicate existence of any trough over the area. Radar observations taken at SDR Nagpur did not show any significant echoes near or around Raipur.

6. Conclusions

- (i) It was an anticyclonic tornado — a rare occurrence in India.
- (ii) The tornado formed ahead of the depression in the area of strong low level convergence.
- (iii) It occurred at a distance of about 500 km WNW of the centre of the depression.
- (iv) An upper air trough, mid level and upper level jet winds were absent.
- (v) The movement of the tornado was from NNE to SSW.

References

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