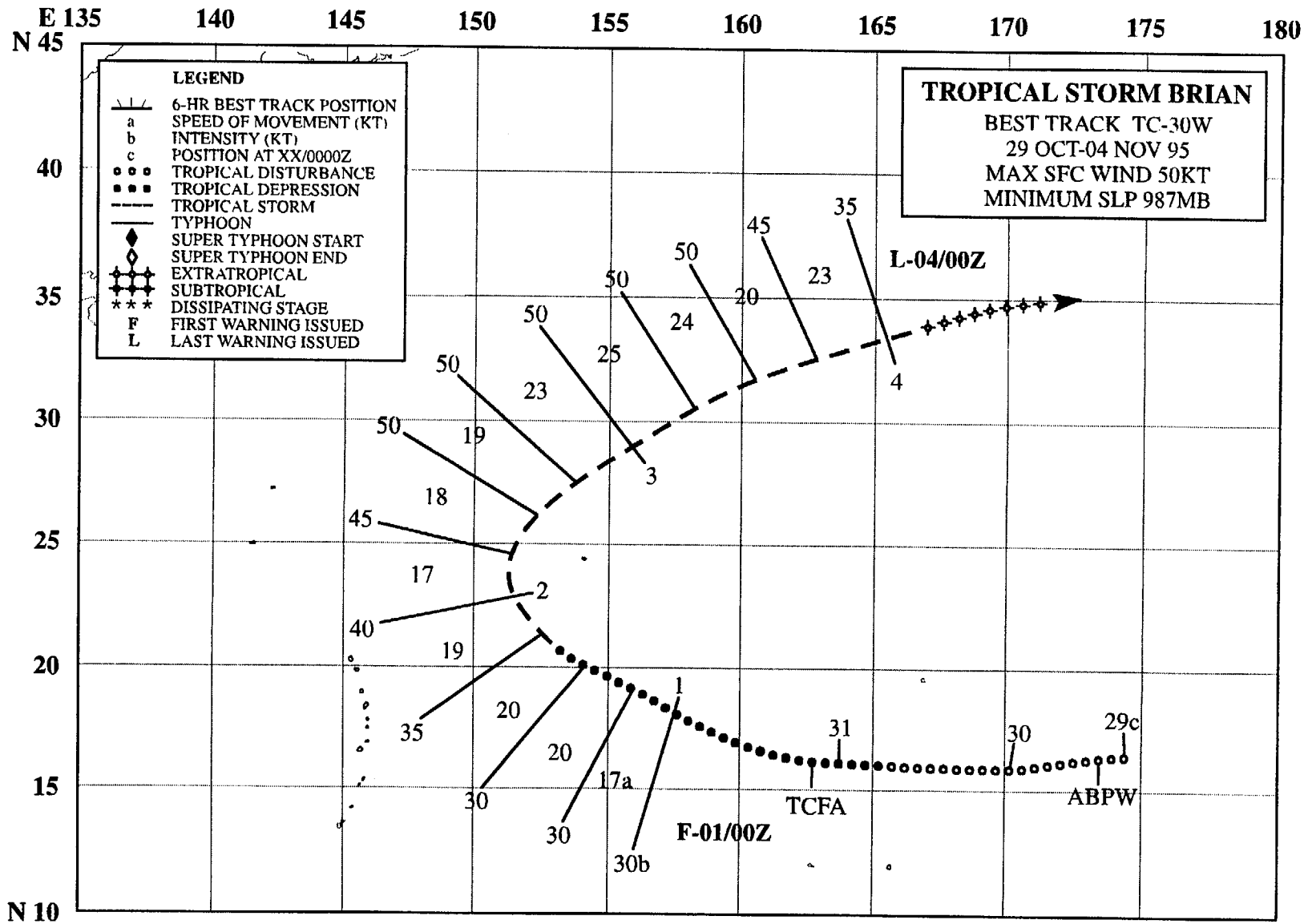
E 135
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LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
TROPICAL STORM BRIAN
BEST TRACK TC-30W
29 OCT-04 NOV 95
MAX SFC WIND 50KT
MINIMUM SLP 987MB
L-04/00Z
F-01/00Z
TCFA
ABPW
50
50
50
50
50
45
35
23
20
24
25
23
19
18
45
17
2
40
19
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20
30
30
30b
17a
1
31
30
29c
4
3

TROPICAL STORM BRIAN (30W)

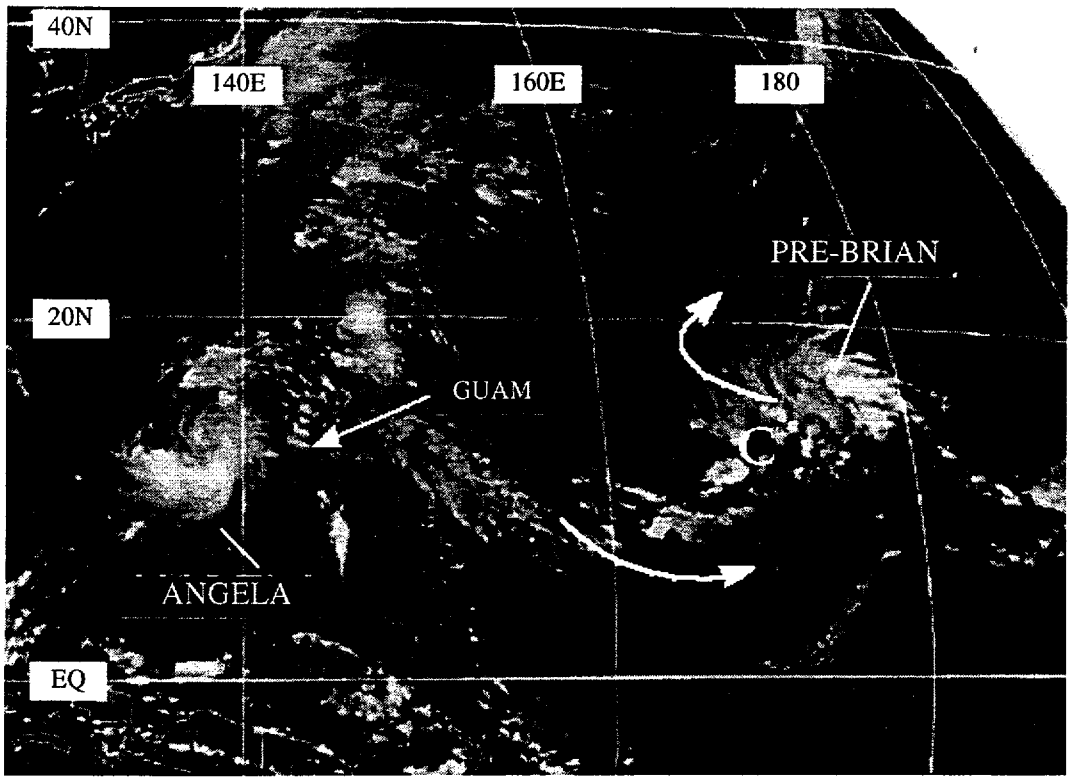

Figure 3-30-1 The indicated area of deep convection located to the northeast of a TUTT cell (labeled, C) that was the precursory tropical disturbance from which Brian developed (290633Z October Infrared GMS imagery).

I. HIGHLIGHTS

Brian formed in direct association with a TUTT cell. Typical of such tropical cyclones, Brian was small and embedded in the easterly wind flow on the southwestern flank of the low-level subtropical ridge. Prior to recurving and becoming absorbed into the cloud band of an advancing cold front, Brian's entire cloud system was isolated within a large relatively cloud-free region south of the polar front and to the north of the convection associated with the tradewind trough.

II. TRACK AND INTENSITY

Based upon over 48 hours of persistence, an area of deep convection that was located to the north of the Marshall Islands was first mentioned on the 290600Z October Significant Tropical Weather Advisory. This area of deep convection (Figure 3-30-1) was associated with a TUTT cell (Figure 3-30-2a,b). On 31 October, the deep convection consolidated to the northeast of the TUTT cell and became better organized (Figure 3-30-3), prompting the JTWC to issue a Tropical Cyclone Formation Alert at 310500Z. By the daylight hours of 01 November, visible satellite imagery indicated that the cloud system had become well-organized, and the first warning on Tropical Depression 30W, valid at 010000Z November, was issued.

In advance of an approaching frontal system (Figure 3-30-4), Tropical Depression 30W turned northward and intensified. It was upgraded to Tropical Storm Brian on the warning valid at 020600Z (post-analysis indicated that tropical storm intensity was reached 12 hours earlier at 011800Z). Brian was at its point of recurvature at this time, and subsequently began to accelerate to the northeast. It continued to intensify following recurvature reaching a peak intensity of 50 kt (26 m/sec) during the period

021200Z to 031200Z. As Brian moved northeast, the frontal system to its west was catching up with it. Overtaken by the frontal system on 04 November, Brian lost its deep convection and merged with the frontal cloud band. The final warning on Tropical Storm Brian was issued valid at 040000Z November when the weakening tropical cyclone began to merge with the frontal cloud band.

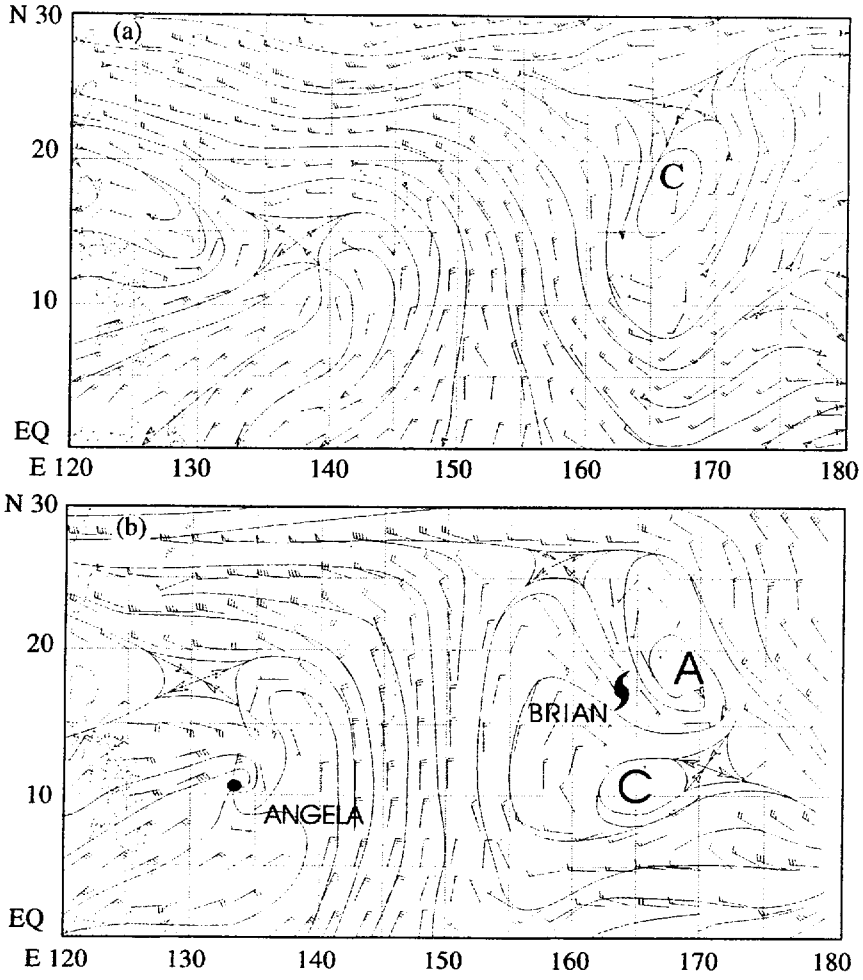

Figure 3-30-2 (a) A TUTT cell (labeled, C) is located north of the Marshall Islands (281200Z October NOGAPS 200-mb windbarbs and streamlines). (b) The TUTT cell (labeled, C) moved southward as diffluent and anticyclonically curved flow became established over the developing Brian (indicated by the tropical cyclone symbol). The center of an anticyclone is labeled, A. (310000Z October NOGAPS 200-mb windbarbs and streamlines).

III. DISCUSSION

Formation in direct association with a TUTT cell

A persistent feature of the upper-tropospheric flow over the tropics of the western North Pacific and North Atlantic oceans during the summer is the tropical upper tropospheric trough (TUTT) (Sadler 1975). In the western North Pacific, the axis of the TUTT overlies low-level easterly flow approximately mid-way between the axis of the subtropical ridge and the axis of the monsoon trough.

In synoptic analyses, the TUTT is commonly observed to consist of a chain of westward moving synoptic-scale cyclonic vortices called "TUTT cells" in the western North Pacific, and, "upper cold lows" in the Atlantic. The typical distribution of clouds associated with a TUTT cell features isolated cumulonimbi and/or small mesoscale convective systems in, or near, its core. Cloudiness to the south and east of a TUTT cell in the western North Pacific is often associated with the monsoon trough, and the TUTT cell (or a chain of TUTT cells) may affect the distribution of cloudiness along the axis of the trough and also of the cirrus outflow from the monsoon cloud band (e.g., see Figure 3-26-1 in Ward's summary).

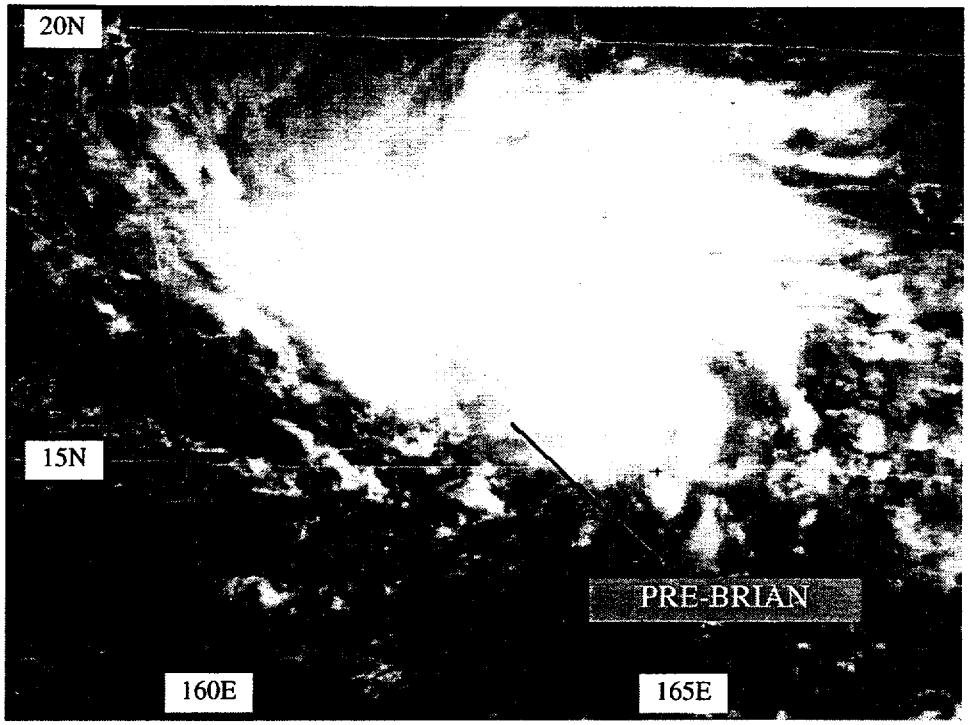

Figure 3-30-3 Cyclonically curved bands of deep convection associated with some poorly defined cyclonically curved low-level cloud lines indicated that the tropical disturbance that became Brian was intensifying (302331Z October visible GMS imagery).

Sadler (1967) proposed that the TUTT (with its embedded TUTT cells) was the primary source for disturbances (e.g., inverted troughs, isolated areas of deep convection, etc.) in the tradewind flow. Sadler (1967) also credits TUTT cells with the capacity to induce tropical cyclogenesis. TUTT-induced tropical cyclogenesis was envisioned by Sadler to be the result of the distal penetration of the TUTT cell's cyclonic circulation into the lower levels, thereby initiating deep convection which, through the release of latent heat, gradually converted the TUTT cell into a warm-core low (i.e., a tropical cyclone). In a later paper (Sadler 1976), the TUTT (and of TUTT cells within it) is hypothesized to contribute to the development of a tropical cyclone by providing an efficient outflow channel for the incipient tropical cyclone. In this scenario, the tropical cyclone is located to the south or southeast of the TUTT, or a TUTT cell.

In our investigations of the role of the TUTT — and in particular, TUTT cells — in tropical cyclone formation, we have observed a process whereby a small tropical cyclone forms (sometimes rapidly) under diffluent and anticyclonically curved flow to the east through north of the TUTT cell. This process is similar to Sadler's (1967) distal mechanism of TUTT cell-induced tropical cyclogenesis. Careful observation has shown that the isolated area of deep convection that forms a tropical cyclone near a TUTT cell, does so not directly in the core of the TUTT cell, but usually 200 to 400 km to the north or northeast of the circulation center of the TUTT cell. Brian was a good example of tropical cyclogenesis in direct association with a TUTT cell. Typical characteristics of direct TUTT-induced tropical cyclones include:

(1) rapid formation;
(2) small size;
(3) isolation in an easterly low-level flow regime;
(4) a relatively cloud free environment;

(5) a relatively high latitude of formation (i.e., near the latitude of the axis of the TUTT — usually at about 20-30°N); and,

(6) initial motion with a component south of west.

IV. IMPACT

No reports of damage or injuries attributable to Tropical Storm Brian were received at the JTWC.

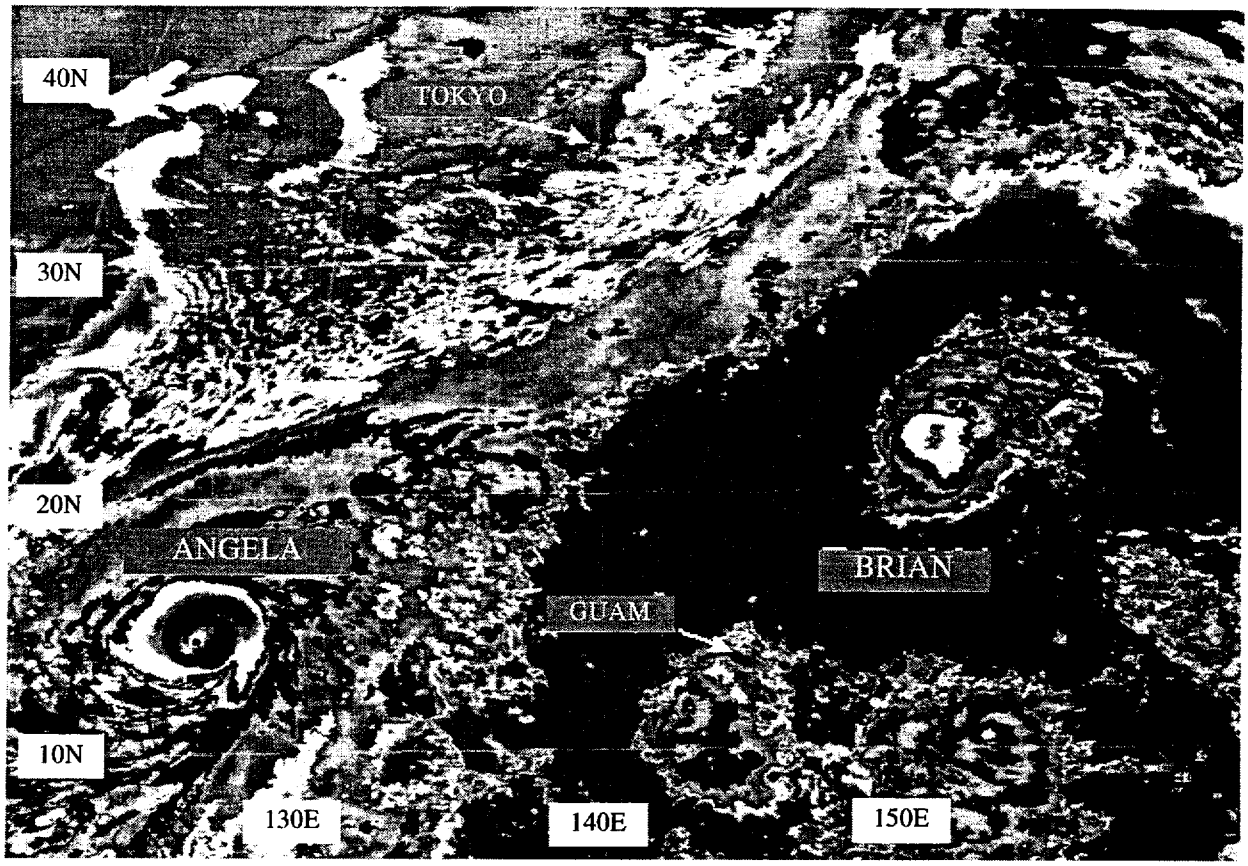

Figure 3-30-4 In advance of an approaching frontal system, Brian recurves and intensifies (012031Z November enhanced infrared GMS imagery).