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A Tornado over northwest Assam and adjoining West Bengal on 19 April 1963

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ABSTRACT. On the evening of 19 April 1963, a tornado passed over a few places in Cooch Behar district of North Bengal and adjoining Goalpara district of North Assam. Details of the tornado as far as could be gathered from on-the-spot enquiries have been presented in the paper. The area is frequented with severe thundersqualls and hailstorms, but this one caused the biggest havoc in living memory. The tornado had a track of 36 km. The diameter of the funnel of the tornado where it touched the ground was 100-130m. The rotation was anticlockwise. At three places, the funnel itself showed spiralling motion. There was practically no rain in and around the area affected by the tornado. Hailstones as large as 14 cm in diameter could be observed. The meteorological conditions showed high probability of occurrence of severe thunderstorm over North Assam with possibilities of large hail.

1. Introduction

On the evening of 19 April 1963, a tornado passed over a few places in the Cooch Behar district of West Bengal and adjoining parts of Goalpara district in the northwest Assam causing severe damage to life and property. On the same evening many other places in northwest Assam experienced severe thunderstorms accompanied by squall and large hailstones. Though the area is well known for occurrences of thundersqualls (Nor'westers), this was the biggest havoc caused by the tornado.

Some photographs of devastation caused by the tornado are reproduced (Figs. 1 and 2). One of the authors (J. Nandy) toured the affected places to obtain details of the tornado. The results of the investigation are reported in the present paper.

2. General description

A few minutes before the tornado hit the places, a huge column of black cloud, resembling thick smoke rising from a huge chimney, appeared in the northwest sector of sky. There was a red glow emanating from the lower part of the column and it appeared to many inhabitants of the area to be a big fire that had broken out there. As it approached nearer, churning motion with bits of flying corrugated iron sheets and branches of trees were seen revolving around in the upper part of the huge column.

Also a rumbling sound accompanied the phenomenon. Large hailstones started falling around with very little or no rain. Immediately afterwards, the furious storm which lasted for a very short period of 1/2 to 1 minute devastated the place. Before and after the passage of the tornado, the spraying of mud caused deposition of a uniform mud plaster of nearly 1/8" thickness all over the place. After the passing of the tornado a hot blast of suffocating air was felt by the inhabitants particularly towards the north of the track.

The whole phenomenon had occurred and passed so quickly that people were caught unawares. Those who were inside their houses found the roofs and walls simply lifted up and blown off to the sky over their heads. Many who happened to be outdoors were either lifted up in the air and thrown off to a distance with a fatal injury or were fatally hit by the flying bits of C.I. sheets and other solid missiles. The C. I. sheets from the roofs and walls of houses were torn off to pieces, crumpled, twisted (Fig. 3) and blown off. Big trees were uprooted (Fig. 4) and thrown off to a distance. Bamboo groves which are well known to withstand the fury of severest hurricane storms were found to have been uprooted enmasse (Figs. 5 and 6). Coconut and arecanut trees lying on the track were also broken. Many tube wells were either broken off from the main tube or were bent down by the twisting motion (Fig. 7). Loaded steel trunks, suitcases and household utensils of many houses on the storm track were lifted up and blown off to distances ranging from a few furlongs to a few miles. In the open field, freshly planted paddy and jute plants were sucked in by the tornado along with earth at places.

2.1. *Track*

A line of *Cb* cloud approximately along north-south direction was sighted at Cooch Behar C.W.O. at about 1630 IST. A tornado was seen in the process of formation just north of Cooch Behar airfield between 1650 and 1700 IST when the stem of the funnel was still above ground. As it moved 5-6 km further southeast, it touched the ground at Sholadanga village. The tornado started

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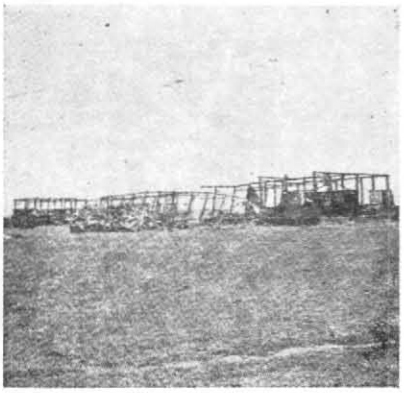

Fig. 1. A school building at Deosarai village in Cooch Behar district devastated by tornado

Note the C. I. sheets roofs and walls almost completely removed leaving only the wooden frames in precarious position

Fig. 2. A village house at Jhapsabari in Goalpara district of Assam demolished by tornado

Note how neatly the cottages have been demolished removing everything except the mud-plinth

Fig. 3. Torn-off and twisted C. I. sheets blown off to distant places were collected and kept together after the tornado was over

Fig. 4. A large banian tree uprooted by the tornado at Harirhat in Goalpara district

Fig. 5. Bamboo bushes uprooted by the tornado

Note the anticlockwise arrangement of the befallen bamboo bushes

Fig. 6. Bamboo groves ransacked by the tornado

Note the anticlockwise arrangement of the bamboos felled by the storm

Fig. 7. The pump of a tube-well broken off from the main tube which was thrown off nearly 30 metres away. The pump is picked up and placed near the main tube for taking photograph

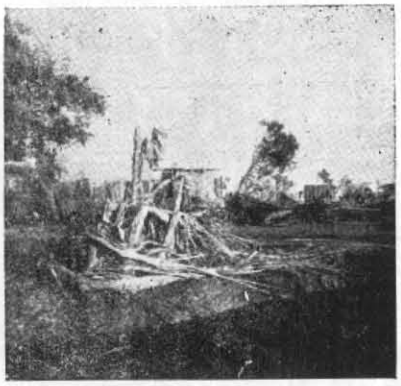

Fig. 9. A cluster of banana trees demolished by the tornado in Balabhut village
Note the anticlockwise arrangement of the befallen banana trees

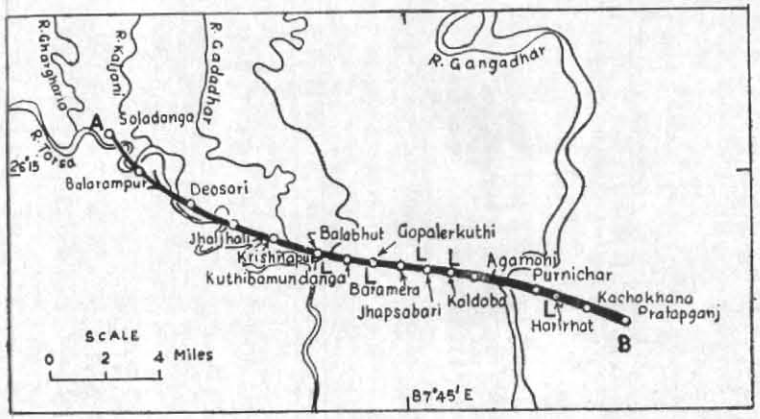

Fig. 8. Storm track
A — Tornado starts devastation at this point at 1710 IST (approx.)
B — Tornado lifts up at this point at about 1740 IST
Length from A to B is roughly 36 km
L — Loops detected at these points from chaotic devastation left over by the tornado

its devastation from this village at 1710 IST and moved in 295°—115° direction. After travelling about 3 km, it moved over a 3 km wide river bed at the confluence of Torsa and Kaljani rivers. After crossing the river bed the tornado became extremely violent and its devastation continued upto Kachokhana village. The tornado maintained its path along 295°—115° from Sholadanga to Agononi (about 25 km), and thereafter followed 270°—90° course upto Kachokhana (another 11 km). Thus the total length of the tornado track had been about 36 km and its breadth at most places was 100/130 metres and at some places it was 200 metres or slightly more. The track as constructed from the evidences of destructions as well as from the reports gathered from eye witnesses is given in Fig. 8. The funnel cloud was seen at Cooch Behar at 1700 IST, and a balloon cloud was seen at Rupsi at 1740 IST. From these data the speed of movement of the tornado is estimated at 80 km/hr.

2.2. *Funnel*

In the beginning near Cooch Behar the stem of the funnel was slanting from north to south as seen from cloud to ground. During its journey it became vertical after some time. An eye witness reported that the funnel was oscillating during its journey along the track. The stem of the funnel also rose above ground and descended again intermittently at some places which was confirmed from inspection of gaps on the paddy fields affected by the tornado. At the end of the track the funnel lifted up and looked like a huge balloon as observed from Rupsi C. W. O. situated about 10 km southwards from the end of the storm track.

According to Brooks (1951), study of devastation on walls, buildings etc do not reveal properly the type of motion inside a tornado as they may have different strengths and some of these might have been sheltered by obstruction like huge trees. So bamboo groves which were so numerous in the

Fig. 10. Tree trunks from which the leaves and branches have been ripped off by the tornado

Note the torn-off C. I. sheets how nicely wrapped into the tree trunks

storm affected area were considered more suitable for studying the rotation inside the tornado. From the regular arrangements the bamboos were lying, it was clear that the whirling motion was anticlockwise (Figs. 5 and 6). From the type of devastation of houses and trees this was confirmed (Fig. 9).

Due to the oscillation of the funnel of the tornado, the track showed a spiralling effect with loops at intervals. In these loops the tornado lasted longer (1-2 minutes) than at places which were simply swept over by it. As a result, the devastation was more severe and chaotic in those places which lay in such loops. It was noticed that a group of fallen bamboos in the ransacked groves lay in two adjacent spots both with evidence of anticlockwise whirl. This, therefore, indicated that the tornado had some sort of spiralling effect at those places. This effect was noticed from the devastation at Balabhut, Jhapsabari and Harirhat.

The suction inside the tornado was tremendous as could be inferred from the heavy articles lifted up by it. Due to the suction effect when the tornado came over the confluence of Torsa and Kaljani rivers, water was sucked in. The river water was flowing fast towards the centre of the tornado. People who saw from south at the time of the tornado crossing the river, observed that river water was flowing in the opposite (to normal) direction. Column of water and sand were seen going up the funnel.

Many persons were lifted up by the tornado and fatally thrown off nearly 500–600 metres away. Instances have also occurred in which persons so lifted up by the tornado have safely landed a little distance away without being injured.

It is difficult to estimate the wind speed inside the tornado. A few facts may, however, help in the matter. Corrugated iron roofs were blown off to a distance of 30 miles from a nearest point of the tornado. C.I. sheets were wrapped in tree trunks and posts (Fig. 10).

2.3. *Other effects*

Outside the tornado limit there had been no devastation. But there had been thundersqualls and hail in the surrounding area.

After the passage of the tornado, some of the affected places and the surrounding area, particularly towards north of the track, experienced thick haze on the following two days. Due to the suction effect of the tornado, considerable amount of dust and sand particles were lifted high up in the air. These were deposited in the surrounding area giving thick layer of dust over everything. The finer particles of dust took much longer time to descend and thus caused dust haze.

Amongst the peculiarities observed during the tornado, a few are described below —

(*a*) An easterly gusty wind 20/25 kts over the affected area before the incidence of the tornado,

(*b*) Unusually warm air with feeling of suffocation was experienced by the inhabitants of the affected area after the passage of the tornado particularly towards the north of the track.

(*c*) Several villagers in the western part of the storm track reported that they had seen two separate storm clouds one appearing from northwest and the other towards westsouthwest. These two cloud masses merged together to produce the huge formation of tornado cloud. However, from the signs of devastations existence of only one tornado could be confirmed.

2.4. *Precipitation*

One peculiarity of this tornado was that there was practically no rain in and around the area affected by it. Almost all the precipitation consisted of hailstones which were very large at Cooch Behar. The biggest one was somewhat like a disc with diameter 14 cm and thickness 9 cm (estimated). The centre was a bit depressed. There were several spikes on the sides. Another one collected at Cooch Behar (residential area of the airfield) was small but was shaped like a pear. This one had no spikes on the side. Near Balabhut village a large spherical hailstone with jagged outer appearance made a hole in the ground due to impact. At this place another very big spherical (about 10 cm diameter) hailstone was found to have three spikes, each about 1 cm in length.

One distinct feature was that, the hailstones collected were very large near the starting place of tornado. The size of the hailstones was probably same near the places where tornado was active,

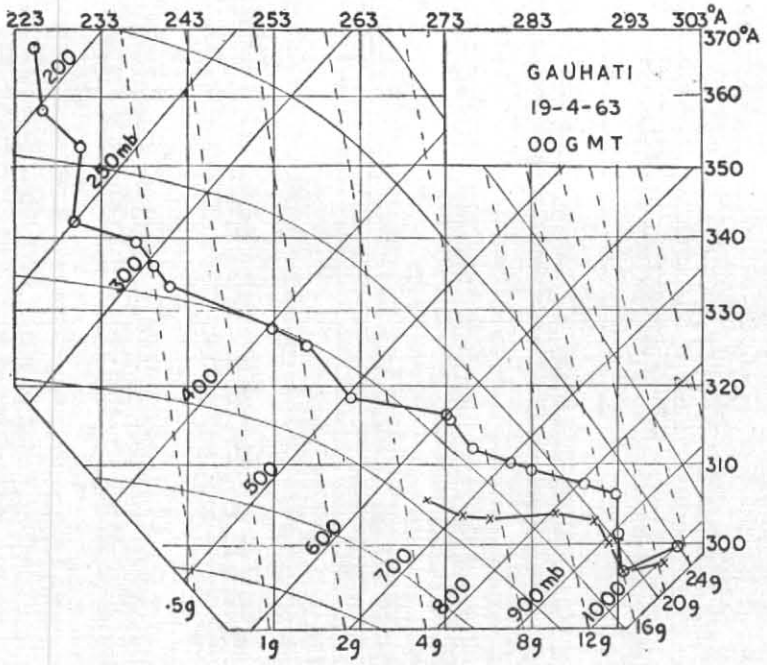

Fig. 11

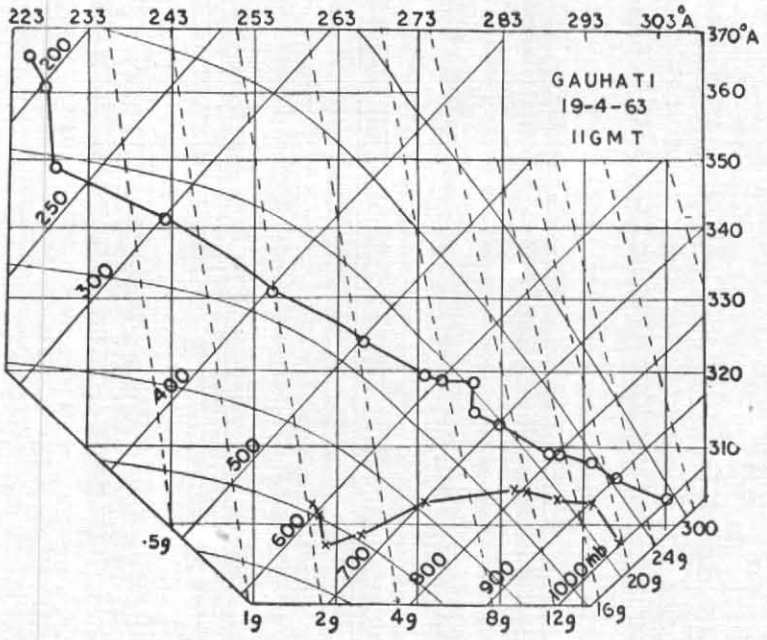

Fig. 12

There was sudden diminution in size of hailstones at the places where the funnel finally lifted up. At the Rupsi Observatory, there were some spherical hailstones (diameter not more than 2 cm) and a few drops of very cold rain. Another important feature was that almost all the people who noticed the hailstones carefully, reported them to be opaque.

3. Discussions

3.1. *Meteorological conditions*

Analysis of existing data indicated that there was incursion of moist air into Assam as a whole on this day. There was also an east-west wind discontinuity over Upper Assam between warm

moist southwest/southerly air and drier cool easterlies from northeast. Hence widespread thunderstorm activity was expected over Assam (Sen and Basu 1961). Upper wind data for the 19th were, however, inadequate for the purpose of analysis.

Tephigrams of Gauhati airport for morning and evening of 19th are reproduced in Figs. 11 and 12. It will be seen that both morning and evening tephigrams show instability, the former showing more. The evening radiosonde ascent was taken between 1640 and 1720 IST. Towards the end of this period the tornado was occurring at 120 miles to the upstream. It is, therefore, more reasonable to think that the evening radiosonde data represent the atmospheric condition under which tornado and the severe nor'westers occurred over Assam. A comparison of the evening data with the normal radiosonde data for April afternoon over Gauhati indicated that the physical properties of air were nearly normal except that the air above 1500 m a.s.l. was slightly dry. The morning tephigram, of course, showed large area of positive energy indicating the possibility of very severe thunderstorms.

One feature noticed is that strong winds which normally remain at high levels descended down to 3·0 km.

3.2. *Size of hailstones*

Fawbush and Miller (1953) found that almost every hailstorm situation was associated with low level inversion in the morning radiosonde ascents. In the present case also low level inversion was observed in the morning radiosonde ascent at Gauhati (Fig. 11).

Fawbush and Miller gave method of evaluating hailstone size upto a maximum of 4″ diameter. Assuming that same method is applicable for bigger size stones, this was used to evaluate the size in the present case. It was found that hailstones as big as 6″ diameter might occur according to the morning radiosonde data. Hailstones as big as 2·25″ were expected according to the afternoon data.

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