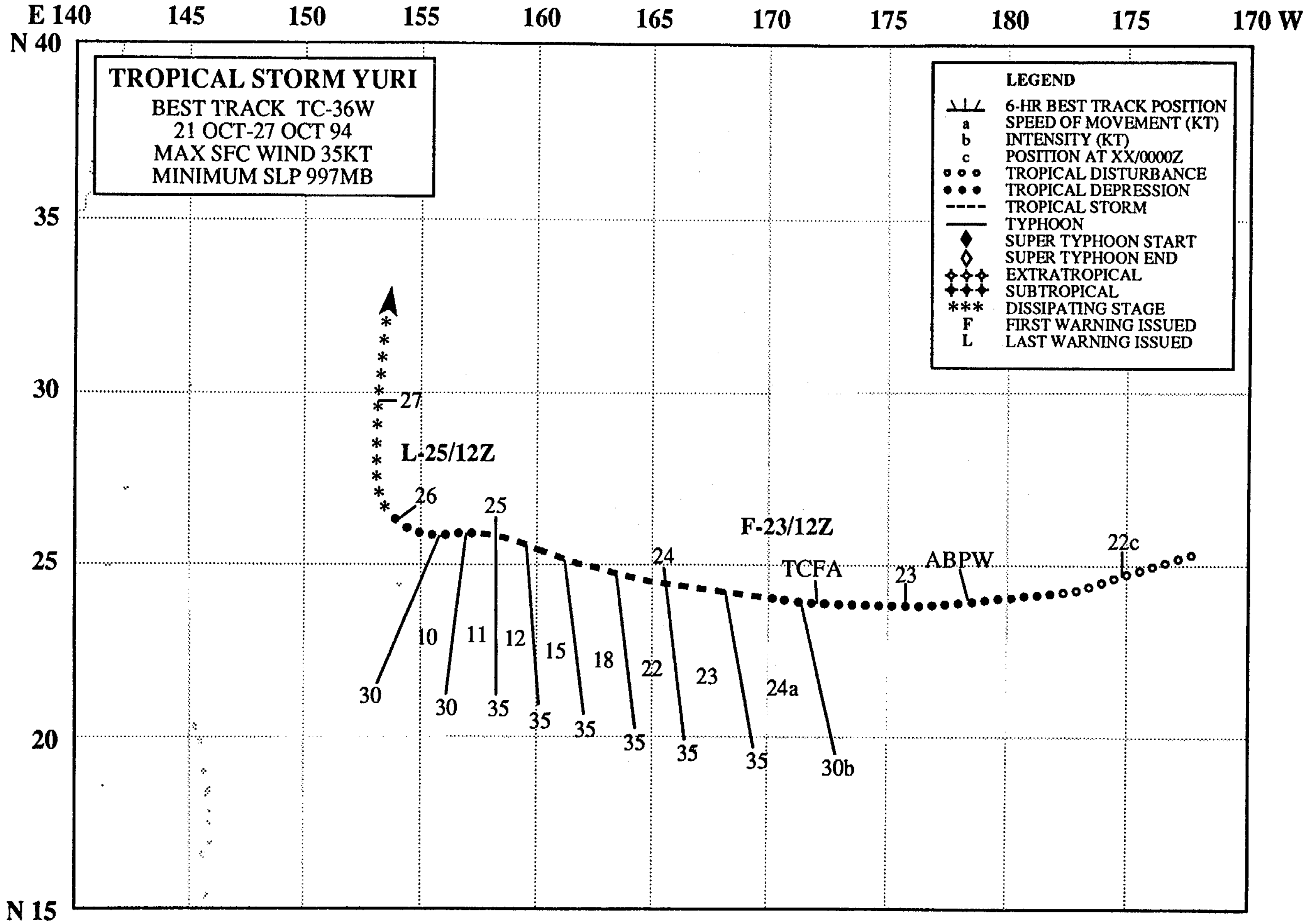
TROPICAL STORM YURI
BEST TRACK TC-36W
21 OCT-27 OCT 94
MAX SFC WIND 35KT
MINIMUM SLP 997MB
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
E 140
145
150
155
160
165
170
175
180
175
170 W
N 40
35
30
25
20
N 15
27
L-25/12Z
26
25
F-23/12Z
24
TCFA
23
ABPW
22c
10
11
12
15
18
22
23
24a
30
30
35
35
35
35
35
35
30b

TROPICAL STORM YURI (36W)

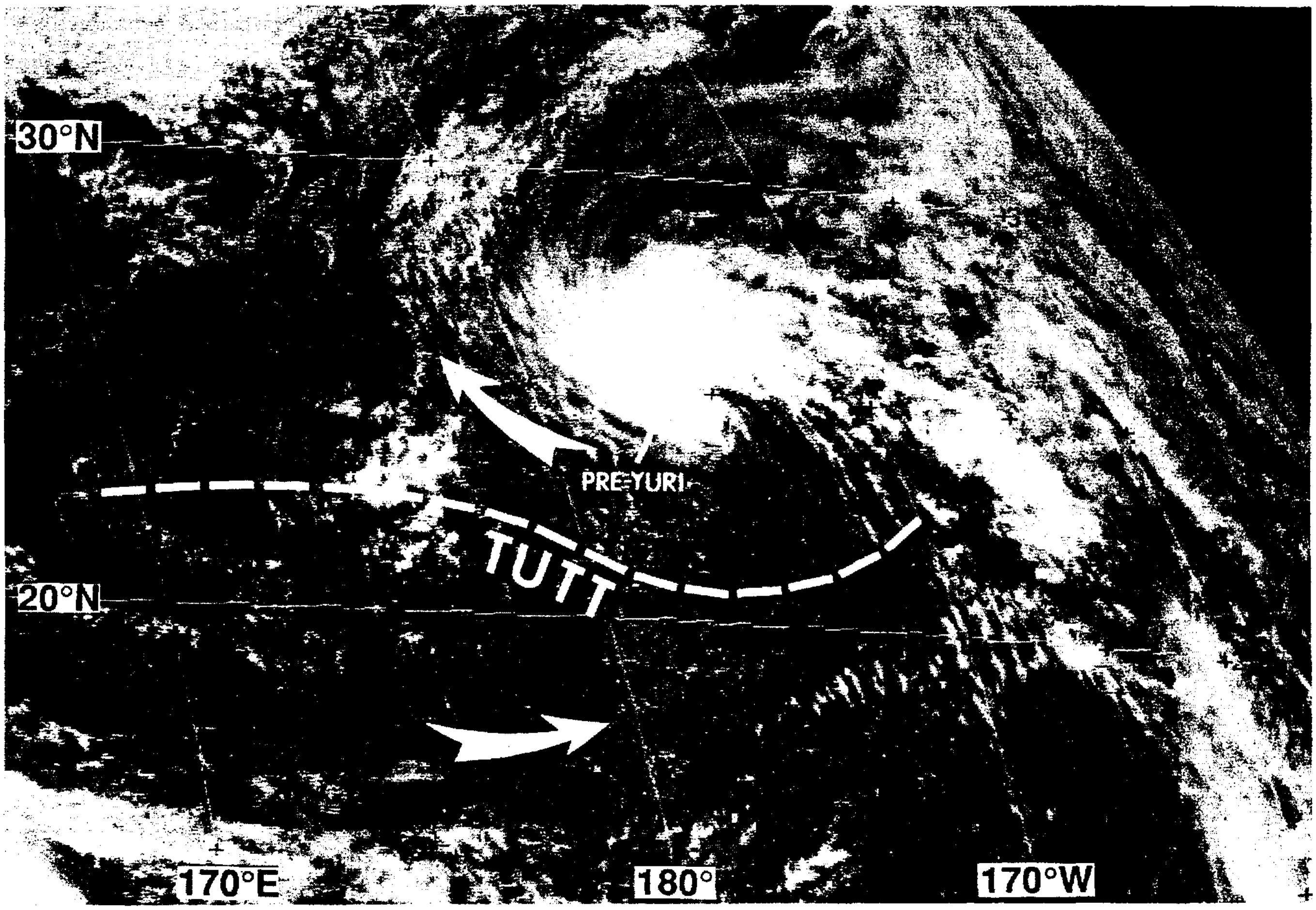

Figure 3-36-1 The tropical disturbance which later became Tropical Storm Yuri is seen northwest of Hawaii along the axis of the TUTT (212331 visible GMS imagery).

I. HIGHLIGHTS

Yuri was a small, short-lived tropical cyclone which formed at relatively high latitude (25°N) in direct association with a TUTT cell. Forming east of the international date line in a relatively cloud-free area (Figure 3-36-1), the disturbance that became Yuri, moved rapidly westward at 21 kt (40 km/hr). For a couple of days, the low-level southwest monsoon stretched from the Philippines all the way out to the south of Yuri. This temporarily placed Yuri at the eastern reaches of the reverse-oriented monsoon trough that also included Teresa (34W), Verne (33W), and Wilda (35W).

II. TRACK AND INTENSITY

The low-level circulation of the western North Pacific during late October was dominated by an active monsoon trough. In the upper troposphere, the axis of the tropical upper tropospheric trough (TUTT) stretched along 25°N from about 150°E to a position (30°N ; 160°W) northwest of Hawaii. This TUTT overlaid a relatively cloud-free region between the monsoon cloudiness to the south and the cloudiness associated with the polar front to north. A distinct area of persistent convective clouds formed in association with a TUTT cell that was northwest of Hawaii on 22 October. This area of con-

Figure 3-36-2 The remnant low-level circulation of Yuri (252331Z visible GMS imagery).

vection was clearly associated with a low-level circulation center. Moving rapidly westward at nearly 21 kt (40 km/hr), this circulation crossed the international date line shortly after 221200Z. The 221800Z October Significant Tropical Weather Advisory noted that a weak low-level circulation center which appeared to be developing beneath a TUTT cell had crossed the international date line. Based upon well-organized low-level cloud lines in satellite imagery, a Tropical Cyclone Formation Alert was issued at 230000Z. The first warning on Tropical Depression 36W was issued at 231200Z. The rationale for issuing the first warning is stated in the prognostic reasoning message (WDPN34 PGTW 231500):

"... [at 231200Z] animated infrared satellite imagery shows that Tropical Depression 36W is moving rapidly westward near Wake island. Well-defined lower level cumulus lines are evident on infrared metsat data as well as DMSP nighttime visible imagery. There is a lack of deep convection near the center, but animation shows the cloud elements spinning around the cyclone center at a velocity estimated at 30 to 40 knots. It is possible that this system is most intense at the 850-700 mb level above the surface. We have no [conventional] synoptic data to support our current intensity estimate. The Dvorak satellite analysis model for intensity estimates does not handle these types of hybrid systems very well, so it is likely the satellite intensity estimates on Tropical Depression 36W [may] be significantly lower than the actual winds at the surface."

During the night of 23 October, a small area of deep convection formed on the southeastern side of the well-defined low-level circulation center of Tropical Depression 36W. In addition, low-level cloud motion (obtained from the satellite-derived cloud-motion bulletin issued by the JMA) of 40 kt (20 m/sec) was observed on the north side of the circulation. These data prompted an upgrade of the system to Tropical Storm Yuri at 231800Z. Yuri remained at minimal tropical storm intensity until 250000Z. The loss of all deep convection and a degradation in the appearance of the low-level cloud lines, indicated that the system had weakened to tropical depression intensity at 250600Z. The final warning was issued at 251200Z. The remnant low-level circulation of Yuri (Figure 3-36-2) was captured nicely by the scatterometer aboard the ERS-1 satellite at 260000Z (Figure 3-36-3).

III. DISCUSSION

a. Unusual genesis

Most of the tropical cyclones of the western North Pacific form along the axis of the monsoon trough. On rare occasions, a tropical cyclone forms from a small convective cloud cluster in direct association with a TUTT cell. The cloud system of such tropical cyclones is often isolated in the relatively cloud-

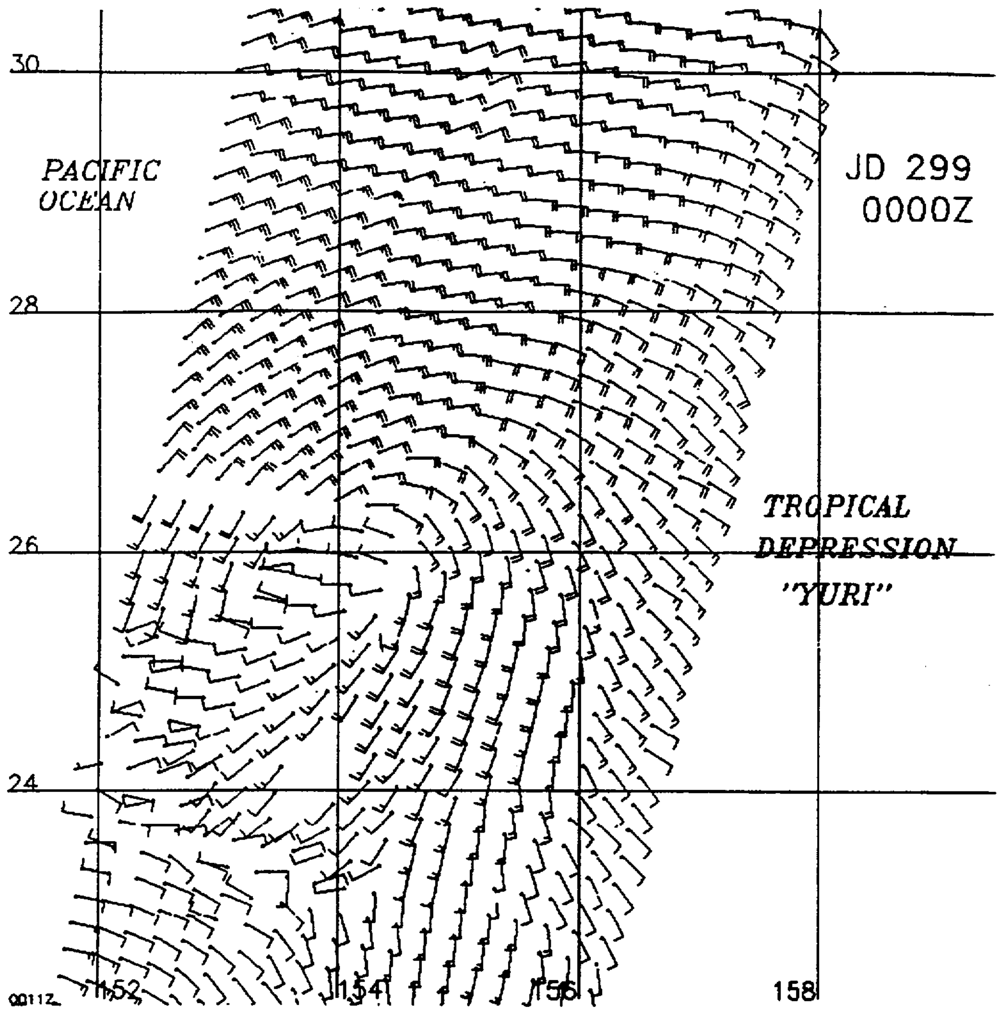

Figure 3-36-3 Low-level wind flow derived from the scatterometer aboard the ERS-1 satellite showing the remnant circulation of Yuri (260000Z October ERS-1 scatterometer-derived wind).

free region between the cloudiness associated with the monsoon trough and the cloudiness associated with the polar front. These TUTT-cell induced tropical cyclones are usually small-sized and isolated in easterly low-level winds (i.e., the low-level wind returns to easterly a few hundred kilometers equatorward of the system). (see also the summary of Tropical Depression 31W, which — like Yuri — formed in direct association with a TUTT cell.)

In recent years, we have observed that tropical cyclones which form along the TUTT axis, in association with TUTT cells, tend to form to the northeast of the center of the TUTT cell where the upper-level winds are from the south or southeast, and are highly diffluent (Figure 3-36-4a,b). This mode of formation is quite different from the influence of TUTT cells on tropical cyclone development suggested by Sadler (1976). In this paper, Sadler hypothesizes that TUTT cells aid tropical cyclone development by providing a diffluent upper-level outflow region in the southeast quadrant of a TUTT cell which is located to the northwest of a developing tropical cyclone (Figure 3-36-4c). In an earlier paper by Sadler (1967), he hypothesizes that TUTT cells may penetrate to the surface and create an inverted trough or a vortex in the tradewind flow. In fact, he claims that TUTT-cell penetration to the surface is the primary source for disturbances in the trade winds during summer. This process, though providing a better description of the formation of Yuri and TD 31W (and of other recent tropical cyclones (e.g., Gordon, 1989) observed to have formed in direct association with TUTT cells), lacks a description of the role of

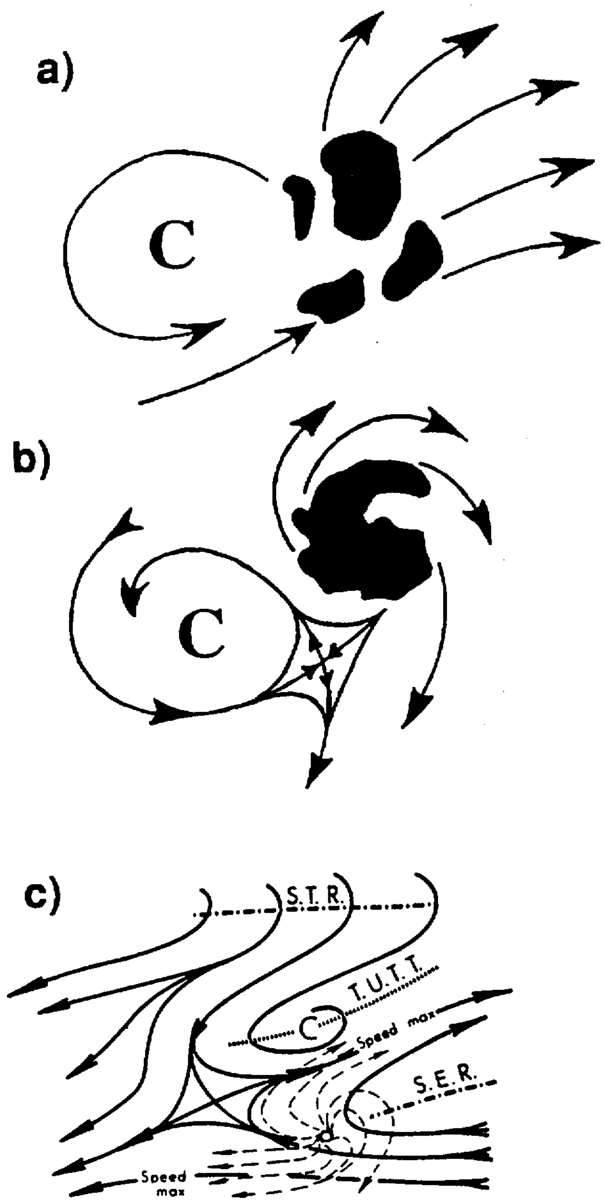

Figure 3-36-4 (a) Cloud clusters to the east of a TUTT cell prior to development of a low-level circulation center. (b) A tropical cyclone which has evolved from a cloud cluster near a TUTT cell. Black silhouettes represent deep convection, arrows depict 200 mb flow, large "C" represents the center of the TUTT cell. (c) A TUTT cell provides an upper-level outflow channel to a developing tropical cyclone (After Sadler, 1976). STR is the subtropical ridge; SER the sub-equatorial ridge; TUTT, the tropical upper tropospheric trough.

deep convection in the formation of the surface low, and is vague about whether the tropical cyclones that form in such cases are initiated by the reflection of the TUTT cell at the surface or whether they are independently produced by convective processes associated with the TUTT cell.

IV. IMPACT

No reports of serious damage or injuries were received.