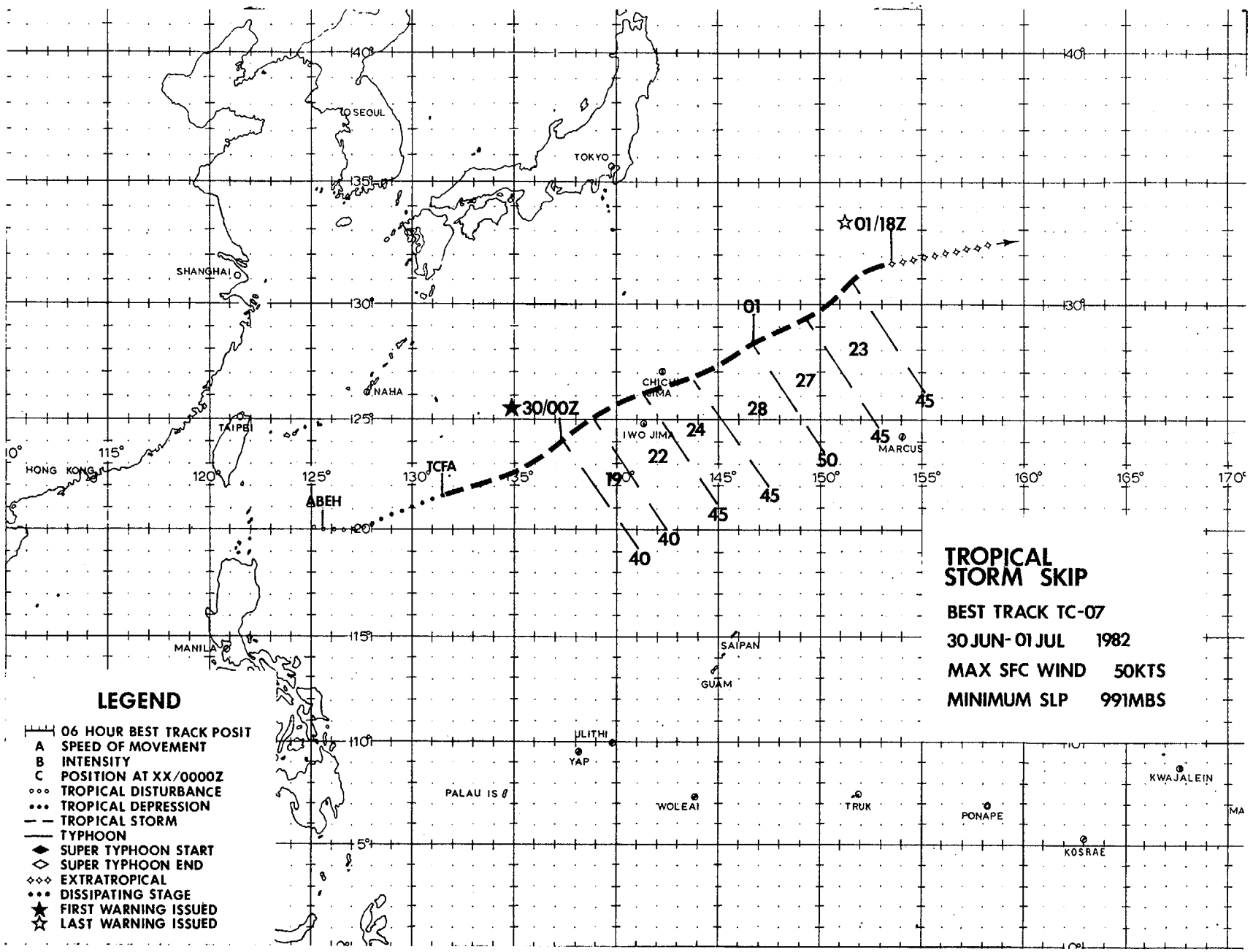
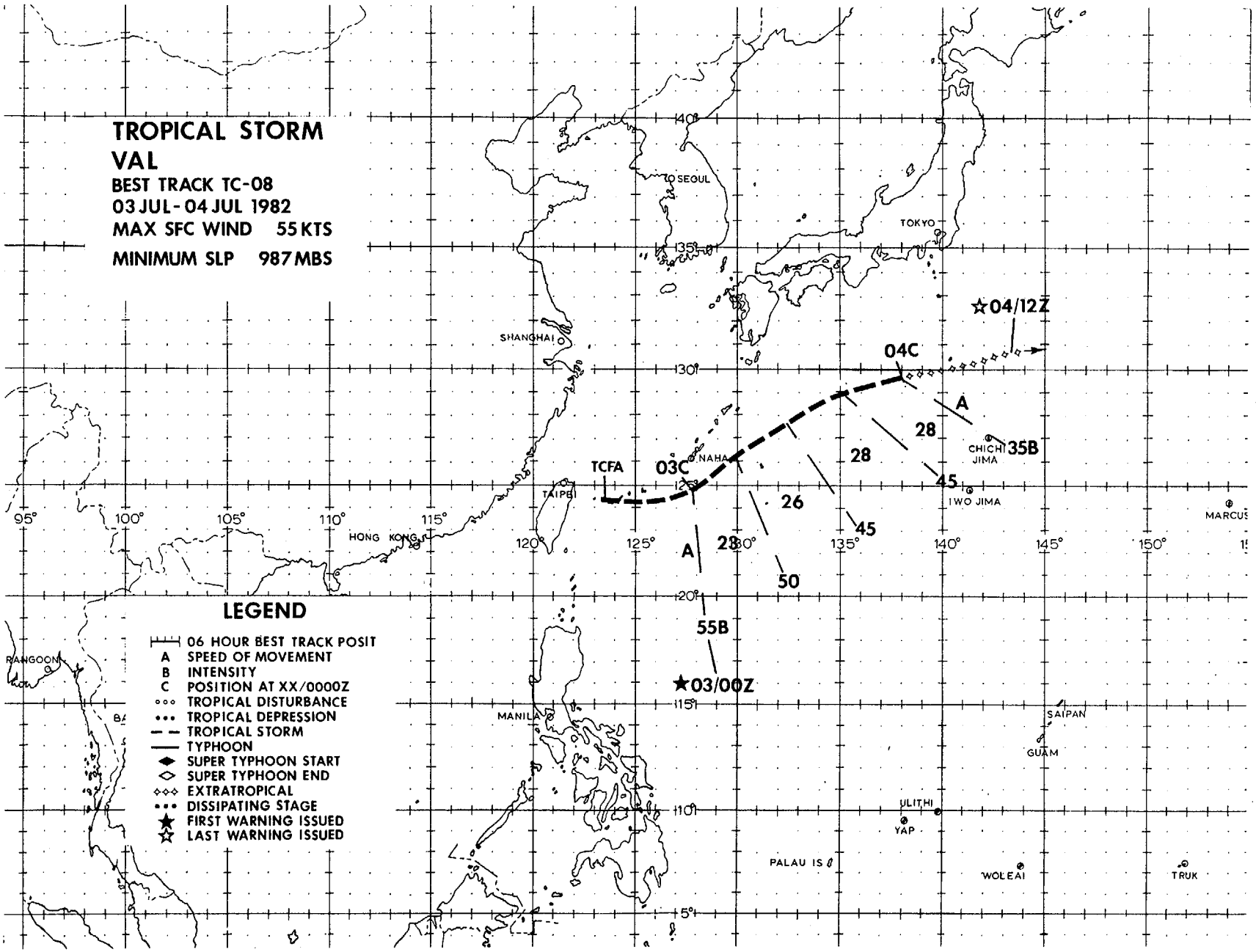

TROPICAL
STORM SKIP
BEST TRACK TC-07
30 JUN- 01 JUL 1982
MAX SFC WIND 50KTS
MINIMUM SLP 991MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
☆01/18Z
★30/00Z
TCFA
ABEH
01
19
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MARCUS
MANILA
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
KWAJALEIN


TROPICAL STORM
VAL
BEST TRACK TC-08
03 JUL - 04 JUL 1982
MAX SFC WIND 55 KTS
MINIMUM SLP 987 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
RANGOON
MANILA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
TCFA
03C
04C
35B
55B
☆04/12Z
★03/00Z
A
28
45
26
50
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
150°
40°
35°
30°
25°
20°
15°
10°
5°

Each tropical cyclone season sees a few circulations develop near the mid-latitudes which appear to have both tropical and extratropical characteristics. These "hybrid" or "subtropical" cyclones have long been known to the tropical forecaster. In particular, an article by Herbert and Poteat (1975) describes several distinguishing characteristics that allow differentiation between tropical and subtropical systems based upon satellite imagery (Table 3-07-1). The week between 23 June and 5 July saw two such circulations, Tropical Storms Skip and Val, develop southeast of Taiwan. During their existence each of these relatively small and compact systems were observed to have several characteristics associated with non-tropical cyclones, e.g. very little deep-layer convection near the surface center, displacement of convective features poleward and eastward of the system center, and each remained entirely enveloped within a larger cloud system associated with the mid-latitude westerlies. Conversely, both aircraft and satellite reconnaissance data indicated some typical tropical characteristics, i.e. a sharp pressure gradient near the center, surface winds in excess of 45 kt (23 m/sec), warm central temperatures, and a small but uniquely tropical upper-level anticyclonic outflow pattern.

The origin of the first circulation, Tropical Storm Skip, was more tropical in nature. The disturbance was first detected near 20N 124E on 26 June when surface synoptic data indicated the presence of a circulation that was subsequently apparent as an exposed low-level circulation on satellite imagery. Synoptically, a sharp trough existed between this area and Typhoon Ruby (05), which was in its initial phases of extratropical transition near 30N 130E. Although satellite imagery indicated that frontogenesis had begun, it is unclear from the available data just how far south along the trough the front could be identified. To the west, an active monsoon trough, which was soon to spawn Tropical Storm Tess (06) in the South China Sea, had also begun to push into the area. During the next three days, winds in excess of 15 to 20 kt (8 to 10 m/sec) could be detected in the monsoon flow south of the circulation; however, very little organized convection could be detected near the vortex. In the upper-troposphere, westerlies penetrated as far south as 25N (at 500 mb) and 20N (at 200 mb) as the result of deep troughing behind the now extratropical Ruby. By 29 June the 200 mb flow began to ridge strongly along the trough boundary and 60 to 70 kt (31 to 36 m/sec) westerly winds to the north were soon accompanied by 65 kt (33 m/sec) northeasterly winds south of the trough. This resulted in an extensive cloud band more than 500 nm (926 km) wide along this entire region. A Tropical Cyclone Formation Alert (TCFA) was issued at 290500Z when a small upper-level anticyclone appeared to be developing in the vicinity of the low-level circulation (Figure 3-07-1).

TABLE 3-07-1. SUBTROPICAL AND TROPICAL CYCLONES

A. DETERMINING TYPE

	SUBTROPICAL	TROPICAL
1. Main convection	Poleward & eastward from center	Equatorward & eastward from center
2. Cloud system size	Width 15° latitude or more	Width usually less than 10° latitude
3. Interaction with environment	Convective cloud system remains connected to other synoptic systems (Some cold lows excepted)	Cloud system becomes isolated

B. DETERMINING ORIGIN

1. Frontal band - typical cloud structure
2. East of upper trough - amorphous convective cloud mass
3. Cold low - circular cloud pattern with limited convection near center

(From Herbert and Poteat, 1975)

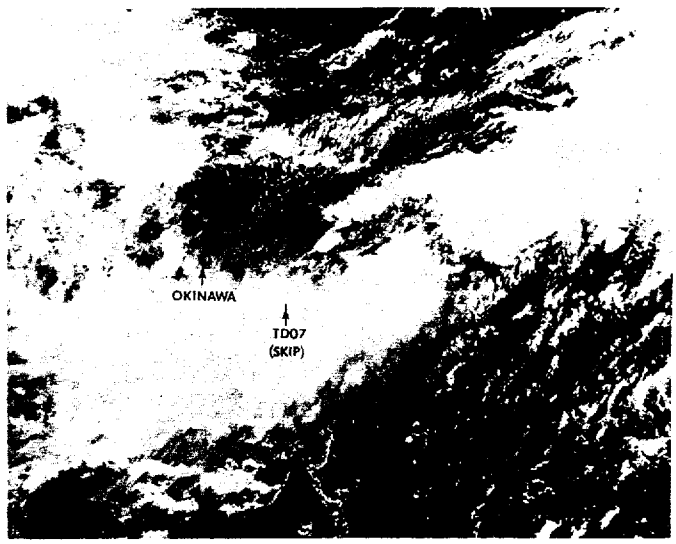


Figure 3-07-1. A developing low-level circulation can be detected within the confines of a broad large-scale cloud pattern. Weak upper-level outflow can be detected at 290526Z June (NOAA 7 visual imagery).

An aircraft investigative mission on 30 June located a 991 mb center with surface winds of 45 kt (23 m/sec), prompting the first warning to be issued at 300000Z. During the next 36 hours, Skip moved quickly northeastward along the frontal trough, averaging over 24 kt (44 km/hr), however its convection remained weak and generally restricted to within 120 nm (222 km) of its northern and eastern sides (Figure 3-07-2). Throughout Skip's lifetime, the Aerial Reconnaissance Weather Officers (ARWOs) consistently reported very little convection near the center, rather large light and variable wind centers, and an abundance of stratocumulus entrainment. By 011600Z July, all convection had dissipated from the vicinity of Skip's center and the upper-level anticyclone was no longer visible, indicating that the storm had completed its extratropical transition.

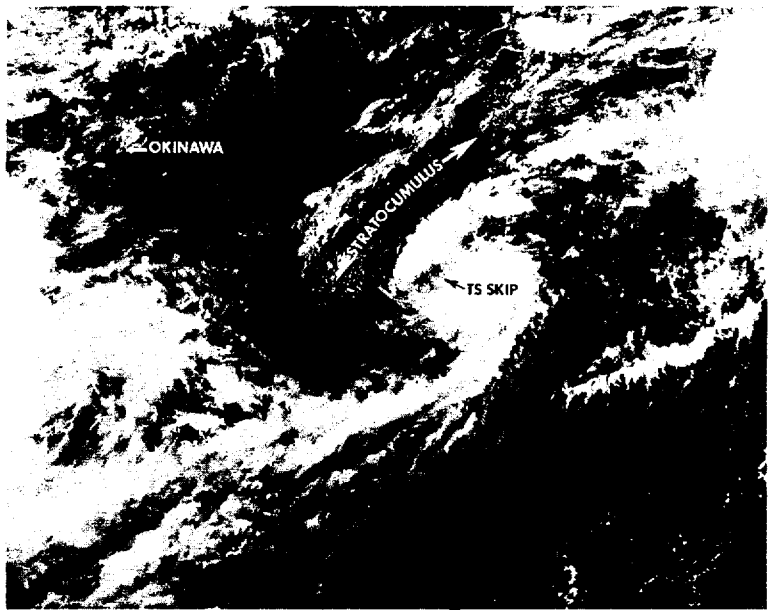


Figure 3-07-2. Tropical Storm Skip's exposed low-level circulation can be seen at 300514Z June to the south and west of its major convective area. Note the extent of stratocumulus to the north of this system. (NOAA 7 visual imagery).

As Skip was moving rapidly toward the northeast, a new circulation could be identified from 1 July synoptic data, just east of Taiwan. At this time, the frontal trough ran westward from Skip into the vicinity of northern Taiwan. Upper-level westerlies prevailed throughout the region although sharp ridging south of the 200 mb jet still maintained the large band of clouds. Isolated convection was present throughout this cloud mass, although none could be identified with the low-level circulation as it remained quasistationary. However, aircraft reconnaissance at 020115Z did identify a 995 mb center with winds up to 35 kt (18 m/sec) in the flow south of the circulation, thus a TCFA was issued. Convection finally began to develop near the circulation's center by 021200Z and, when the next aircraft mission found that the circulation had moved eastward and deepened to 987 mb, the first warning was issued at 030000Z. As was the case for Tropical Storm Skip, Val moved quickly northeastward along the trough, averaging over 26 kt (46 km/hr). Also like Skip, convection remained weakly organized and restricted to within 100 to 200 nm (185 to 370 km) of the system's center (mostly on the northern and eastern sides). As can be seen in Figure 3-07-3, Val still displayed its own individual outflow pattern despite being embedded within the larger cloud mass. By 040000Z, Val had lost all of its convection and could no longer be identified on satellite imagery as it completely merged into the frontal zone.

Both Tropical Storms Skip and Val contained many of the characteristics of sub-tropical cyclones identified in Table 3-07-1. Although monsoonal flow probably helped initiate Skip's low-level vortex, its further development and propagation can more likely be attributed to its position in relation to the eastern side of the upper trough. This is especially true of Val which formed farther north. Convection for both storms remained weak and unorganized and, partially due to strong westerly vertical shear, the low-level centers were often exposed with convection remaining poleward and eastward. Figures 3-07-2 and 3-07-3 show that each system did eventually become partially isolated from the dominance of the mid-latitude westerlies and displayed their own anticyclonic outflow pattern.

Re-analysis of synoptic and satellite data revealed that Skip and Val were not the only circulations to develop during this unique period. At 300000Z, Skip (located near 24N 137E) could be seen flanked by circulations (or frontal waves) at 34N 153E, 31N 143E and 20N 125E. Similar conditions occurred for Tropical Storm Val as well. On the synoptic-scale each was only a small part of an extensive mass of clouds along the eastern boundary of a very active mid-latitude upper-level trough.

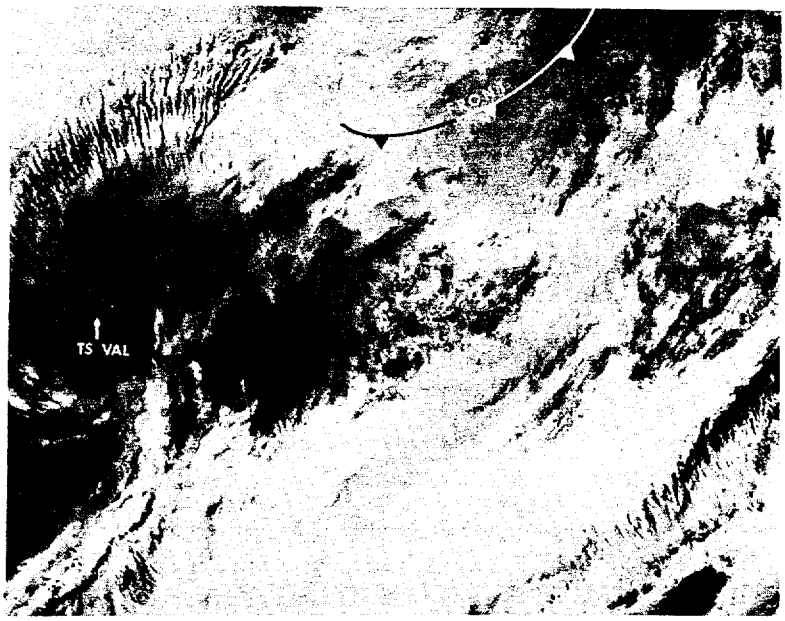


Figure 3-07-3. Tropical Storm Val's unorganized convection and outflow pattern can be seen with respect to larger frontal cloud mass pattern at 031723Z July. (NOAA 7 infrared imagery).