EXECUTIVE SUMMARY

The 2001 tropical cyclone season marked the completion of three consecutive record breaking years for tropical cyclone (TC) forecast accuracy for JTWC. JTWC had the best forecast performance in its 43-year history as well as the lowest standard deviation for forecast tracks ever, indicating a more consistent and accurate forecast. The improved track forecasts are attributed to the proactive use of consensus forecast methods in JTWC operations. TC intensity errors also decreased by 17 % at 72 hours between 2000 and 2001. This improvement in TC intensity forecasting can be at least partially attributed to the implementation of Dr. Kerry Emanuels Coupled Hurricane Intensity Program and the use of an Intensity Consensus derived from several intensity forecast aids.

While JTWC made great strides forward, there is still work to be done to improve the operational support provided to the Army, Air Force, Navy, and Department of State. JTWCs mean track errors of 73 nm, 122 nm, and 180 nm at 24, 48, and 72 hours still fell short of the USCINCPAC goals of 50 nm, 100 nm and 150 nm. TCs such as Pabuk (14W), Nari (20W), and Vamei (32W) all illustrate the need for improved TC reconnaissance, modeling, and TC position and intensity analysis and forecasts.

During 2001, JTWC operations continued to change to meet the demands of evolving DOD operations. JTWC started the process of moving the Alternate JTWC site from NAVPACMETOCCEN Yokosuka to the FLENUMETOCCEN Moneterey. This move will be completed by May 2002, and will ensure the facilities and personnel are available to provide a robust infrastructure for Pacific and Indian Ocean TC warning operations.

The events of September 11th focused attention on the impacts of TCs on the air bridge and forces stationed throughout the Pacific and Indian Oceans in support of Operation ENDURING FREEDOM.

JTWC continued efforts to develop working relationships with the World Meteorological Organization Regional Specialized Meteorological Centers and National TC Warning Centers throughout its area of responsibility. The strategic objective is to produce better TC forecasts through the sharing of knowledge and information.

The success of this year's TC warning operations can only be attributed to the people and organizations that worked together to support the operator. The personnel of JTWC, Fleet Numerical Meteorology and Oceanography Center, Air Force Weather Agency, Naval Research Laboratory, Naval Post Graduate School, NOAA Hurricane Research Division, NOAA National Environmental Satellite Data and Information Service, Cooperative Institute for Meteorological Satellite Studies, Massachusetts Institute of Technology, and others formed a team that broke all previous records. JTWC will continue to work with the TC community to exploit science, technology, and training in order to provide the best possible support to the sailors, soldiers, and airmen who stand in harms way.

FOREWORD

The Annual Tropical Cyclone Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a joint Navy/Air Force organization under the command of the Commanding Officer, Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center (NPMOC/JTWC) located in Pearl Harbor, Hawaii.

The mission of JTWC as directed by USCINCPAC Instruction 3140.1W (series) is multifaceted and includes:

1. Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from the west coast of the Americas to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.

2. Issuance of warnings on all significant tropical cyclones in the area of responsibility.

3. Determination of requirements for tropical cyclone reconnaissance and assignment of appropriate priorities.

4. Post-storm analysis of significant tropical cyclones occurring within the Western North Pacific and North Indian Oceans.

Colocated with the JTWC is the 17th Operational Weather Squadron Satellite Operations branch (SATOPS), which executes the PACAF Executive Agency Responsibility for Tropical Cyclone Reconnaissance support. SATOPS primary mission includes the following:

1. Conduct 24-hour meteorological watch on all tropical and subtropical disturbances within the JTWC AOR.

2. Make and disseminate tropical cyclone observations based on all available data. Provide positions every 3 hours and intensities every 6 hours or more frequently as requested by the Typhoon Duty Officer.

3. Report positions, estimated intensities, and warning criteria wind radii of significant tropical cyclones in these regions.

Additionally, in 2001, SATOPS took on the task of providing metsat graphics and fix statistics for the ATCR.

Special thanks are extended to the following organizations for their timely support of the JTWC mission:

Alternate Joint Typhoon Warning Center (NAVPACMETOCCEN Yokosuka)

Fleet Numerical Meteorology and Oceanography Center

Air Force Weather Agency

NOAA Environmental Satellite Data and Information Service

Naval Research Laboratory, Monterey

Naval Postgraduate School.

Of specific note, we would like to thank the following individuals:

Mr. Charles R. "Buck" Sampson and Ms. Ann Schrader, et al, for their constant support and continued development of the Automated Tropical Cyclone Forecasting System.

Dr. Lester E. Carr III, for continuing work on the Systematic and Integrated Approach to Tropical Cyclone Forecasting.

Mr. Jeff D. Hawkins, et al, for continuing efforts to exploit remote sensing technologies.

University of Hawaii Department of Meteorology graduate students, Mr. Sean Daida, Ms. Cynthia Palmer, Mr. Kevin Mallen, and Mr. Andrew Levine for their contributions to JTWC.

The men and women of the USPACOM tropical cyclone warning network, who participate in locating the tropical cyclone and help disseminate the tropical cyclone warning to the operational customer.

1. SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

1.1 WESTERN NORTH PACIFIC OCEAN TROPICAL CYCLONES

Tropical cyclone genesis regions compared to the 15-year average are shown in Figure 1-1. This year's tropical cyclones are listed in Table 1-1. Table 1-2 shows the monthly distribution of tropical cyclones for each year since 1959 and Table 1-3 shows the monthly average occurrence of tropical storms separated into: (1) typhoons only; and (2) tropical storms and typhoons. A summary of this year's Tropical Cyclone Formation Alerts is shown in Table 1-4. The annual number of tropical cyclones of tropical storm strength and higher appear in Figure 1-2, while the number of super typhoons are shown in Figure 1-3. Composites of the tropical cyclone best tracks for the western North Pacific appear following Figure 1-3.

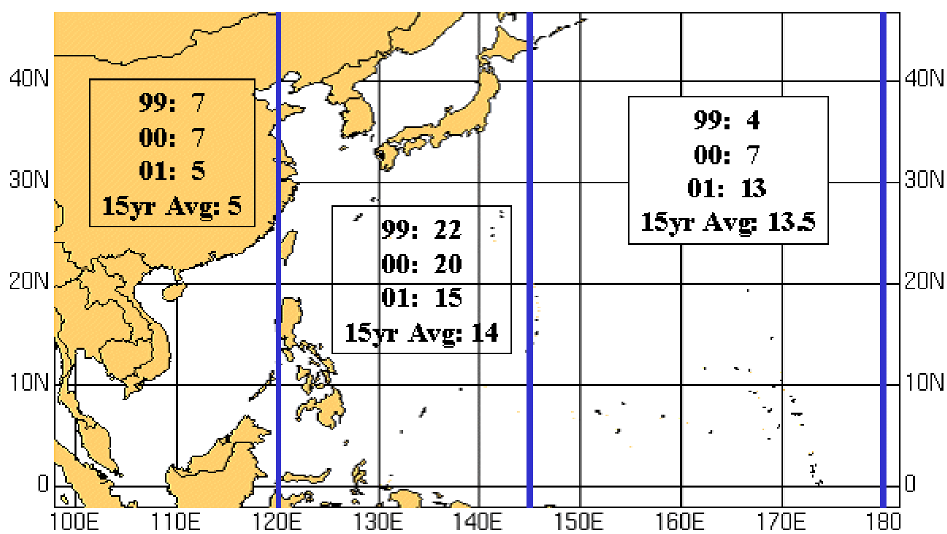


Figure 1-1. Comparison of the number of tropical cyclones that developed within 3 designated areas for 1999, 2000, 2001 and the 15-year average.

Table 1-1 WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES FOR 2001 (01 JAN 2001 - 31 DEC 2001)

TC	NAME	PERIOD	WARNINGS ISSUED	EST MAX SFC WINDS KTS (M/SEC)	MSLP (MB)**
TD 01W	-	18 Feb 20 Feb	10	25 (13)	1002
TD 02W	-	18 Apr 19 Apr	3	25 (13)	1002
TS 03W	(CIMARON)	07 May 14 May	31	60 (31)	980
TY 04W	(CHEBI)	19 Jun 24 Jun	18	100 (51)	943
TY 05W	(DURIAN)	29 Jun 02 Jul	13	75 (39)	967
TY 06W	(UTOR)	01 Jul 06 Jul	23	80 (41)	963
TS 07W	(TRAMI)	09 Jul 12 Jul	14	40 (21)	994
TD 08W	-	10 Jul 11 Jul	3	25 (13)	1002
TY 09W	(KONG-REY)	21 Jul 28 Jul	29	85 (44)	958
TY 10W	(YUTU)	22 Jul 26 Jul	15	85 (44)	958
TY 11W	(TORAJI)	25 Jul 31 Jul	24	100 (51)	943
TY 12W	(MAN-YI)	01 Aug 08 Aug	29	120 (62)	922
TS 13W	(USAGI)	09 Aug 10 Aug	8	40 (21)	994
TY 14W	(PABUK)	14 Aug 22 Aug	36	90 (46)	954
TD 15W	-	24 Aug 25 Aug	3	30 (15)	1000
STY 16W	(WUTIP)	27 Aug 02 Sep	28	130 (67)	910
TS 17W	(SEPAT)	27 Aug 30 Aug	13	45 (23)	991
TS 18W	(FITOW)	29 Aug 31 Aug	11	45 (23)	991
TY 19W	(DANAS)	03 Sep 12 Sep	38	105 (54)	938
TY 20W	(NARI)	06 Sep 21 Sep	61	100 (51)	943
TY 21W	(VIPA)	17 Sep 21 Sep	20	75 (39)	967
TY 22W	(FRANCISCO)	19 Sep 25 Sep	28	100 (51)	943
TY 23W	(LEKIMA)	22 Sep 29 Sep	32	95 (49)	949
TY 24W	(KROSA)	03 Oct 09 Oct	23	105 (54)	938
TY 25W	(HAIYAN)	11 Oct 17 Oct	26	90 (46)	954
STY 26W	(PODUL)	19 Oct 27 Oct	36	140 (72)	898
TY 27W	(LINGLING)	06 Nov 12 Nov	26	115 (59)	927
TS 28W	-	18 Nov 24 Nov	25	35 (18)	997
TS 29W	-	20 Nov 23 Nov	13	35 (18)	997
TS 30W	(KAJIKI)	05 Dec 09 Dec	17	35 (18)	997
TS 31W	-	11 Dec 13 Dec	6	35 (18)	997
TY 32W	(VAMEI)	27 Dec 31 Dec	10	65 (33)	976
STY 33W	(FAXAI)	13 Dec 25 Dec	50	155 (80)	879
		TOTAL	722		

**MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2001

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
1959	0	1	1	1	0	1	3	8	9	3	2	2	31
	000	010	010	100	000	001	111	512	423	210	200	200	17 7 7
1960	1	0	1	1	1	3	3	9	5	4	1	1	30

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2001

	001	000	001	100	010	210	210	810	041	400	100	100	19 8 3
1961	1	1	1	1	4	6	5	7	6	7	2	1	42
	010	010	100	010	211	114	320	313	510	322	101	100	20 11 11
1962	0	1	0	1	3	0	8	8	7	5	4	2	39
	000	010	000	100	201	000	512	701	313	311	301	020	24 6 9
1963	0	0	1	1	0	4	5	4	4	6	0	3	28
	000	000	001	100	000	310	311	301	220	510	000	210	19 6 3
1964	0	0	0	0	3	2	8	8	8	7	6	2	44
	000	000	000	000	201	200	611	350	521	331	420	101	26 13 5
1965	2	2	1	1	2	4	6	7	9	3	2	1	40
	110	020	010	100	101	310	411	322	531	201	110	010	21 13 6
1966	0	0	0	1	2	1	4	9	10	4	5	2	38
	000	000	000	100	200	100	310	531	532	112	122	101	20 10 8
1967	1	0	2	1	1	1	8	10	8	4	4	1	41
	010	000	110	100	010	100	332	343	530	211	400	010	20 15 6
1968	0	1	0	1	0	4	3	8	4	6	4	0	31
	000	001	000	100	000	202	120	341	400	510	400	000	20 7 4
1969	1	0	1	1	0	0	3	3	6	5	2	1	23
	100	000	010	100	000	000	210	210	204	410	110	010	13 6 4
1970	0	1	0	0	0	2	3	7	4	6	4	0	27
	000	100	000	000	000	110	021	421	220	321	130	000	12 12 3
1971	1	0	1	2	5	2	8	5	7	4	2	0	37
	010	000	010	200	230	200	620	311	511	310	110	000	24 11 2
1972	1	0	1	0	0	4	5	5	6	5	2	3	32
	100	000	001	000	000	220	410	320	411	410	200	210	22 8 2
1973	0	0	0	0	0	0	7	6	3	4	3	0	23
	000	000	000	000	000	000	430	231	201	400	030	000	12 9 2
1974	1	0	1	1	1	4	5	7	5	4	4	2	35
	010	000	010	010	100	121	230	232	320	400	220	020	15 17 3
1975	1	0	0	1	0	0	1	6	5	6	3	2	25
	100	000	000	001	000	000	010	411	410	321	210	002	14 6 5
1976	1	1	0	2	2	2	4	4	5	0	2	2	25
	100	010	000	110	200	200	220	130	410	000	110	020	14 11 0
1977	0	0	1	0	1	1	4	2	5	4	2	1	21
	000	000	010	000	001	010	301	020	230	310	200	100	11 8 2
1978	1	0	0	1	0	3	4	8	4	7	4	0	32
	010	000	000	100	000	030	310	341	310	412	121	000	15 13 4
1979	1	0	1	1	2	0	5	4	6	3	2	3	28
	100	000	100	100	011	000	221	202	330	210	110	111	14 9 5
1980	0	0	1	1	4	1	5	3	7	4	1	1	28
	000	000	001	010	220	010	311	201	511	220	100	010	15 9 4
1981	0	0	1	1	1	2	5	8	4	2	3	2	29
	000	000	100	010	010	200	230	251	400	110	210	200	16 12 1
1982	0	0	3	0	1	3	4	5	6	4	1	1	28
	000	000	210	000	100	120	220	500	321	301	100	100	19 7 2
1983	0	0	0	0	0	1	3	6	3	5	5	2	25
	000	000	000	000	000	010	300	231	111	320	320	020	12 11 2

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2001

1984	0	0	0	0	0	2	5	7	4	8	3	1	30
	000	000	000	000	000	020	410	232	130	521	300	100	16 11 3
1985	2	0	0	0	1	3	1	7	5	5	1	2	27
	020	000	000	000	100	201	100	520	320	410	010	110	17 9 1
1986	0	1	0	1	2	2	2	5	2	5	4	3	27
	000	100	000	100	110	110	200	410	200	320	220	210	19 8 0
1987	1	0	0	1	0	2	4	4	7	2	3	1	25
	100	000	000	010	000	110	400	310	511	200	120	100	18 6 1
1988	1	0	0	0	1	3	2	5	8	4	2	1	27
	100	000	000	000	100	111	110	230	260	400	200	010	14 12 1
1989	1	0	0	1	2	2	6	8	4	6	3	2	35
	010	000	000	100	200	110	231	332	220	600	300	101	21 10 4
1990	1	0	0	1	2	4	4	5	5	5	4	1	32
	100	000	000	010	110	211	220	500	410	230	310	100	21 10 1
1991	0	0	2	1	1	1	4	8	6	3	6	0	32
	000	000	110	010	100	100	400	332	420	300	330	000	20 10 2
1992	1	1	0	0	0	3	4	8	5	6	5	0	33
	100	010	000	000	000	210	220	440	410	510	311	000	21 11 1
1993	0	0	2	2	1	2	5	8	5	6	4	3	38
	000	000	011	002	010	101	320	611	410	321	112	300	21 9 8
1994	1	0	1	0	2	2	9	9	8	7	0	2	41
	001	000	100	000	101	020	342	630	440	511	000	110	21 15 5
1995	1	0	0	0	1	2	3	7	7	8	2	3	34
	001	000	000	000	010	020	210	421	412	512	020	012	15 11 8
1996	0	1	0	2	2	0	7	10	7	5	6	3	43
	000	001	000	011	110	000	610	433	610	212	132	111	21 12 10
1997 *	1	0	0	2	3	3	4	8	4	6	1	1	33
	010	000	000	110	120	300	310	611	310	411	100	100	23 8 2
1998 *	0	0	0	0	0	0	3	3	8	6	3	4	27
	000	000	000	000	000	000	012	210	413	213	030	112	9 8 10
1999 *	1	1	0	3	0	1	5	9	6	2	3	3	34
	010	010	000	210	000	100	113	423	240	110	111	003	12 12 10
2000	0	0	0	0	4	0	8	9	6	3	3	1	34
	000	000	000	000	112	000	233	432	411	210	111	100	15 10 9
2001	0	1	0	1	1	2	6	7	5	3	3	4	33
	000	001	000	001	010	200	411	331	500	300	120	220	20 9 4
(1959-2001)													
MEAN	0.6	0.3	0.5	0.8	1.3	2.0	4.7	6.6	5.8	4.7	2.9	1.6	31.8
TYs TSs TDs	.2 .3 .1	.0 .2 .1	.2 .2 .1	.4 .3 .1	.7 .4 .2	1.0 .7 .3	2.7 1.4 .6	3.5 2.1 1.0	3.4 1.7 .7	3.1 1.0 .6	1.6 1.1 0.3	0.7 0.6 0.3	17.6 9.9 4.3
CASES	24	13	23	35	56	85	201	284	248	202	126	70	1367

The criteria used in TABLE 1-2 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.

2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2001

3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

* Errors in this table have been noted for the years 1997, 1998 and 1999 in previous ATCRs. The current table has been updated to reflect the correct data.

TABLE 1-3 WESTERN NORTH PACIFIC TROPICAL CYCLONES

TYPHOONS (1945-1959)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.3	0.1	0.3	0.4	0.7	1	2.9	3.1	3.3	2.4	2	0.9	16.4
CASES	5	1	4	6	10	15	29	46	49	36	30	14	245

TYPHOONS (1960-2001)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.2	0.0	0.2	0.4	0.7	1.0	2.7	3.5	3.4	3.1	1.6	0.7	17.6
CASES	10	2	8	18	28	44	114	145	144	132	66	30	741

TROPICAL STORMS AND TYPHOONS (1945-1959)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.4	0.1	0.5	0.5	0.8	1.6	2.9	4	4.2	3.3	2.7	1.2	22.2
CASES	6	2	7	8	11	22	44	60	64	49	41	18	332

TROPICAL STORMS AND TYPHOONS (1960-2001)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.5	0.2	0.4	0.7	1.1	1.7	4.2	5.6	5.1	4.2	2.7	1.3	27.6
CASES	21	9	17	29	47	73	175	234	215	175	112	54	1161

TABLE 1-4 TROPICAL CYCLONE FORMATION ALERTS FOR THE WESTERN NORTH PACIFIC OCEAN FOR 1976-2001

YEAR	INITIAL TCFAS	TROPICAL CYCLONES WITH TCFAS	TOTAL TROPICAL CYCLONES	PROBABILITY OF TCFA WITHOUT WARNING*	PROBABILITY OF TCFA BEFORE WARNING
1976	34	25	25	26%	100%
1977	26	20	21	23%	95%
1978	32	27	32	16%	84%
1979	27	23	28	15%	82%
1980	37	28	28	24%	100%
1981	29	28	29	3%	96%
1982	36	26	28	28%	93%
1983	31	25	25	19%	100%
1984	37	30	30	19%	100%
1985	39	26	27	33%	96%
1986	38	27	27	29%	100%
1987	31	24	25	23%	96%
1988	33	26	27	21%	96%
1989	51	32	35	37%	91%
1990	33	30	31	9%	97%

TABLE 1-4 TROPICAL CYCLONE FORMATION ALERTS FOR THE WESTERN NORTH PACIFIC OCEAN FOR 1976-2001

1991	37	29	31	22%	94%
1992	36	32	32	11%	100%
1993	50	35	38	30%	92%
1994	50	40	40	20%	100%
1995	54	33	35	39%	94%
1996	41	39	43	,5%	91%
1997	36	30	33	17%	91%
1998	38	18	27	53%	67%
1999	39	29	33	26%	88%
2000	40	31	34	23%	91%
2001	34	28	33	18%	82%
(1976-2001)					
MEAN:	37.3	28.5	30.7	23.5%	92.9%
TOTALS:	969	741	797		

* Percentage of initial TCFAs not followed by warnings.

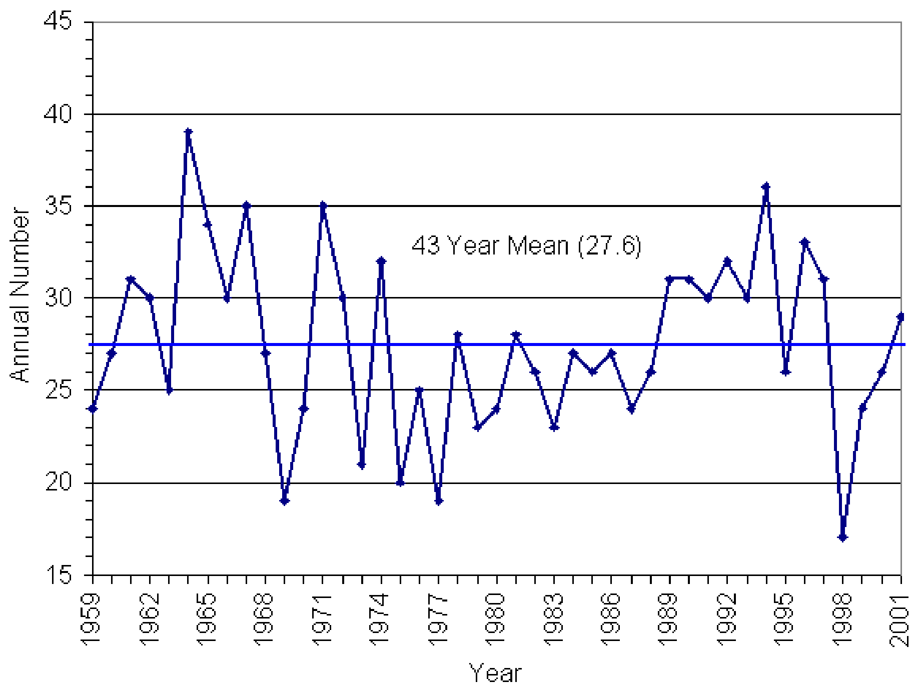


Figure 1-2. Tropical cyclones of tropical storm or greater intensity in the western North Pacific (1959-2001).

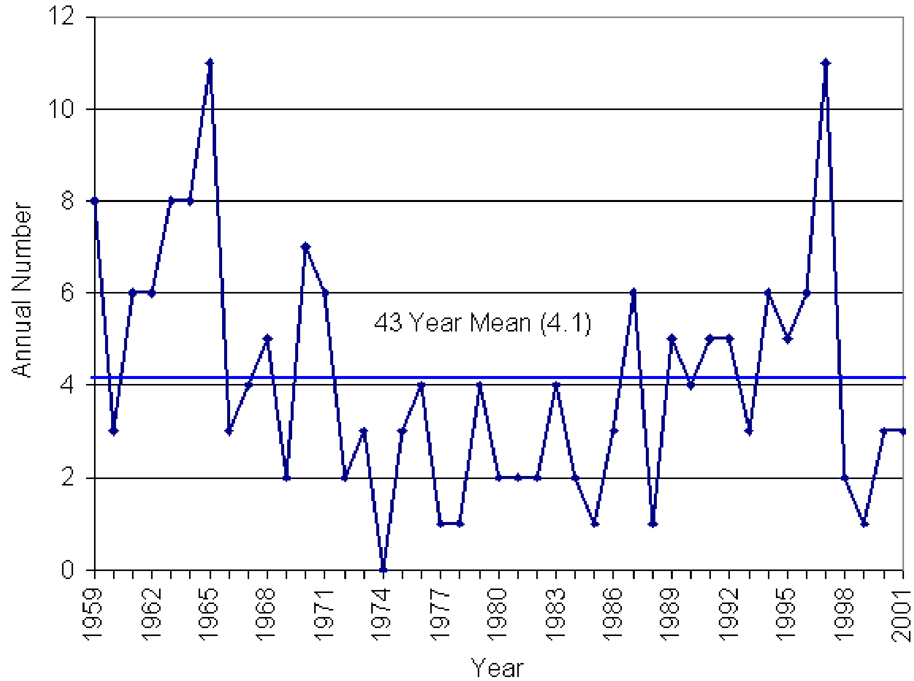
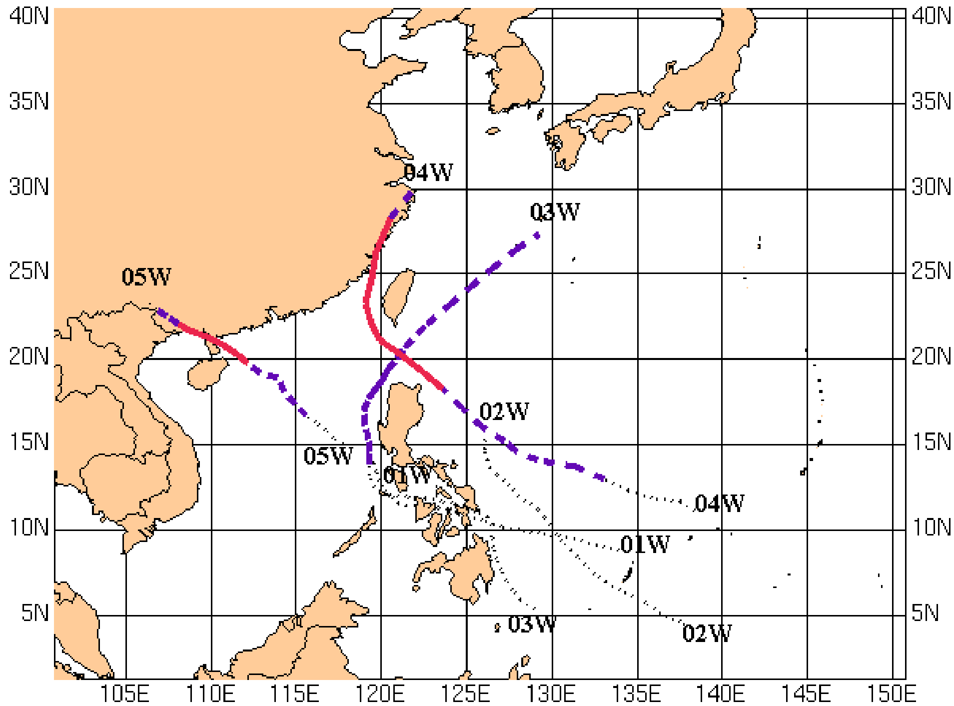


Figure 1-3. Number of western North Pacific super typhoons (1959-2001).

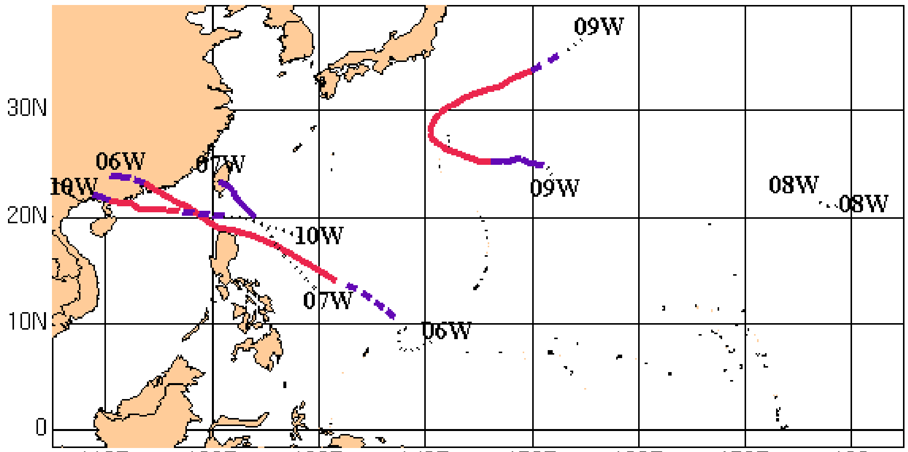


NORTHWEST PACIFIC OCEAN
TROPICAL CYCLONES
18 FEB 01 - 02 JUL 01

01W TD	18 FEB - 20 FEB
02W TD	18 APR - 19 APR
03W TS (CIMARON)	07 MAY - 14 MAY
04W TY (CHEBI)	19 JUN - 24 JUN
05W TY (DURIAN)	29 JUN - 02 JUL

MAXIMUM SUSTAINED SURFACE WIND

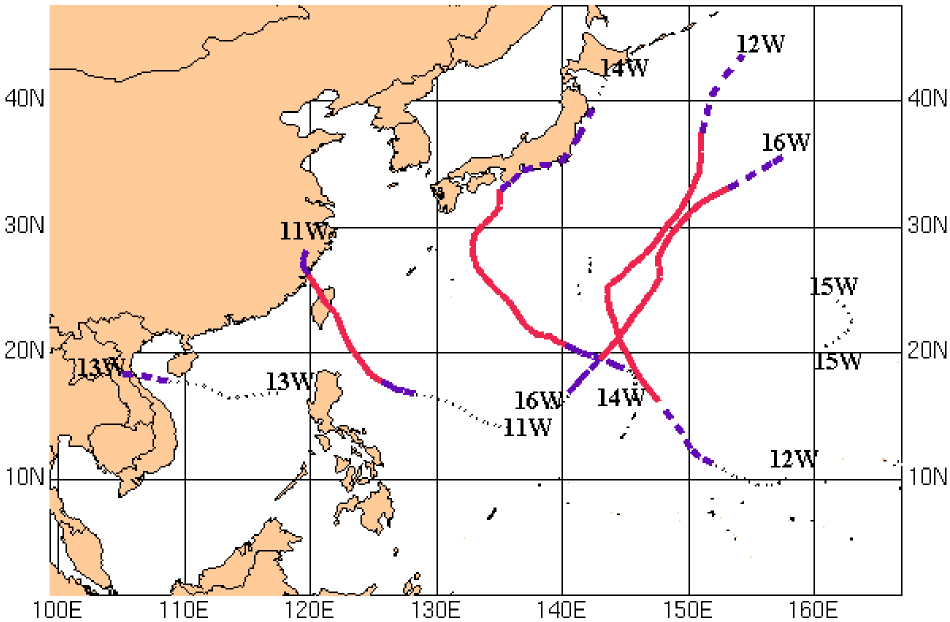
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS



NORTHWEST PACIFIC OCEAN
TROPICAL CYCLONES
01 JULY - 26 JULY 2001

06W TY (UTOR)	01 JUL - 06 JUL
07W TS (TRAMI)	09 JUL - 12 JUL
08W TD	10 JUL - 11 JUL
09W TY (KONG-REY)	21 JUL - 28 JUL
10W TY (YUTU)	22 JUL - 26 JUL

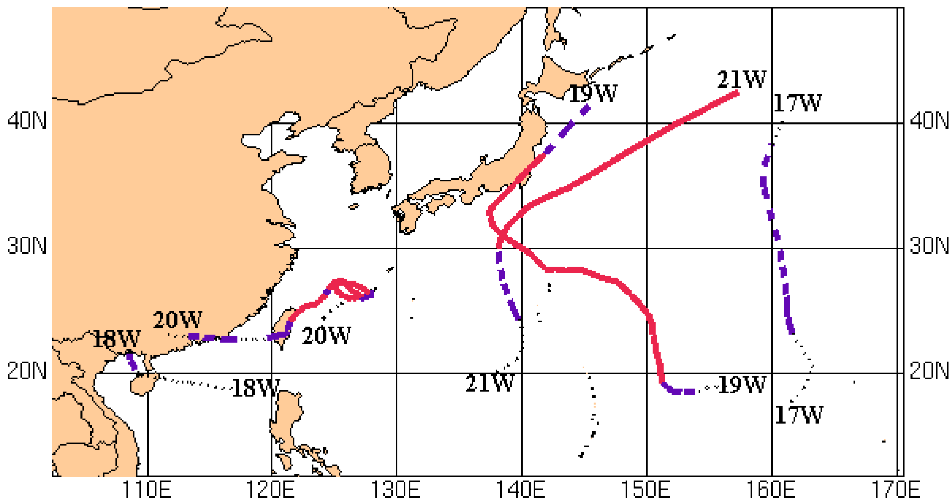
MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS



NORTHWEST PACIFIC OCEAN
TROPICAL CYCLONES
25 JUL 01 - 02 SEP 01

MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS

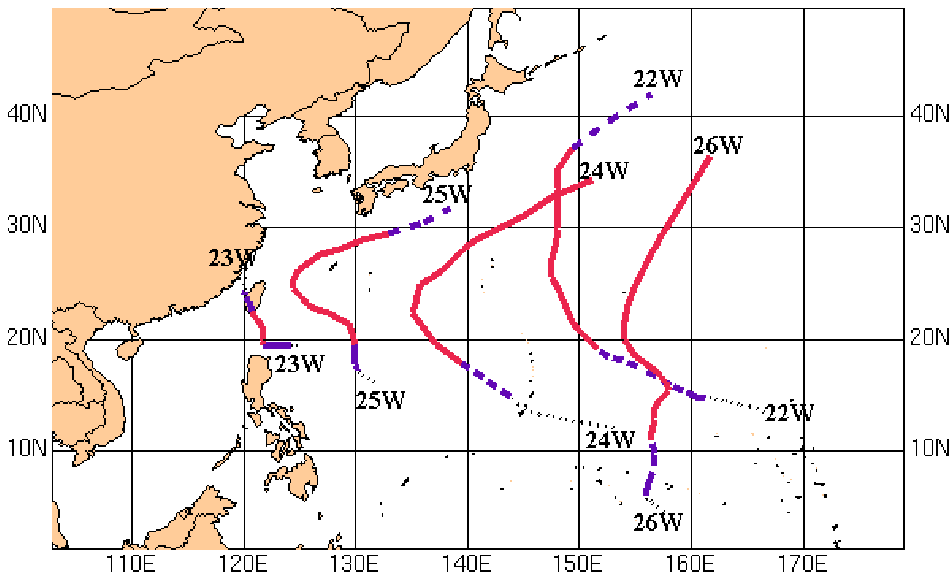
11W TY (TURAJI)	25 JUL - 31 JUL
12W TY (MAN-YI)	01 AUG - 08 AUG
13W TS (USAGI)	09 AUG - 10 AUG
14W TY (PABUK)	14 AUG - 22 AUG
15W TD	24 AUG - 25 AUG
16W STY (WUTIP)	27 AUG - 02 SEP



NORTH PACIFIC OCEAN
TROPICAL CYCLONES
27 AUGUST - 21 SEPTEMBER

MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS

17W TS (SEPAT)	27 AUG - 30 AUG
18W TS (FITOW)	29 AUG - 31 AUG
19W TY (DANAS)	03 SEP - 12 SEP
20W TY (NARI)	06 SEP - 21 SEP
21W TY (VIPA)	17 SEP - 21 SEP

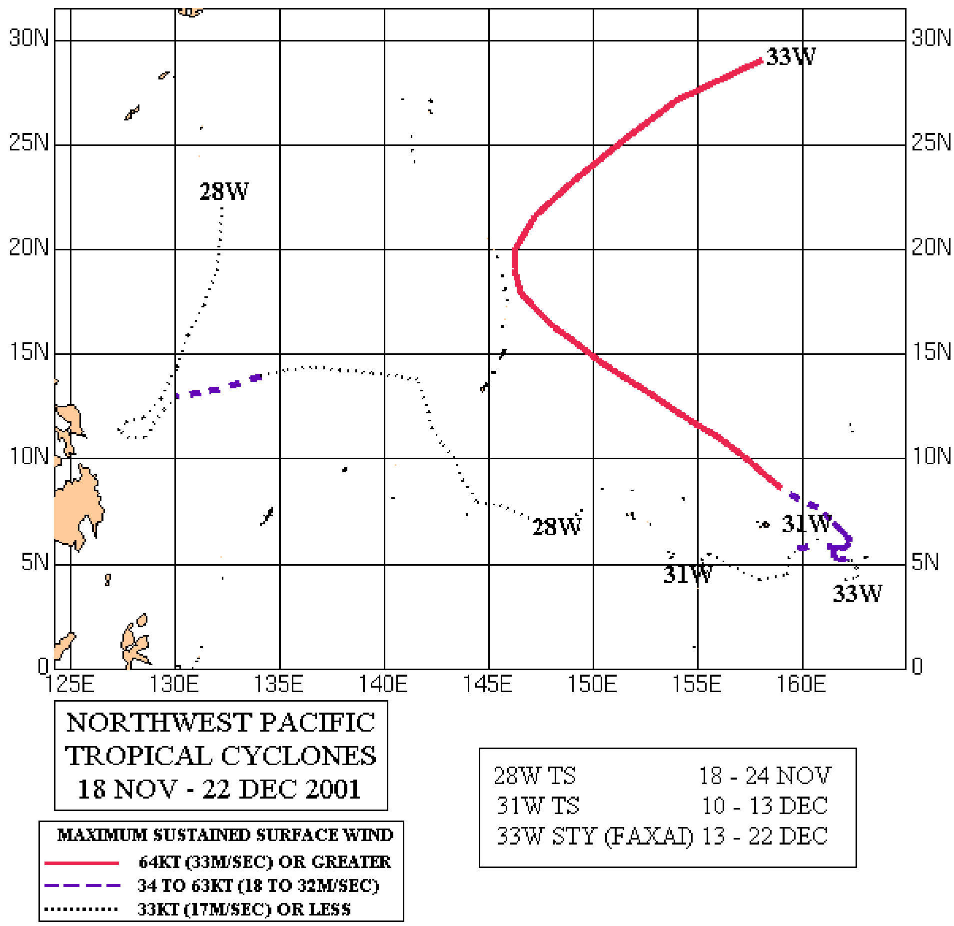


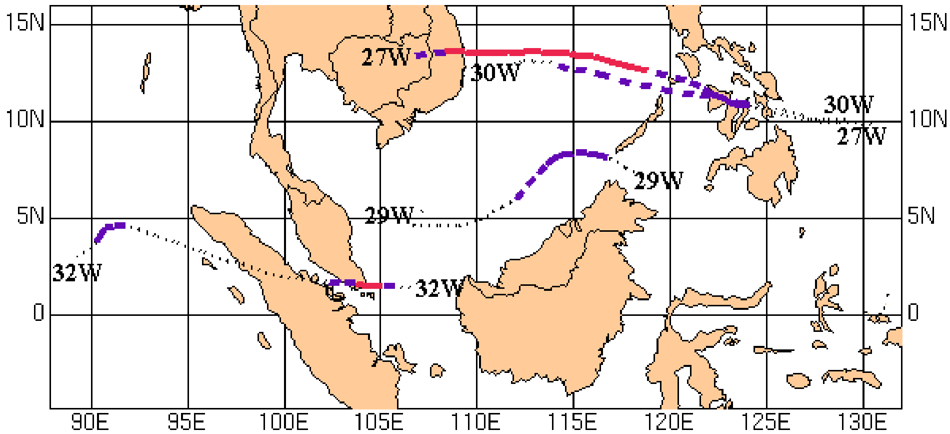
NORTHWEST PACIFIC OCEAN
TROPICAL CYCLONES
19 SEP 01 - 27 OCT 01

MAXIMUM SUSTAINED SURFACE WIND

- 64KT (33M/SEC) OR GREATER
- 34 TO 63KT (18 TO 32M/SEC)
- 33KT (17M/SEC) OR LESS

22W TY (FRANCISCO)	19 SEP - 25 SEP
23W TY (LEKIMA)	22 SEP - 29 SEP
24W TY (KROSA)	03 OCT - 09 OCT
25W TY (HAIYAN)	11 OCT - 17 OCT
26W STY (PODUL)	19 OCT - 27 OCT


30N
25N
20N
15N
10N
5N
0
125E
130E
135E
140E
145E
150E
155E
160E
33W
28W
28W
31W
31W
33W
NORTHWEST PACIFIC
TROPICAL CYCLONES
18 NOV - 22 DEC 2001
MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS
28W TS 18 - 24 NOV
31W TS 10 - 13 DEC
33W STY (FAXAI) 13 - 22 DEC



NORTHWEST PACIFIC
TROPICAL CYCLONES
06 NOV - 31 DEC 2001

27W TY (LINGLING)	06 - 12 NOV
29W TS	20 - 23 NOV
30W TS (KAJIKI)	04 - 09 DEC
32W TY (VAMEI)	27 - 31 DEC

MAXIMUM SUSTAINED SURFACE WIND

64KT (33M/SEC) OR GREATER

34 TO 63KT (18 TO 32M/SEC)

33KT (17M/SEC) OR LESS

1.2 NORTH INDIAN OCEAN TROPICAL CYCLONES

This year's North Indian Ocean tropical cyclones are listed in Table 1-5. The monthly distribution of tropical cyclones for each year since 1975 is shown in Table 1-6. Composites of the tropical cyclone best tracks for the Northern Indian Ocean appear following Table 1-6.

Table 1-5 NORTH INDIAN OCEAN SIGNIFICANT TROPICAL CYCLONES FOR 2001 (01 JAN 2001 - 31 DEC 2001)

TC	NAME	PERIOD	WARNINGS ISSUED	EST MAX SFC WINDS KTS (M/SEC)	MSLP (MB)*
01A	-	21 May - 28 May	29	110 (57)	933
02A	-	26 Sep - 28 Sep	12	35 (18)	997
03A	-	9 Oct - 10 Oct	6	35 (18)	997
04B	-	11 Nov - 12 Nov	3	30 (15)	1000
		JTWC Total	50		

*MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

Table 1-6 DISTRIBUTION OF NORTHERN INDIAN OCEAN TROPICAL CYCLONES FOR 1975 - 2001

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
	0 1 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 2 0	0 0 0	3 3 0
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 1 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 1 0	0 5 0
1977	0	0	0	0	1	1	0	0	0	1	0	2	5
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	1 1 0	1 4 0
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	2 0 0	0 0 0	2 2 0
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 1 0	0 0 0	0 0 0	0 1 1	0 1 0	0 1 1	0 0 0	1 4 2
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 2 0
1981	0	0	0	0	0	0	0	0	1	0	1	1	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	1 0 0	1 0 0	2 1 0
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 2 0	1 0 0	0 0 0	2 3 0
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 1 0	0 1 0	0 0 0	0 3 0
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	2 0 0	0 0 0	2 2 0
1985	0	0	0	0	2	0	0	0	0	2	1	1	6
	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 1 0	0 1 0	0 6 0
1986	1	0	0	0	0	0	0	0	0	0	2	0	3

Table 1-6 DISTRIBUTION OF NORTHERN INDIAN OCEAN TROPICAL CYCLONES FOR 1975 - 2001

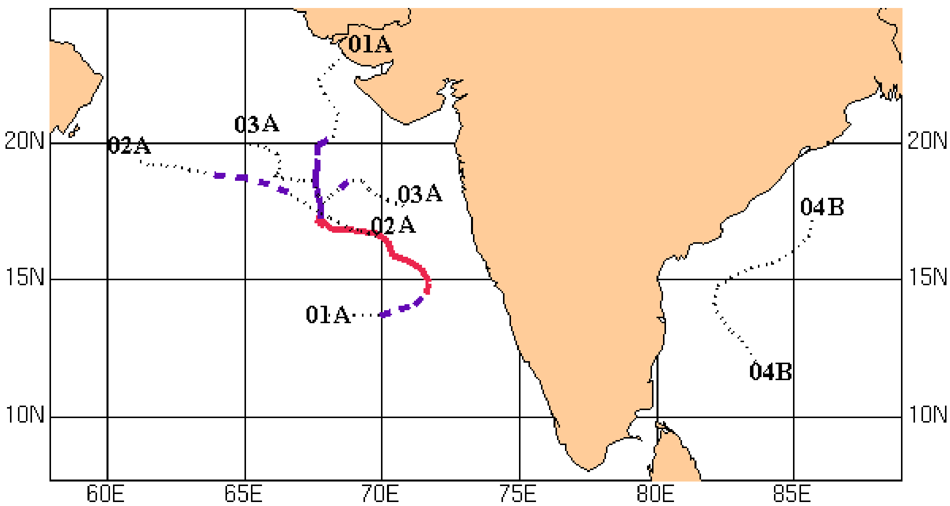
	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 3 0
1987	0	1	0	0	0	2	0	0	0	2	1	2	8
	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 0 0	0 0 0	0 2 0	0 1 0	0 2 0	0 8 0
1988	0	0	0	0	0	1	0	0	0	1	2	1	5
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 0	1 1 0	0 1 0	1 4 0
1989	0	0	0	0	1	1	0	0	0	0	1	0	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	1 2 0
1990	0	0	0	1	1	0	0	0	0	0	1	1	4
	0 0 0	0 0 0	0 0 0	0 0 1	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1	0 1 0	1 1 2
1991	1	0	0	1	0	1	0	0	0	0	1	0	4
	0 1 0	0 0 0	0 0 0	1 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	2 2 0
1992	0	0	0	0	1	2	1	0	1	3	3	2	13
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 2 0	0 1 0	0 0 0	0 0 1	0 2 1	2 1 0	0 2 0	3 8 2
1993	0	0	0	0	0	0	0	0	0	0	2	0	2
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	2 0 0
1994	0	0	1	1	0	1	0	0	0	1	1	0	5
	0 0 0	0 0 0	0 1 0	1 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	1 4 0
1995	0	0	0	0	0	0	0	0	1	1	2	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	2 0 0	0 0 0	2 2 0
1996	0	0	0	0	1	3	0	0	0	2	2	0	8
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	1 2 0	0 0 0	0 0 0	0 0 0	1 1 0	2 0 0	0 0 0	4 4 0
1997	0	0	0	0	1	0	0	0	1	1	1	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 1 0	0 1 0	0 0 0	2 2 0
1998	0	0	0	0	2	1	0	0	1	1	2	1	8
	0 0 0	0 0 0	0 0 0	0 0 0	1 1 0	1 0 0	0 0 0	0 0 0	0 1 0	0 1 0	2 0 0	1 0 0	5 3 0
1999	0	1	0	0	1	1	0	0	0	2	0	0	5
	0 0 0	0 1 0	0 0 0	0 0 0	1 0 0	0 1 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	0 0 0	3 2 0
2000	0	0	0	0	0	0	0	0	0	2	1	1	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	1 0 0	0 1 0	1 3 0
2001	0	0	0	0	1	0	0	0	1	1	1	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 1	0 0 0	1 2 1
(1959-2001)													
MEAN	0.1	0.1	0.0	0.2	0.7	0.6	0.0	0.0	0.3	1.0	1.3	0.5	5.0
CASES	3	2	1	4	18	17	1	1	9	28	36	14	134

The criteria used in TABLE 1-6 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.

2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.

3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.



NORTH INDIAN OCEAN
TROPICAL CYCLONES
21 MAY 01 - 12 NOV 01

01A TC	21 MAY - 28 MAY
02A TC	26 SEP - 28 SEP
03A TC	09 OCT - 10 OCT
04B TC	11 NOV - 12 NOV

MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS

1.3 SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

Tropical Depression (TD) 01W

First Poor : None

First Fair : 0830Z 16 Feb 01

First TCFA : 0300Z 17 Feb 01

First Warning : 0000Z 18 Feb 01

Last Warning : 0600Z 20 Feb 01

Max Intensity : 25 kts, gusts To 35 kts

Landfall : None

Total Warnings : 10

Remarks:

(1) First tropical cyclone of the 2001 season.

(2) On 18-19 February, TD 01W moved west-northwest passing over the central Philippine Islands then into the South China Sea before dissipating off western Luzon on 22 February.

(3) Reuters reported that torrential rains in several areas of Mindanao triggered landslides that caused 17 deaths and flooded the homes of 100,000 residents in 29 towns. The Philippine National Disaster Coordinating Council reported 10 fatalities after a passenger motorboat capsized and sank amid heavy rains and large waves off Tawi-Tawi.

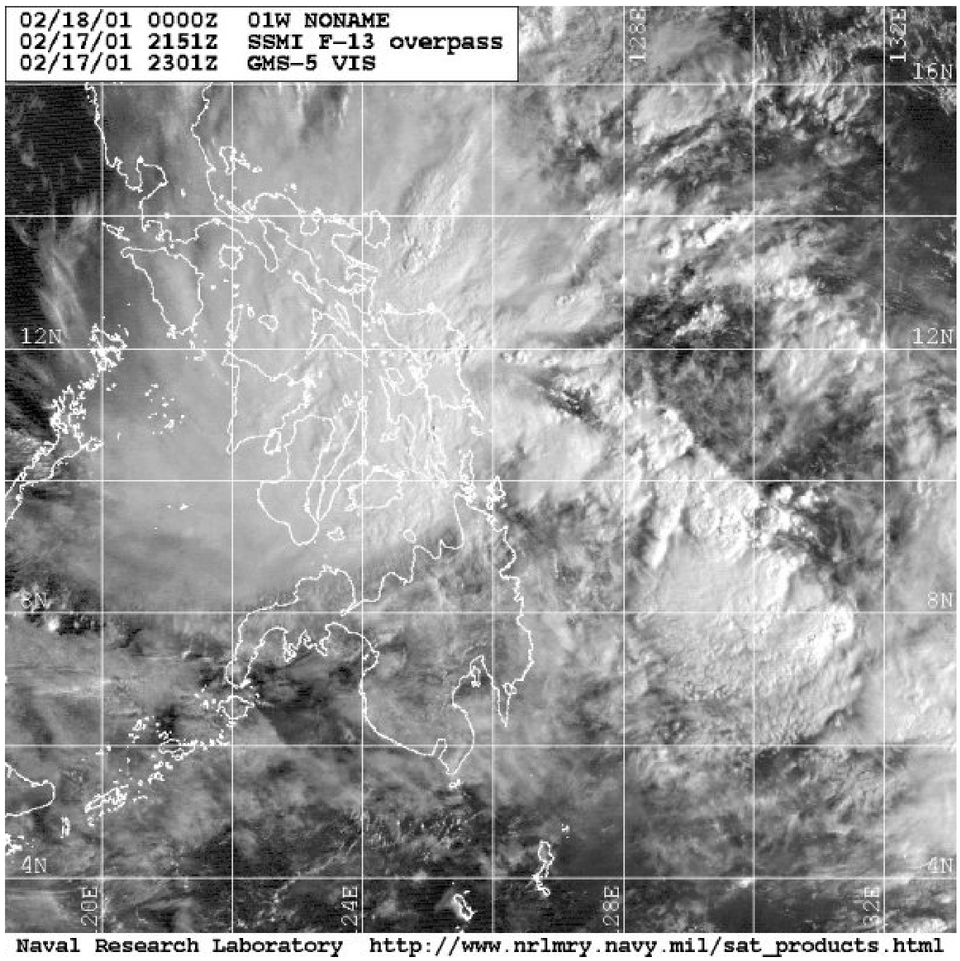


Figure 1-01W-1. 172301Z February 2001 GMS-5 visible satellite imagery of TD 01W, located southeast of Manila, Philippines. At this time, maximum sustained surface winds are estimated at 25 knots.

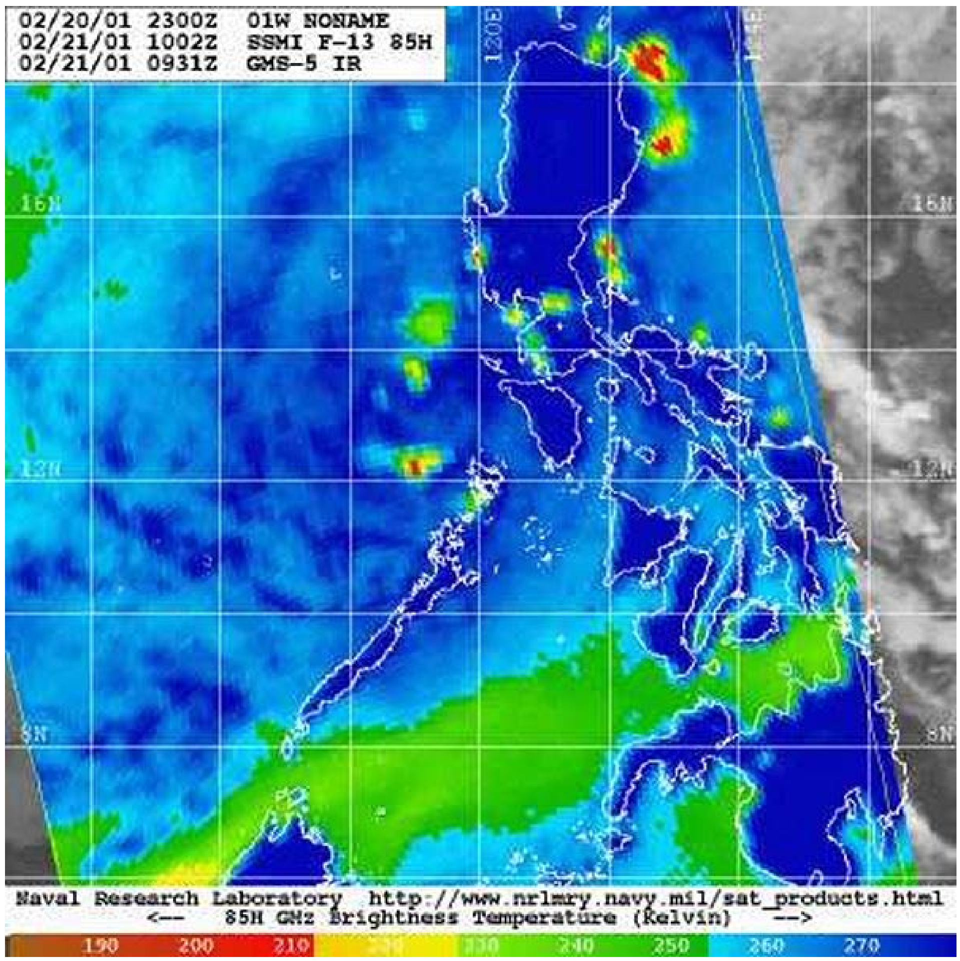
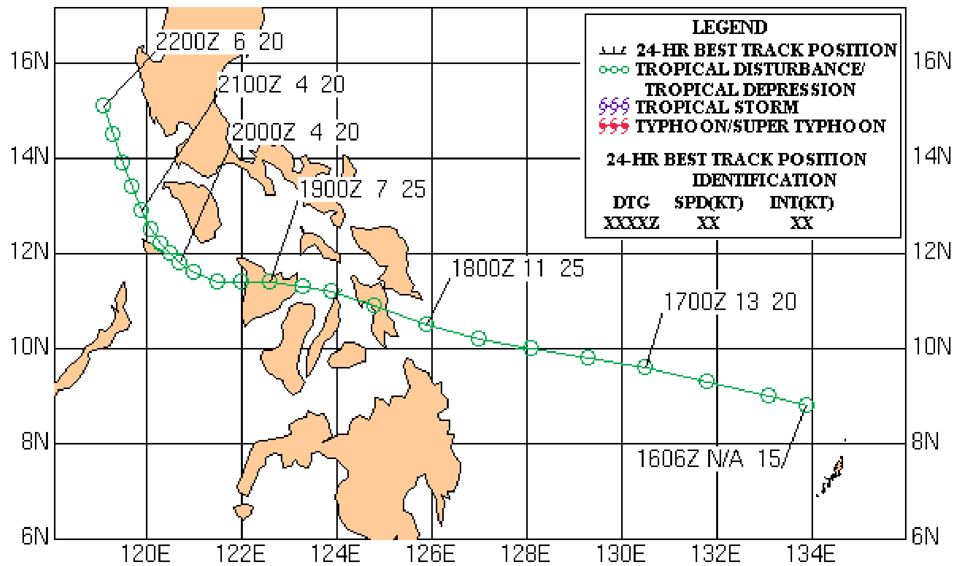


Figure 1-01W-2. 211002Z February 2001 SSMI imagery of TD 01W in the South China Sea approximately 120 nm southwest of Manila, Philippines. At this time, the system was weakening and had an estimated intensity of 20 knots.

TROPICAL DEPRESSION 01W
18-20 FEB 01



Tropical Depression (TD) 02W

First Poor : 1900Z 13 APR 01

First Fair : 2000Z 15 APR 01

First TCFA : 2330Z 17 APR 01

First Warning : 1200Z 18 APR 01

Last Warning : 0000Z 19 APR 01

Max Intensity : 25 kts, gusts To 35 kts

Landfall : None

Total Warnings : 3

Remarks : None

(1) Maintained maximum intensity from 1200Z on 18 April until 0000Z 19 April while it tracked northwest of Palau in the Philippine Sea.

(2) No damage or fatilities reported.

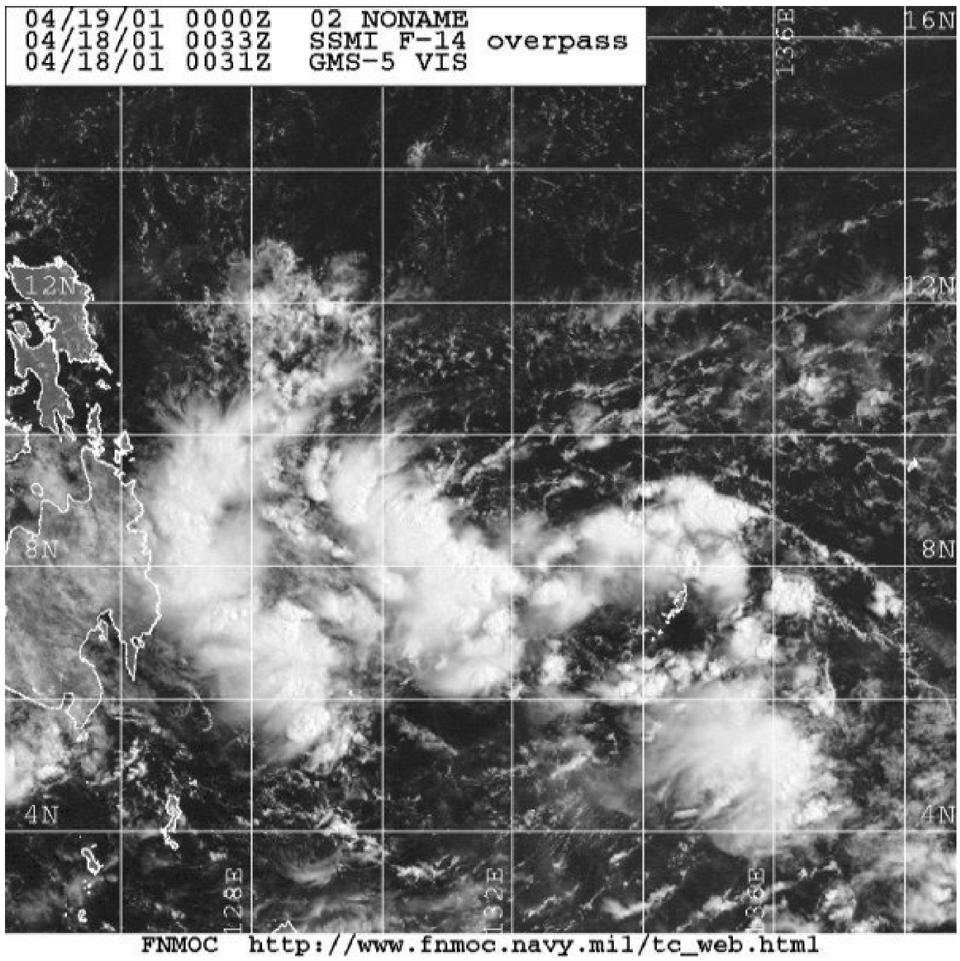


Figure 1-02W-1. 180031Z April 2001 GMS-5 visible satellite imagery of TD 02W 130 nm west of Koror in the Philippine Sea with an estimated intensity of 20 knots.

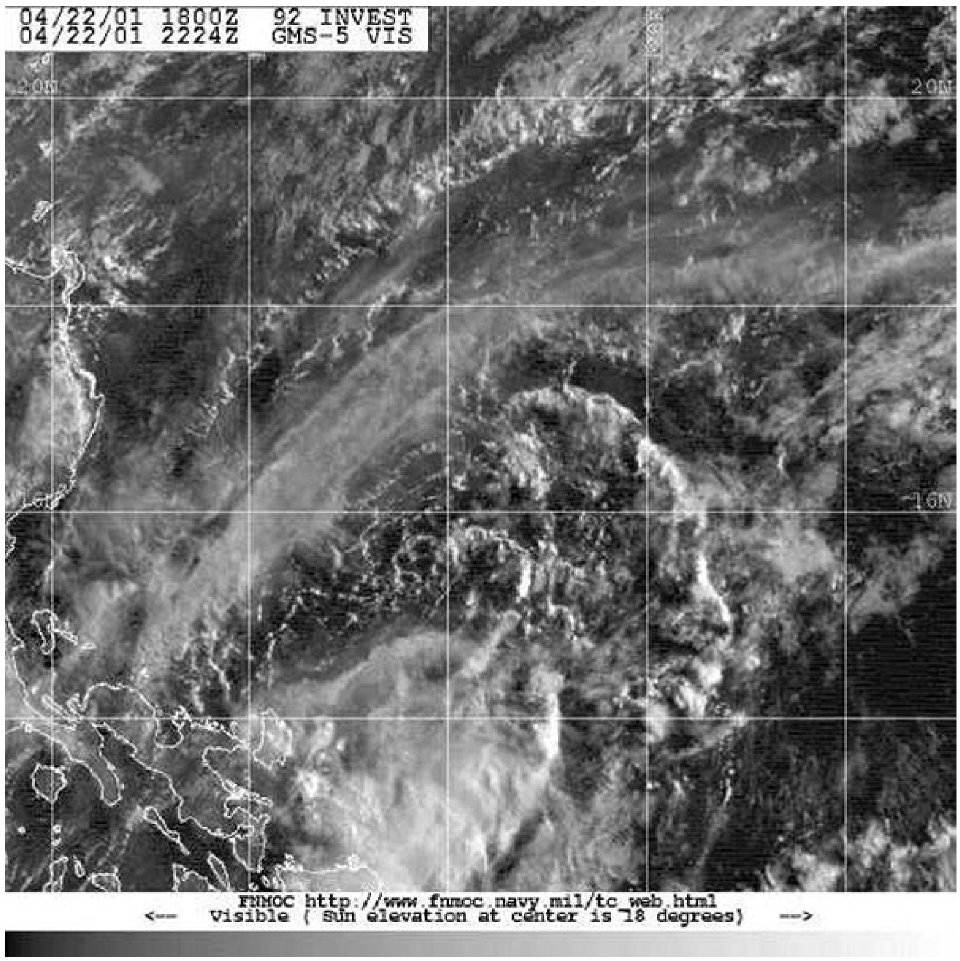
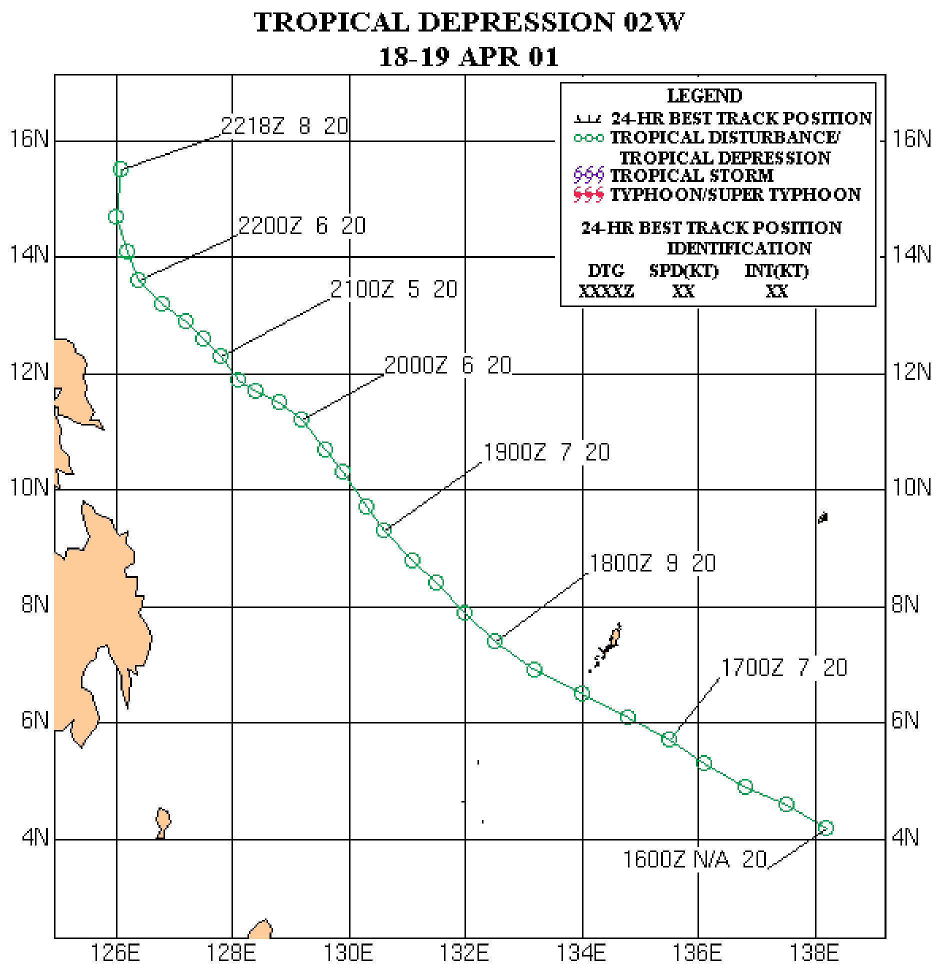


Figure 1-02W-2. 222224Z April 2001 GMS-5 visible satellite imagery of TD 02W, located 240 nm east-southeast of Manila, Philippines with a disorganized low-level circulation and minimal deep convection. Intensity of the cyclone at this time was 20 knots.


TROPICAL DEPRESSION 02W
18-19 APR 01
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX
2218Z 8 20
2200Z 6 20
2100Z 5 20
2000Z 6 20
1900Z 7 20
1800Z 9 20
1700Z 7 20
1600Z N/A 20
16N
14N
12N
10N
8N
6N
4N
126E
128E
130E
132E
134E
136E
138E

Tropical Storm (TS) 03W (Cimaron*)

First Poor : 1430Z 04 May 01

First Fair : 0100Z 05 May 01

First TCFA : 1700Z 06 May 01

First Warning : 0000Z 07 May 01

Last Warning : 1200Z 14 May 01

Max Intensity : 60 kts, gusts To 75 kts

Landfall : None

Total Warnings : 31

Remarks :

(1) Attained maximum intensity at 1800Z on 13 May in the East China Sea while moving northeast toward Okinawa.

(2) Passed over Okinawa on 14 May with maximum sustained winds of 31 knots and gusts up to 48 knots reported by Kadena AB, Okinawa.

(3) Kadena AB also reported 7.36 inches of precipitation for the 36 hour period centered around cyclone passage while Naha International Airport reported 4.84 inches of precipitation for the same period.

(4) No casualties or damage were reported.

*Name assigned by RSMC Tokyo

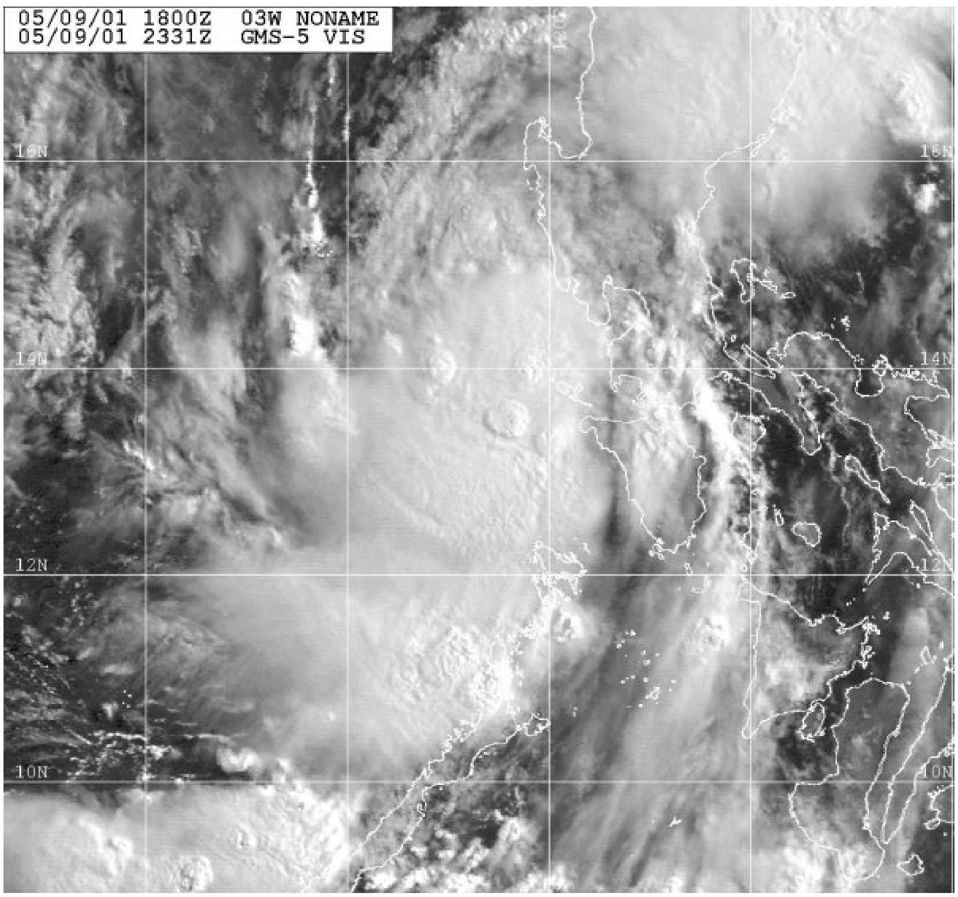


Figure 1-03W-1. 092331Z May 2001 GMS-5 visible satellite imagery of TS 03W (Cimaron) about 80 nm west of Manila, Philippines with an estimated intensity of 35 knots.

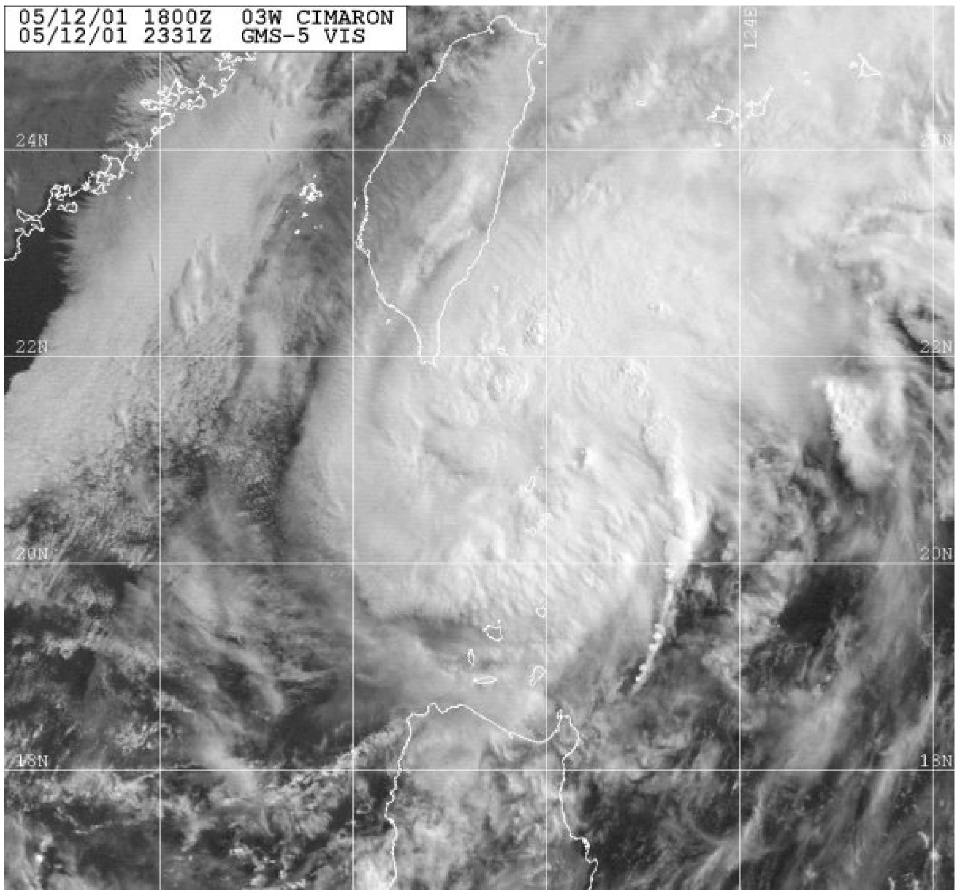
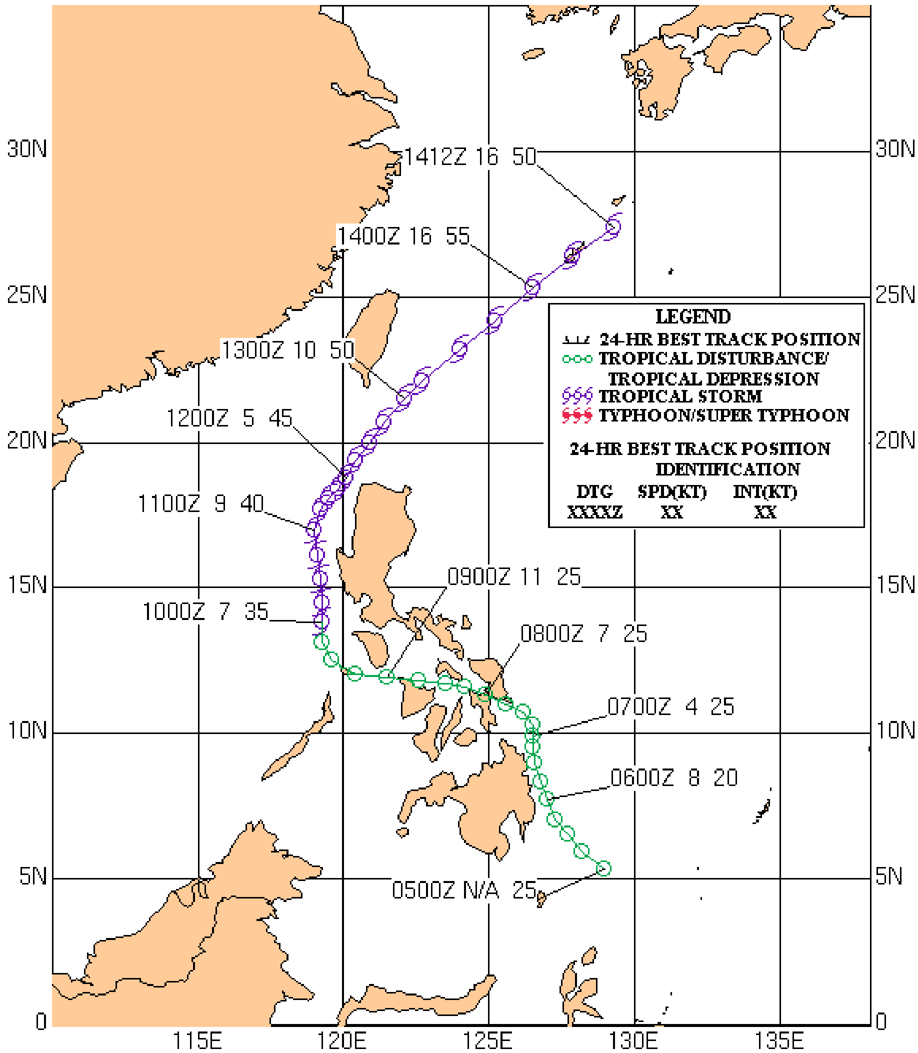


Figure 1-03W-2. 122331Z May 2001 GMS-5 visible satellite imagery of TS 03W (Cimaron) in the Bashi Channel with an estimated intensity of 50 knots.

TROPICAL STORM 03W (CIMARON)
07 - 14 MAY 2001



Typhoon (TY) 04W (Chebi*)

First Poor : 0200Z 15 Jun 01

First Fair : 1300Z 15 Jun 01

First TCFA : NONE

First Warning : 1800Z 19 Jun 01

Last Warning : 0000Z 24 Jun 01

Max Intensity : 100 kts, gusts To 125 kts

Landfall : 1800Z 23 Jun 01 in the Fujian province of mainland China

Total Warnings : 18

Remarks :

(1) First typhoon of the 2001 season.

(2) Originated in the Philippine Sea, tracked northwestward across the Luzon Strait and finally made landfall in the Fujian province of mainland China.

(3) Rapidly intensfied from 75 knots at 1200Z on 22 June to its peak intensity of 100 kts at 0000Z on 23 June southwest of Taiwan.

(3) At least 9 fatalities were reported in southern Taiwan. Among those killed were 4 Chinese crewmembers of a freighter that sunk in heavy seas off the coast of Tainan, southern Taiwan.

(4) The China News Service reported at least 73 fatalities, 83 people missing, and $422 million in damage.

*Name assigned by RSMC Tokyo

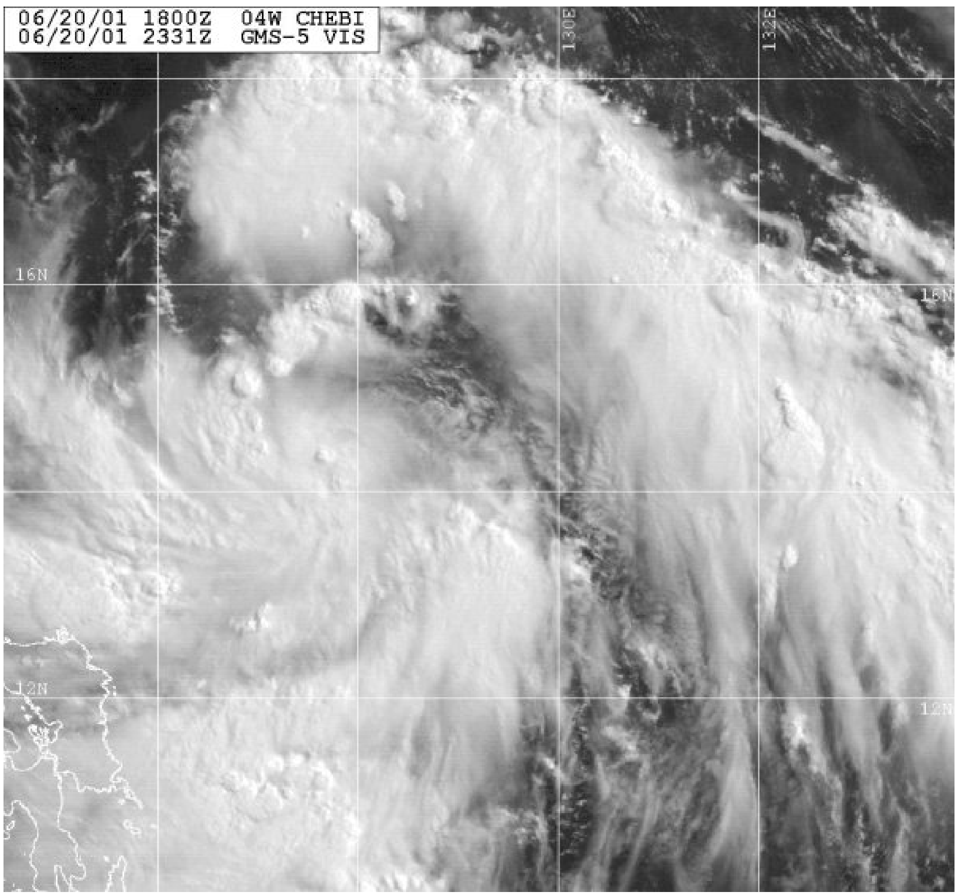


Figure 1-04W-1. 202331Z June 2001 GMS-5 visible satellite imagery of TY 04W (Chebi) about 400 nm east of Luzon with an estimated intensity of 45 knots.

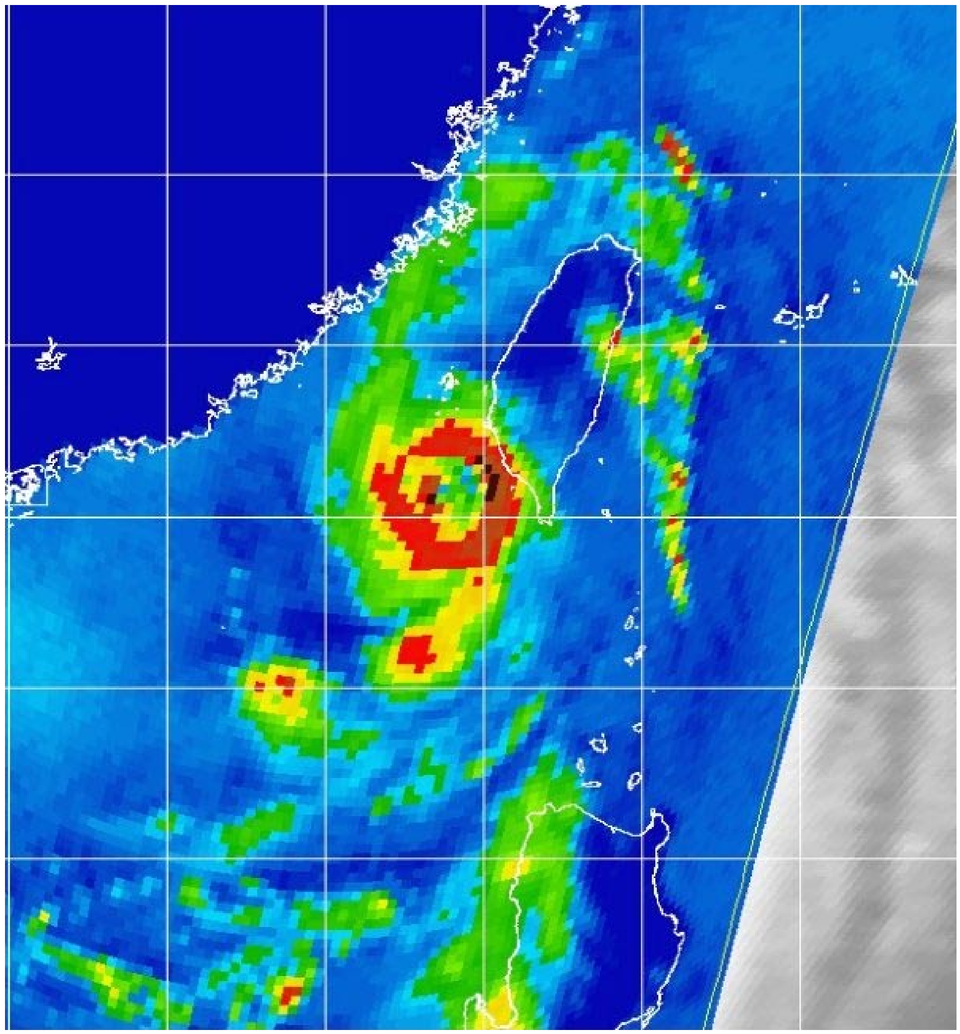
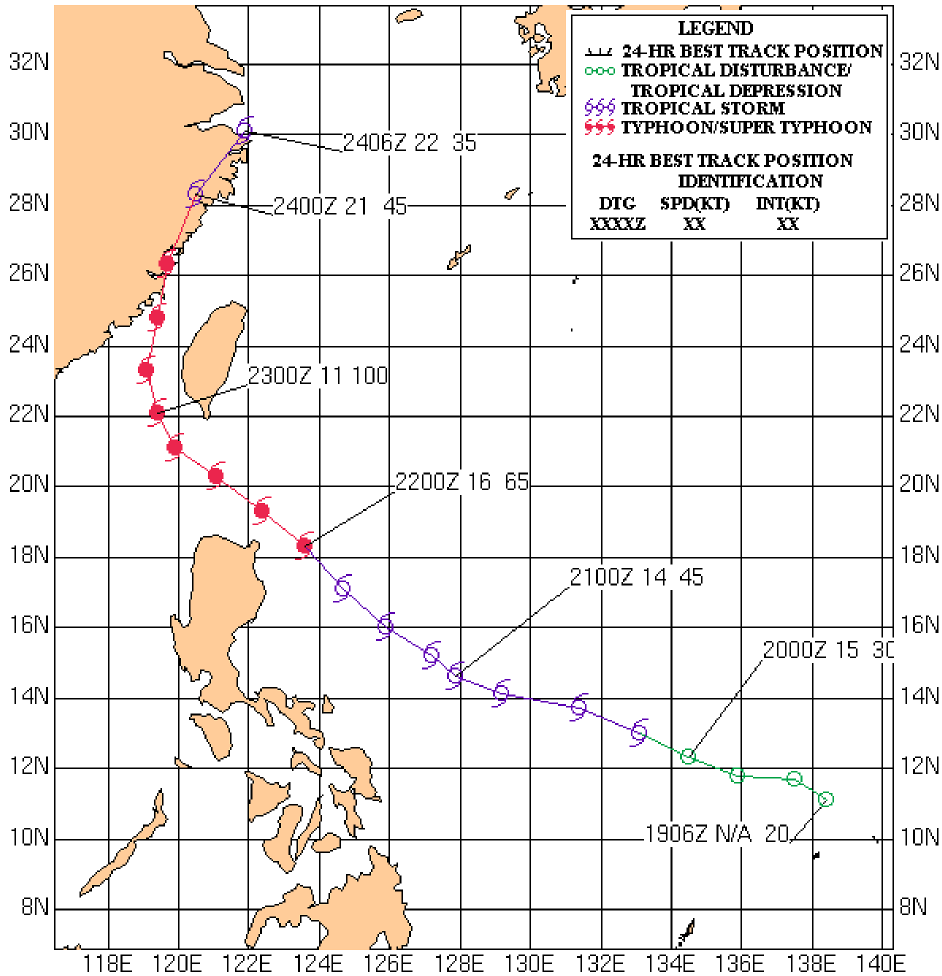


Figure 1-04W-2. 230058Z June 2001 85 GHz microwave satellite imagery of TY 04W (Chebi) 70 nm west of Taiwan at its peak intensity of 100 knots.

TYPHOON 04W (CHEBI)
19-24 JUN 01



Typhoon (TY) 05W (Durian*)

First Poor : None

First Fair : 0030Z 29 Jun 01

First TCFA : 0900Z 29 Jun 01

First Warning : 1800Z 29 Jun 01

Last Warning : 1800Z 02 Jul 01

Max Intensity : 75 kts, gusts To 90 kts

Landfall : 0000Z 02 Jul 01, southern mainland China.

Total Warnings : 13

Remarks :

(1) Heavy rain and flooding in the Southern Guangdong province caused at least $446 million in damage, according to China's official news media. One person was reported killed.

(2) TY 05W was also responsible for the worst flooding in 40 years in northern Vietnam. The Vietnam Hydrometeorological Service reported that TY 05W caused up to 17 inches of precipitation between 02 July and 04 July in some northern provinces and further caused 13 fatalities, 3 missing and 3 injured.

(3) The China Meteorological Administration reported 65 persons killed or missing and over 500 injured due to this cyclone.

*Name assigned by RSMC Tokyo

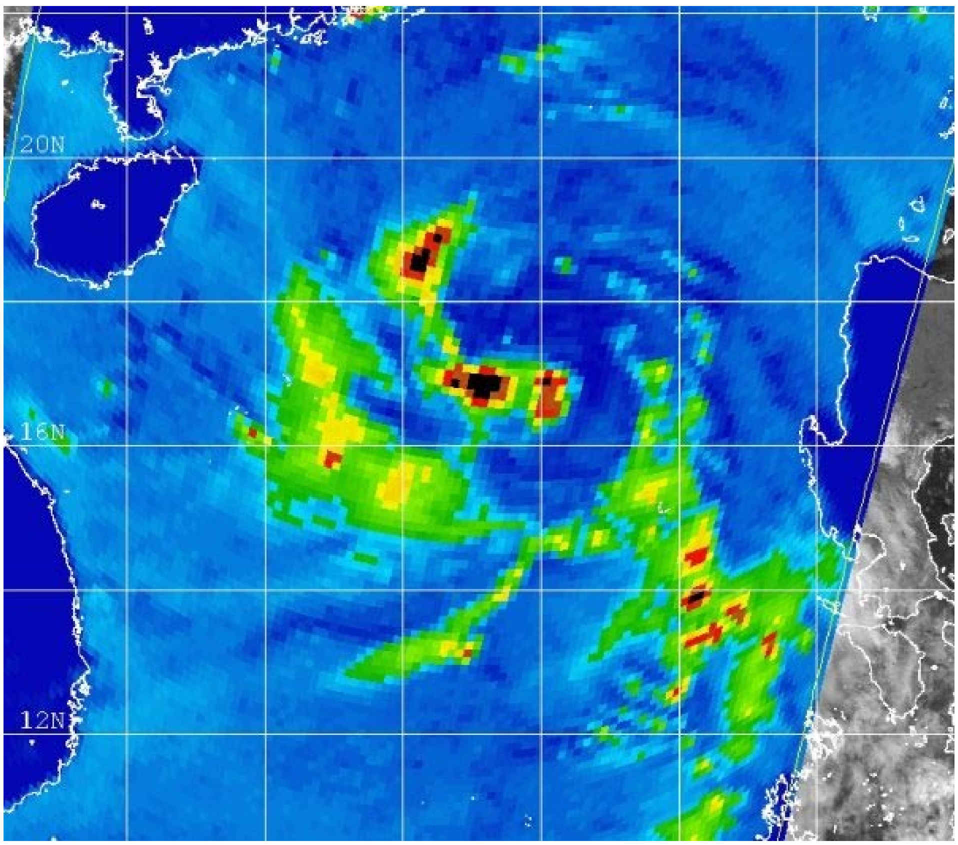


Figure 1-05W-1. 300107Z June 2001 85 GHz SSM/I image of TY 05W (Durian) 360 nm south-southeast of Hong Kong with an estimated intensity of 40 knots.

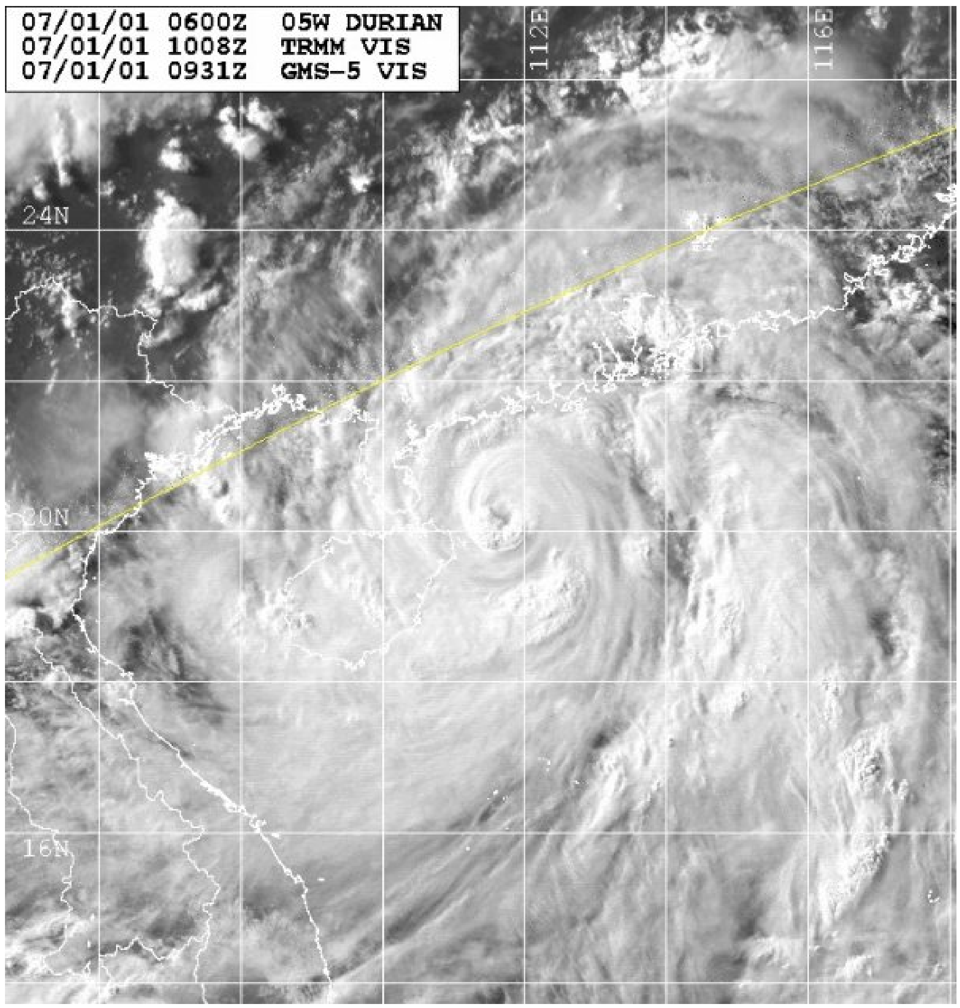
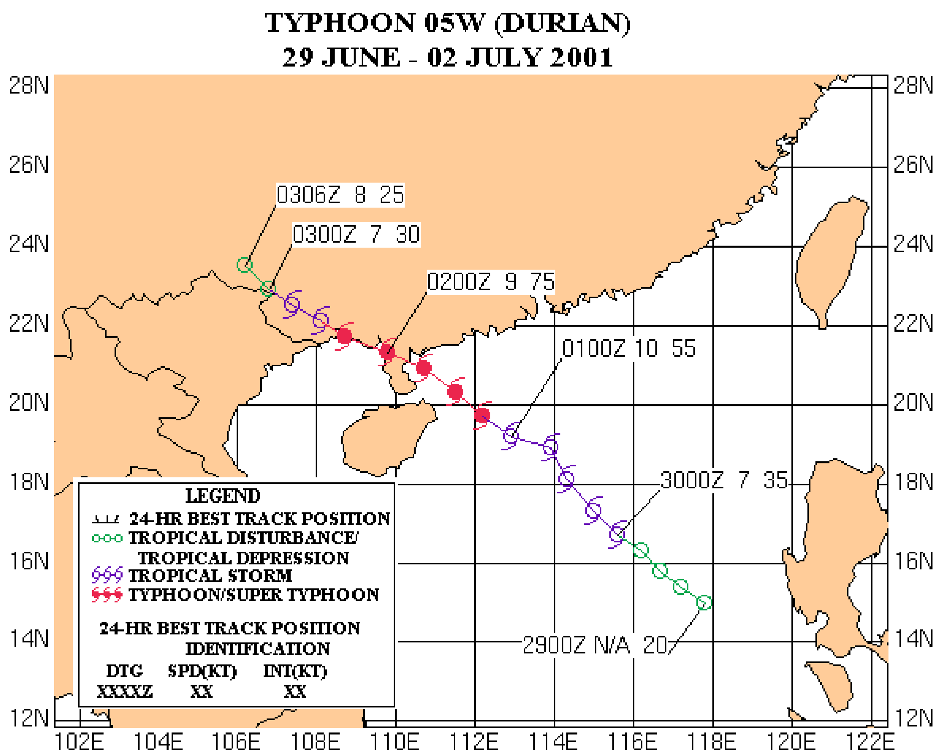


Figure 1-05W-2. 011008Z July 2001 TRMM visible image of TY 05W (Durian) 45 nm east of Hainan Do with an estimated intensity of 65 knots and a banding eye feature.


TYPHOON 05W (DURIAN)
29 JUNE - 02 JULY 2001
0306Z 8 25
0300Z 7 30
0200Z 9 75
0100Z 10 55
3000Z 7 35
2900Z N/A 20
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX
28N
26N
24N
22N
20N
18N
16N
14N
12N
102E 104E 106E 108E 110E 112E 114E 116E 118E 120E 122E

Typhoon (TY) 06W (Utor*)

First Poor : 2130Z 26 Jun 01

First Fair : 0030Z 29 Jun 01

First TCFA : 1230Z 29 Jun 01

First Warning : 0600Z 01 Jul 01

Last Warning : 1800Z 06 Jul 01

Max Intensity : 80 kts, gusts To 100 kts

Landfall : 0000Z 06 Jul 01, Guandong province, China

Total Warnings : 23

Remarks :

(1) Tracked southwest for a short period of time passing south of Yap before moving northwestward making landfall east of Hong Kong between Huidong and Haifeng.

(2) Attained tropical storm intensity just after passing due west of Yap. Reached maximum intensity on 4 July while passing over the northern tip of Luzon.

(3) A large cyclone with an average radius of gale-force wind of 250 nm that simultaneously affected all the countries bordering the Luzon Strait.

(3) The Philippine government reported that the storm affected almost one million people in about 20 provinces, destroying 3,700 houses and damaging at least 8,390 more. Flooding and landslides that resulted in 121 fatalities and at least $11.2 million in damage to agriculture, livestock and infrastructure was also reported.

(4) The outer circulation of TY 06W caused heavy wind and rain, flash floods and landslides in southern Taiwan with one death and no serious damage reported.

(5) According to the Xinhua News Agency, strong winds and landslides triggered by heavy rain caused 23 fatalities in the Guangdong Province of southern China. Damage was estimated at $286 million.

*Name assigned by RSMC Tokyo

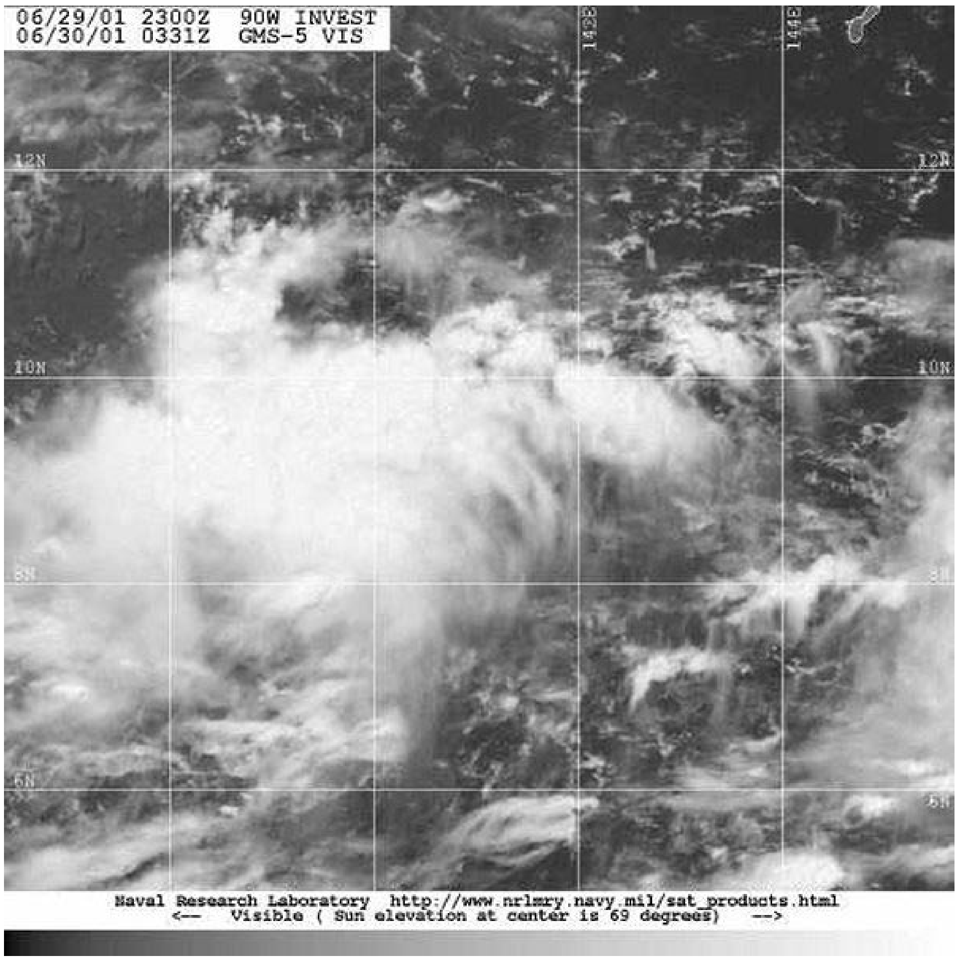


Figure 1-06W-1. 300331Z June 2001 GMS-5 visible satellite imagery of TY 06W (Utor) 360 nm southwest Guam with an estimated intensity of 25 knots.

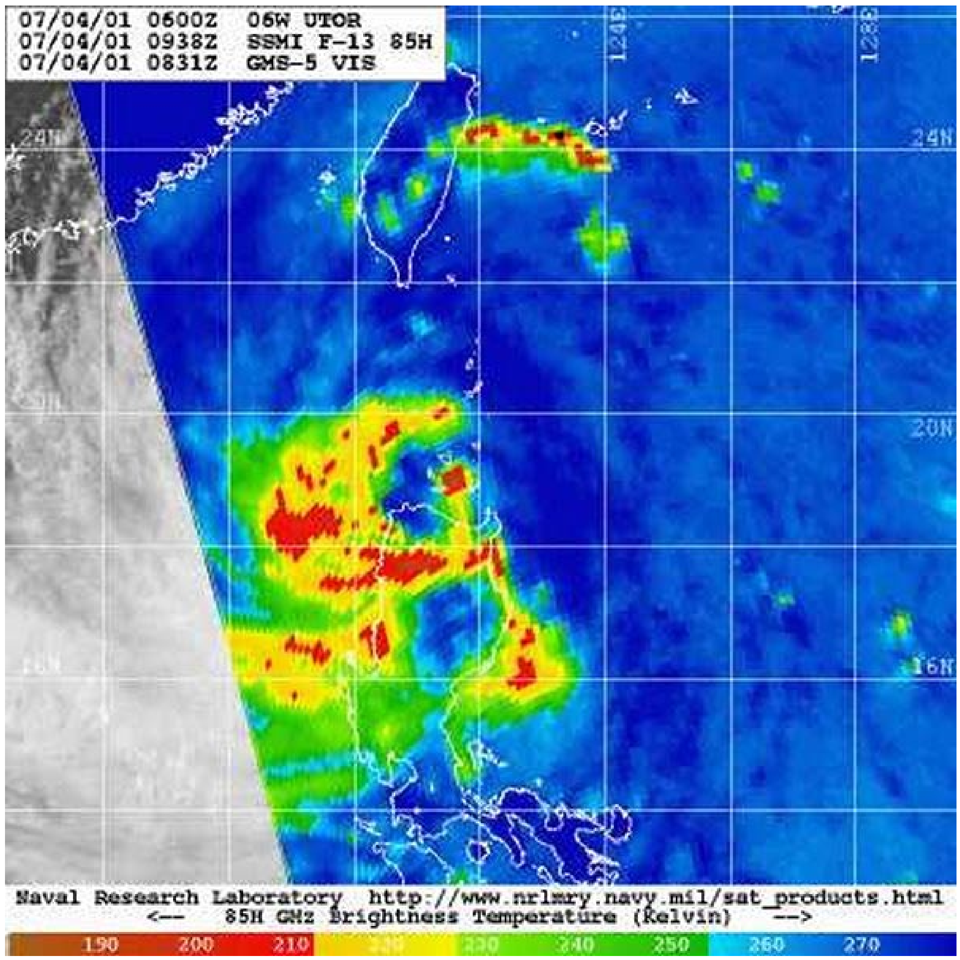


Figure 1-06W-2. 040938Z July 2001 85GHz SSMI satellite imagery of TY 06W (Utor) 50 nm north of Apari, Philippines. At this time, a ragged eye feature has developed while the system was at its peak intensity of 80 knots.

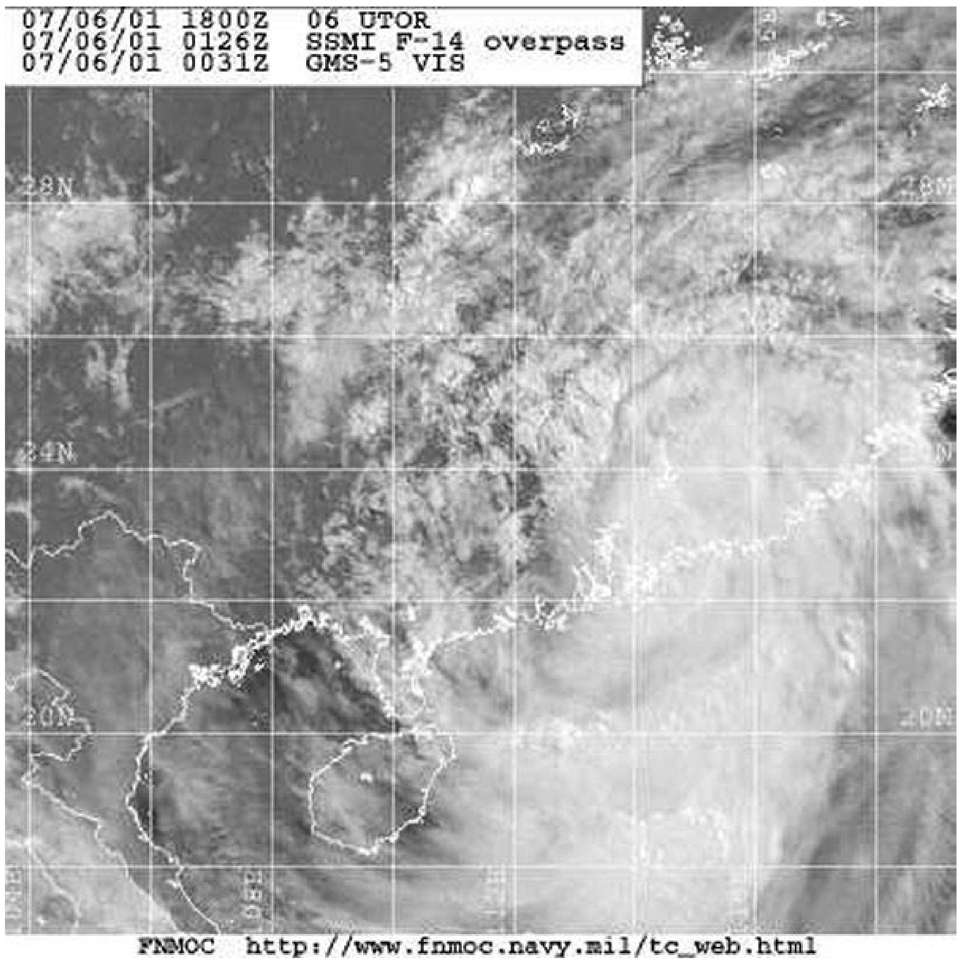
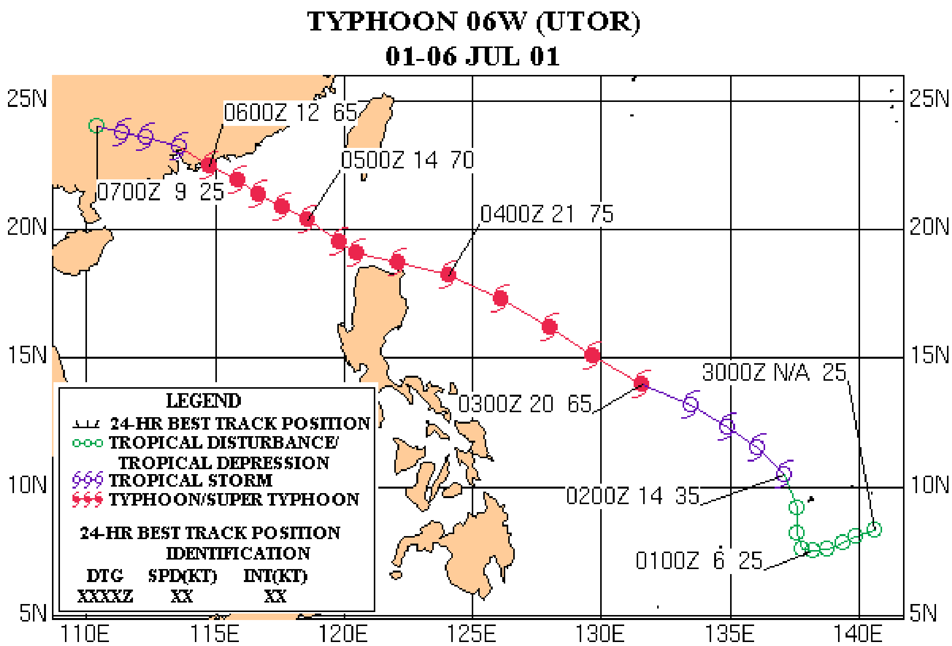


Figure 1-06W-3. 060031Z July 2001 GMS-5 visble satellite imagery of TY 06W (Utor) as it makes landfall 30 nm northeast of Hong Kong. At this time, the system has an estimated intensity of 65 knots.


TYPHOON 06W (UTOR)
01-06 JUL 01
25N
20N
15N
10N
5N
110E
115E
120E
125E
130E
135E
140E
0600Z 12 65
0500Z 14 70
0700Z 9 25
0400Z 21 75
3000Z N/A 25
0300Z 20 65
0200Z 14 35
0100Z 6 25
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION
IDENTIFICATION
DTG
SPD(KT)
INT(KT)
XXXXZ
XX
XX

Tropical Storm (TS) 07W (Trami*)

First Poor : 2330Z 03 Jul 01

First Fair : 0030Z 05 Jul 01

First TCFA : 0100Z 08 Jul 01

First Warning : 0000Z 09 Jul 01

Last Warning : 0600Z 12 Jul 01

Max Intensity : 40 kts, gusts To 50 kts

Landfall : 1800Z 11 Jul 01, Taiwan

Total Warnings : 14

Remarks :

(1) Attained maximum intensity on 10 July approximately 24 hours prior to making landfall in Southern Taiwan.

(2) Taiwan's Central Weather Bureau (CWB) indicated that rainfall rates in the Pingtung County exceeded 500 millimeters in a twelve hour period.

(3) The China Post reported that TS 07W set off flash floods and mudslides killing 3 people, causing power outages and hundreds of million dollars worth of damage.

*Name assigned by RSMC Tokyo

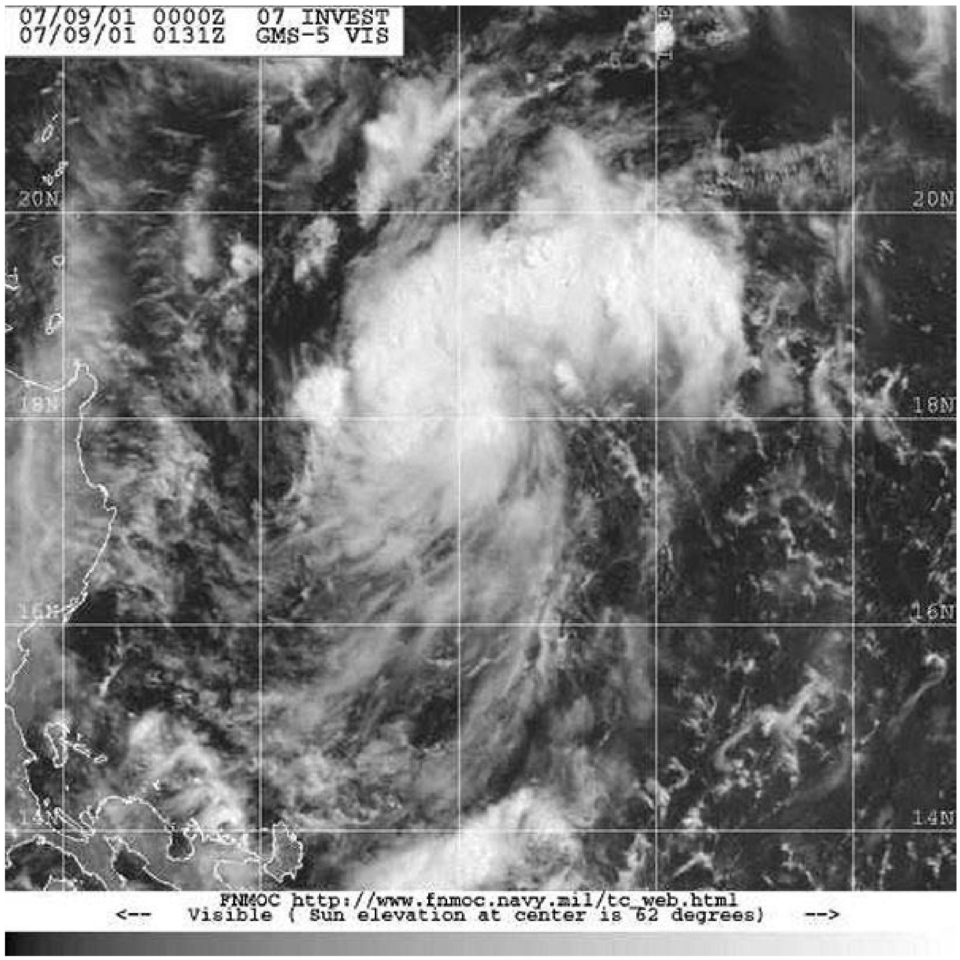


Figure 1-07W-1. 090131Z July 2001 GMS-5 visible satellite imagery of TS 07W (Trami) 210 nm east of Luzon, Philippines with an estimated intensity of 25 knots. Convection was beginning to develop near the low-level circulation center with a banding feature to the north.

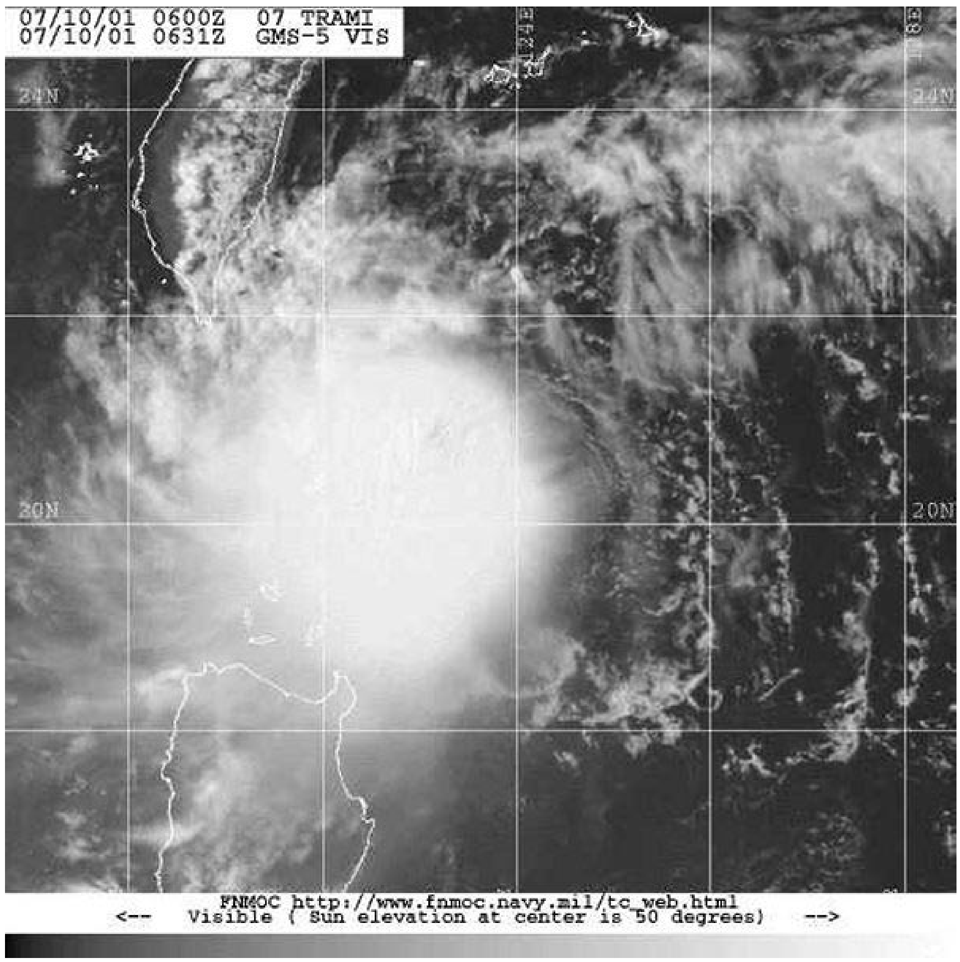


Figure 1-07W-2. 100631Z July 2001 GMS-5 visible satellite imagery of TS 07W (Trami) approximately 145 nm northeast of Luzon, Philippines at its peak intensity of 40 knots.

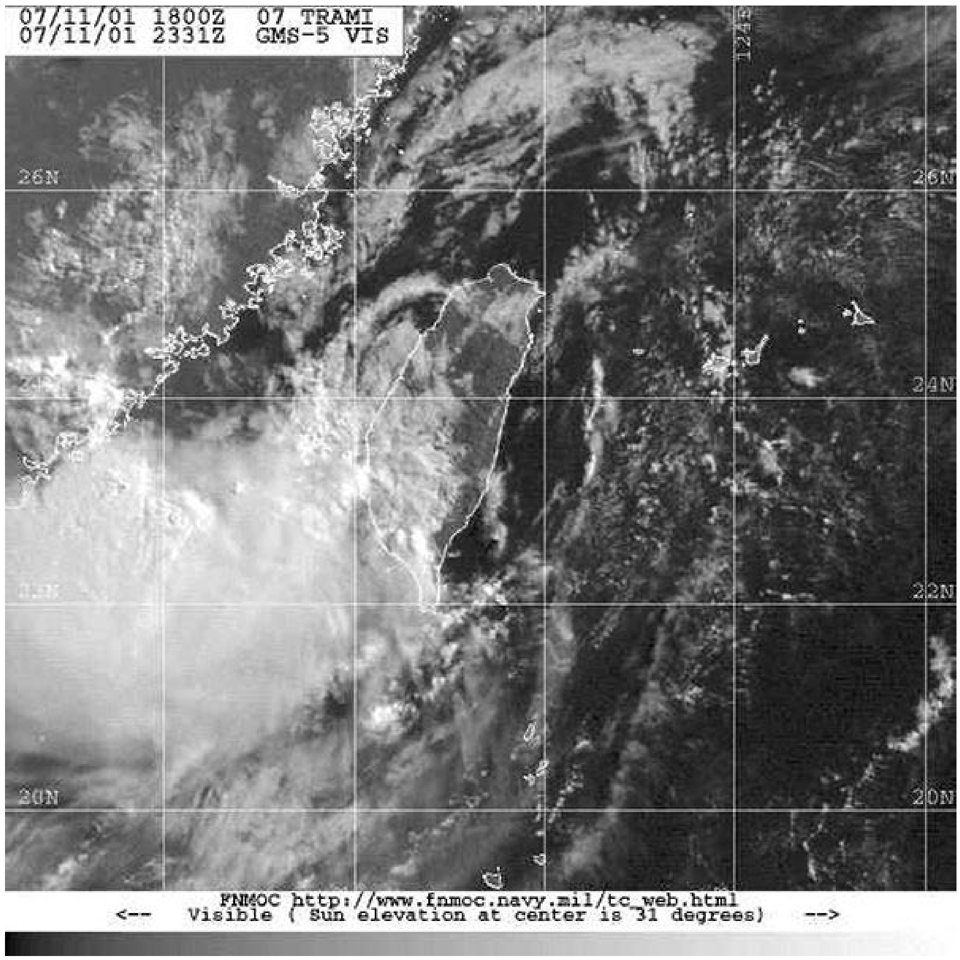
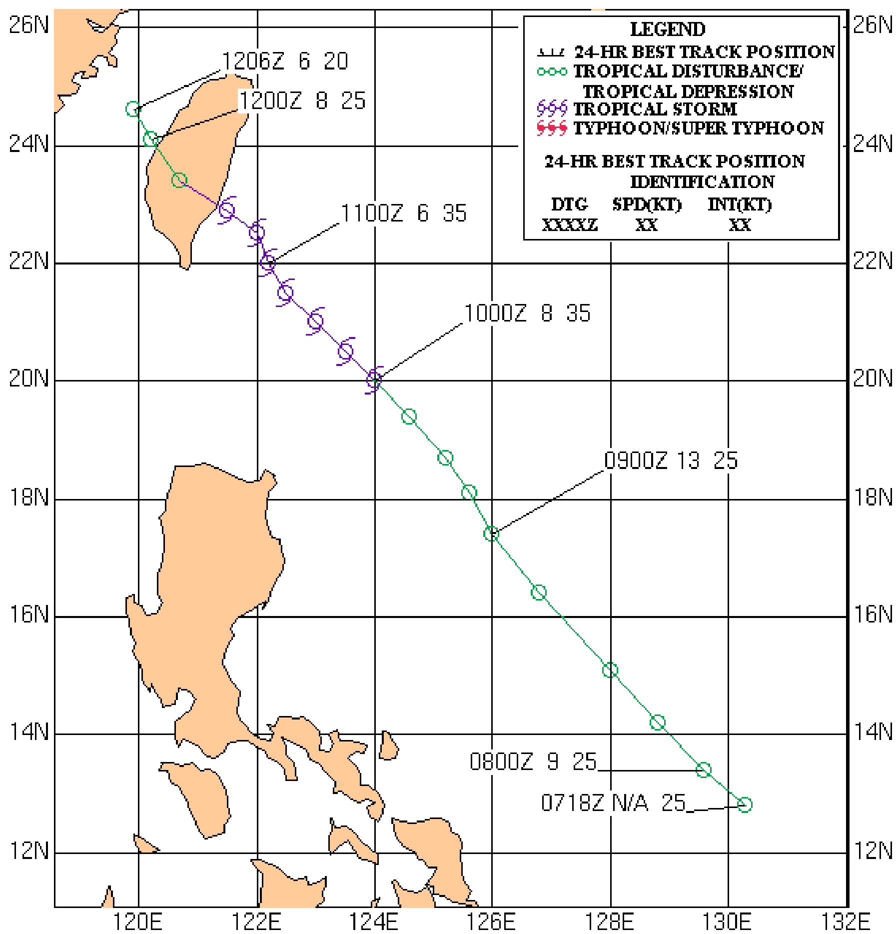


Figure 1-07W-3. 112331Z July 2001 GMS-5 visible satellite imagery of TS 07W (Trami) 12 nm off the western coast of Taiwan with an estimated intensity of 25 knots. The system was dissipating as it interacted with the mountainous terrain.

TROPICAL STORM 07W (TRAMI)
09-12 JUL 01



Tropical Depression (TD) 08W

First Poor : None

First Fair : None

First TCFA : None

First Warning : 1800Z 10 Jul 01

Last Warning : 0600Z 11 Jul 01

Max Intensity : 25 kts, gusts to 35 kts

Landfall : None

Total Warnings : 3

Remarks:

(1) TD 08W was a small and short-lived hybrid tropical depression that developed along a shear zone southwest of Midway Island and then underwent extratropical transition as it was captured by an eastward moving short wave trough.

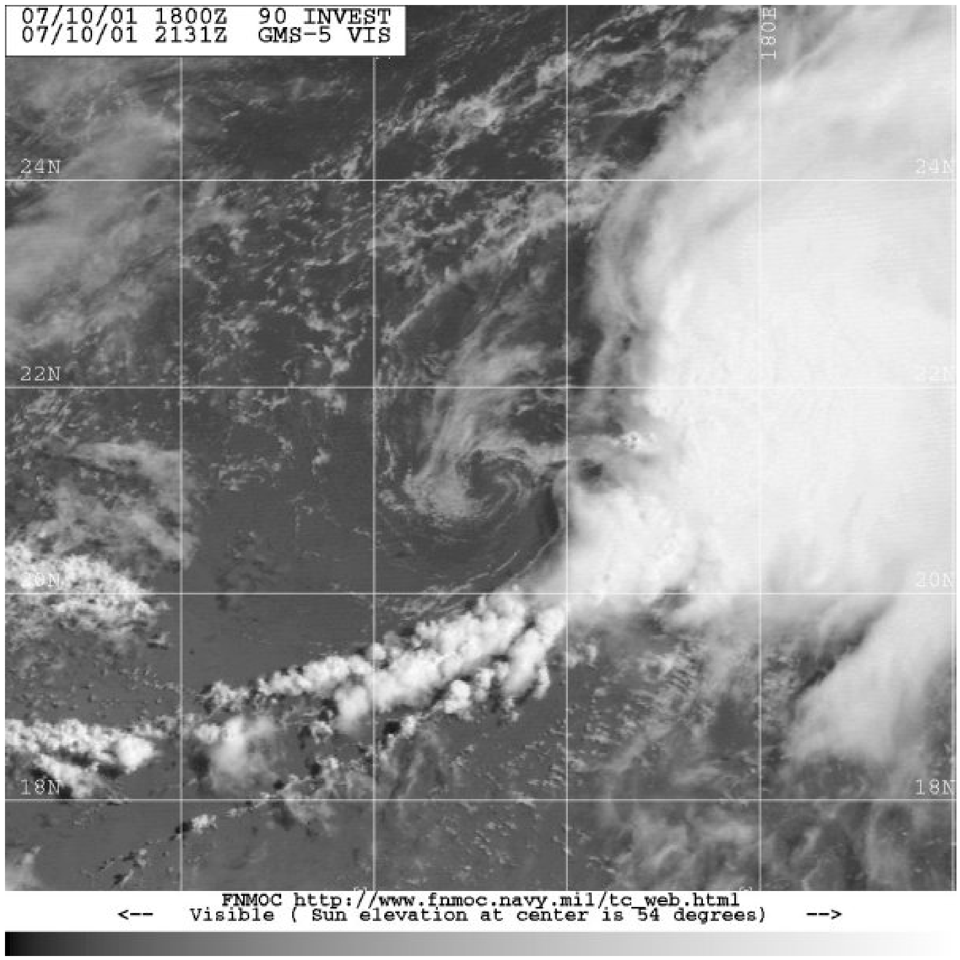


Figure 1-08W-1. 102131Z July 2001 GMS-5 visible image of TD 08W 520 nm southwest of Midway Island. At this time, the system was under strong westerly vertical shear exposing a well defined low-level circulation.

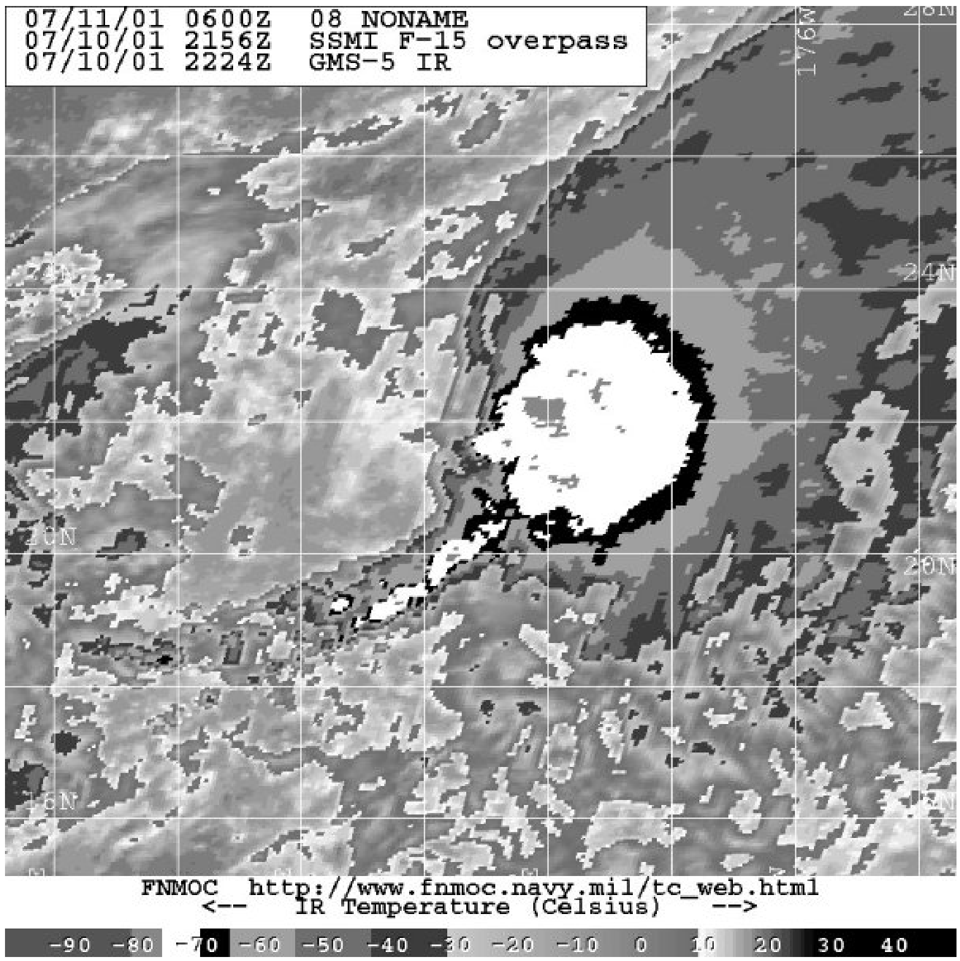
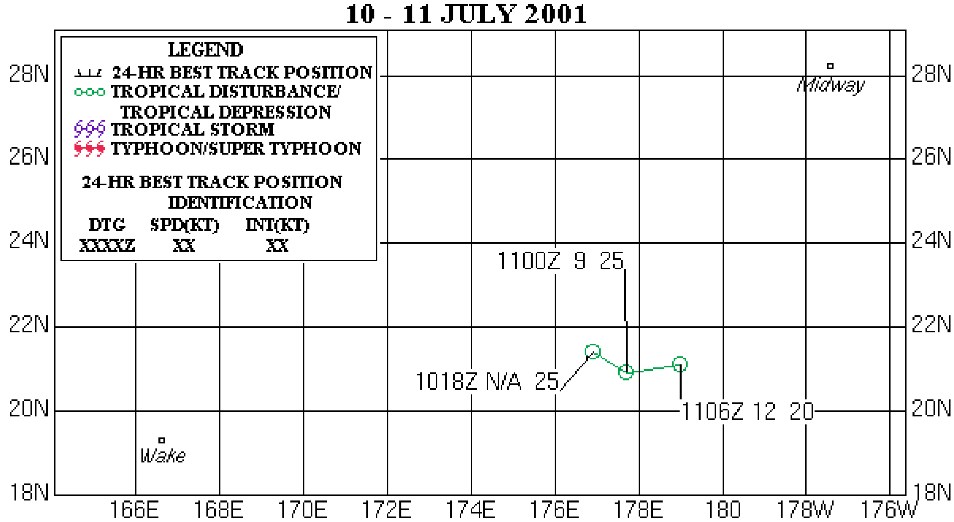


Figure 1-08W-2. 102224Z July 2001 GMS-5 enhanced infrared satellite image of TD 08W. Note the deep convection displaced to the northeast of the low-level circulation center, indicative of strong vertical shear.

TROPICAL DEPRESSION 08W
10 - 11 JULY 2001



Typhoon (TY) 09W (Kong-Rey*)

First Poor : 0030Z 21 Jul 01

First Fair : None

First TCFA : 0251Z 21 Jul 01

First Warning : 0600Z 21 Jul 01

Last Warning : 0600Z 28 Jul 01

Max Intensity : 85 kts, gusts To 105 kts

Landfall : None

Total Warnings : 29

Remarks :

(1) Passed approximately 100 nm north-northeast of Iwo Jima on 24 July before recurving towards the northeast.

*Name assigned by RSMC Tokyo

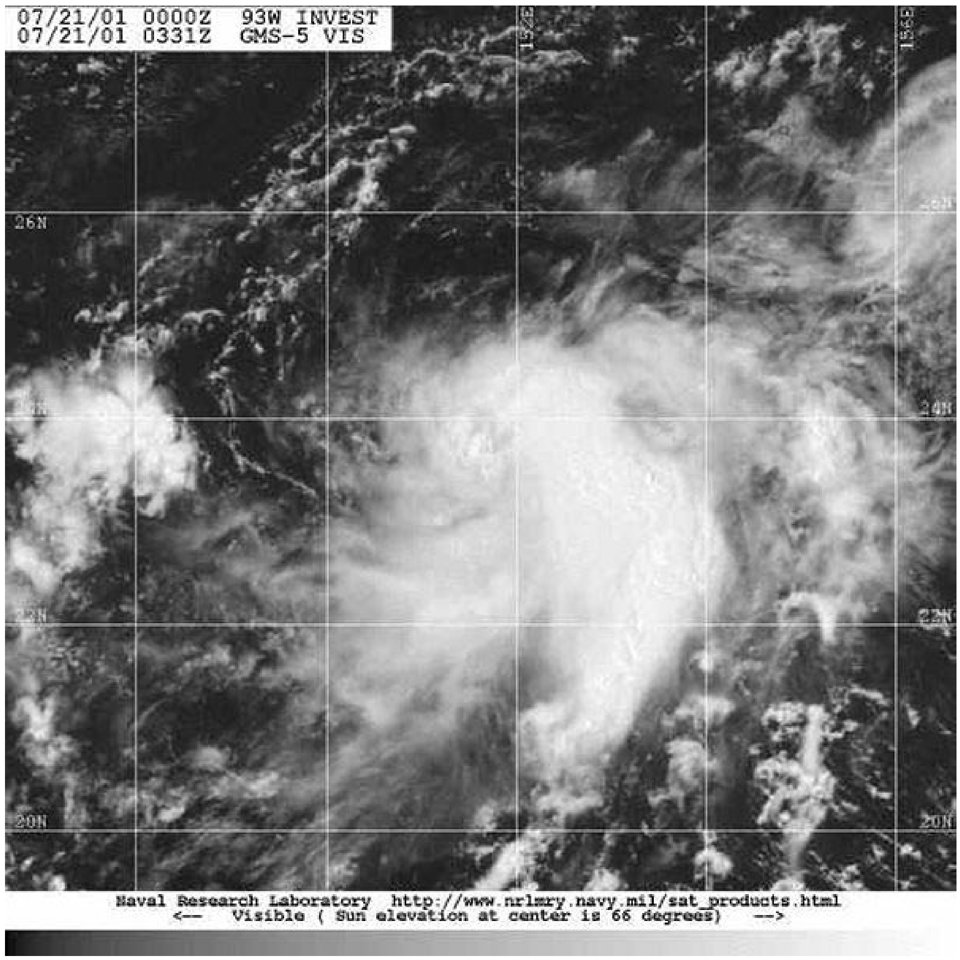


Figure 1-09W-1. 210331Z July 2001 GMS-5 visible satellite imagery of TY 09W (Kong-Rey) about 730 nm northeast of Guam with an estimated intensity of 25 knots. Imagery indicates a developing band of convection along the eastern periphery of the system.

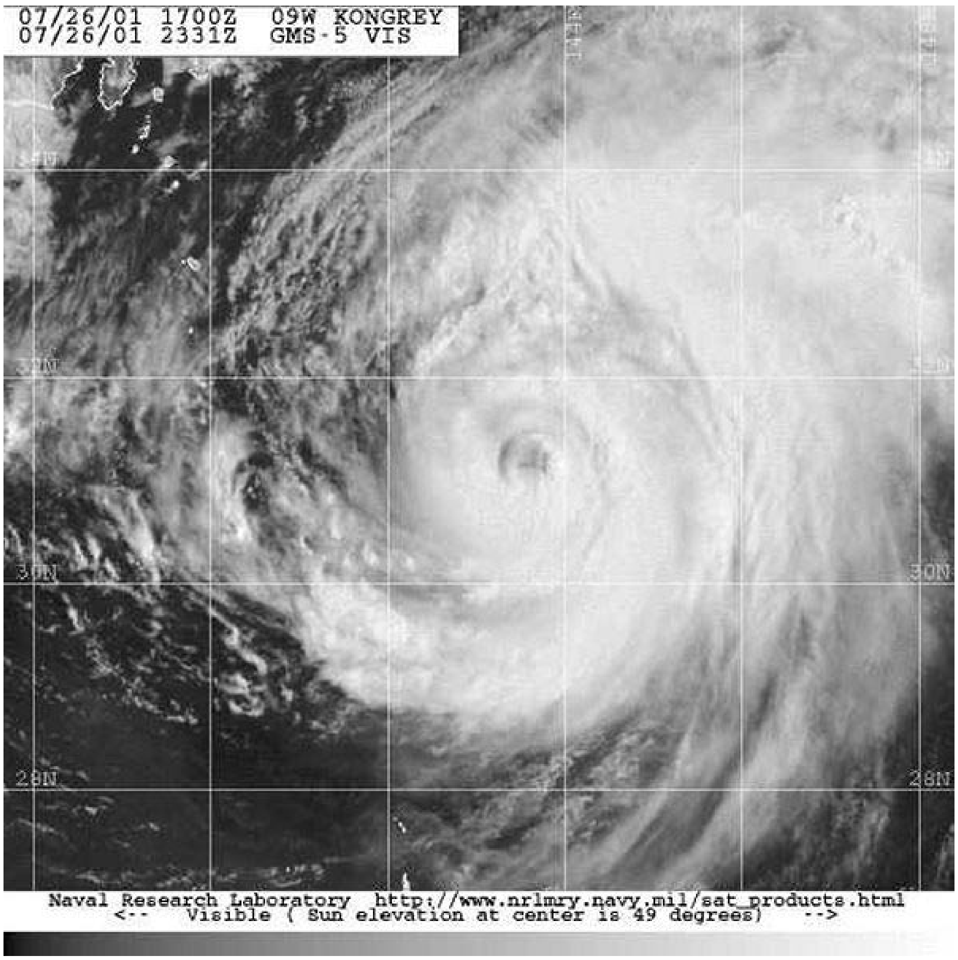


Figure 1-09W-2. 262331Z July 2001 GMS-5 visible satellite imagery of TY 09W (Kong-Rey) about 330 nm southeast of Tokyo, Japan at its peak intensity of an estimated 85 knots.

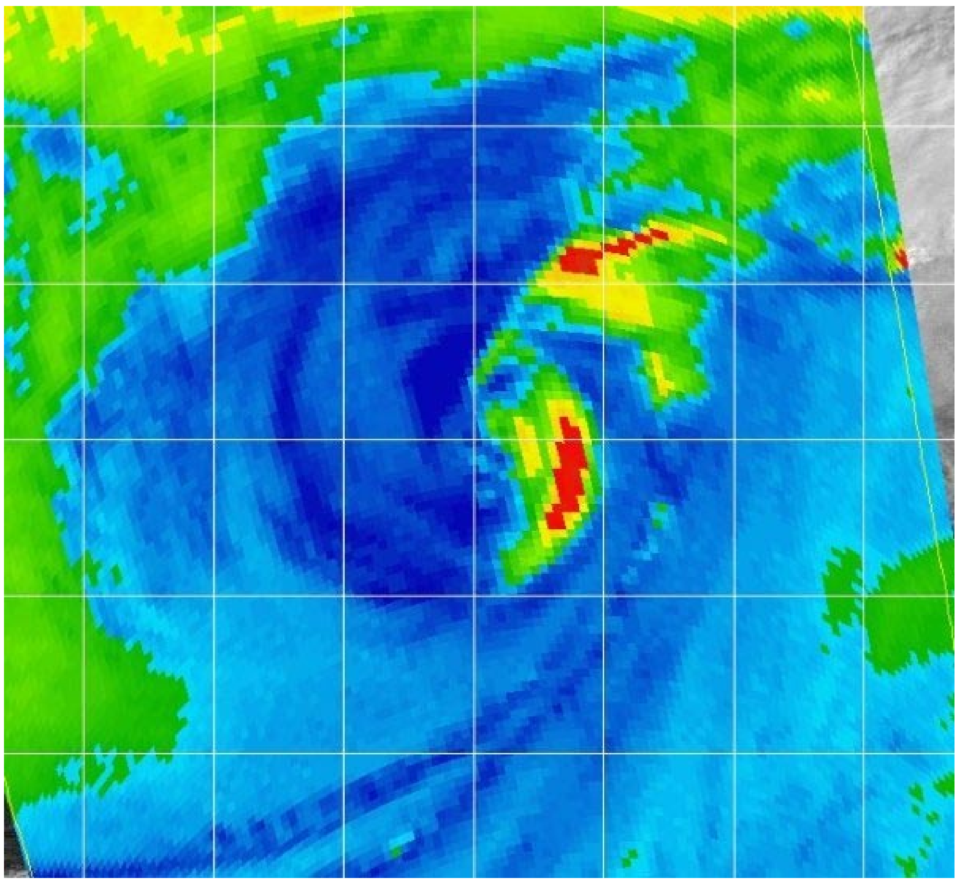
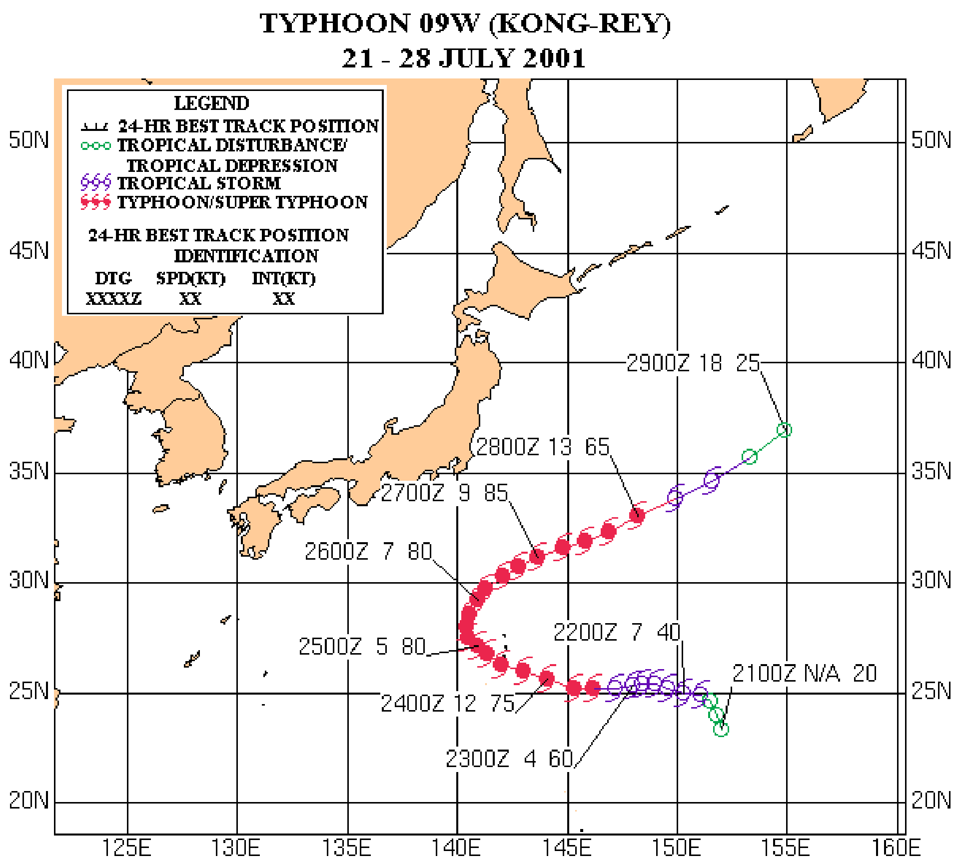


Figure 1-09W-3. 280747Z July 2001 85 GHz SSM/I image of TY 09W (Kong-Rey) about 510 nm east-southeast of Tokyo, Japan with an estimated intensity of 60 knots. Imagery indicates that the system was undergoing extratropical transition with associated convection located poleward and eastward of the low-level.



TYPHOON 09W (KONG-REY)
21 - 28 JULY 2001
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX
2900Z 18 25
2800Z 13 65
2700Z 9 85
2600Z 7 80
2500Z 5 80
2400Z 12 75
2300Z 4 60
2200Z 7 40
2100Z N/A 20
50N
45N
40N
35N
30N
25N
20N
125E
130E
135E
140E
145E
150E
155E
160E

Typhoon (TY) 10W (Yutu*)

First Poor : 0030Z 21 Jul 01

First Fair : 1200Z 22 Jul 01

First TCFA : 1730Z 22 Jul 01

First Warning : 1800Z 22 Jul 01

Last Warning : 0600Z 26 Jul 01

Max Intensity : 85 kts, gusts To 105 kts

Landfall : 1800Z 25 Jul 01

Total Warnings : 15

Remarks :

(1) Developed in northern Philippine Sea, tracked through the Luzon Strait into the South China Sea before making landfall between Zhanjiang and Yangjiang, China.

(2) Hong Kong was affected by heavy rain and high winds as the system passed south of the city. No serious injuries or deaths were reported.

*Name assigned by RSMC Tokyo

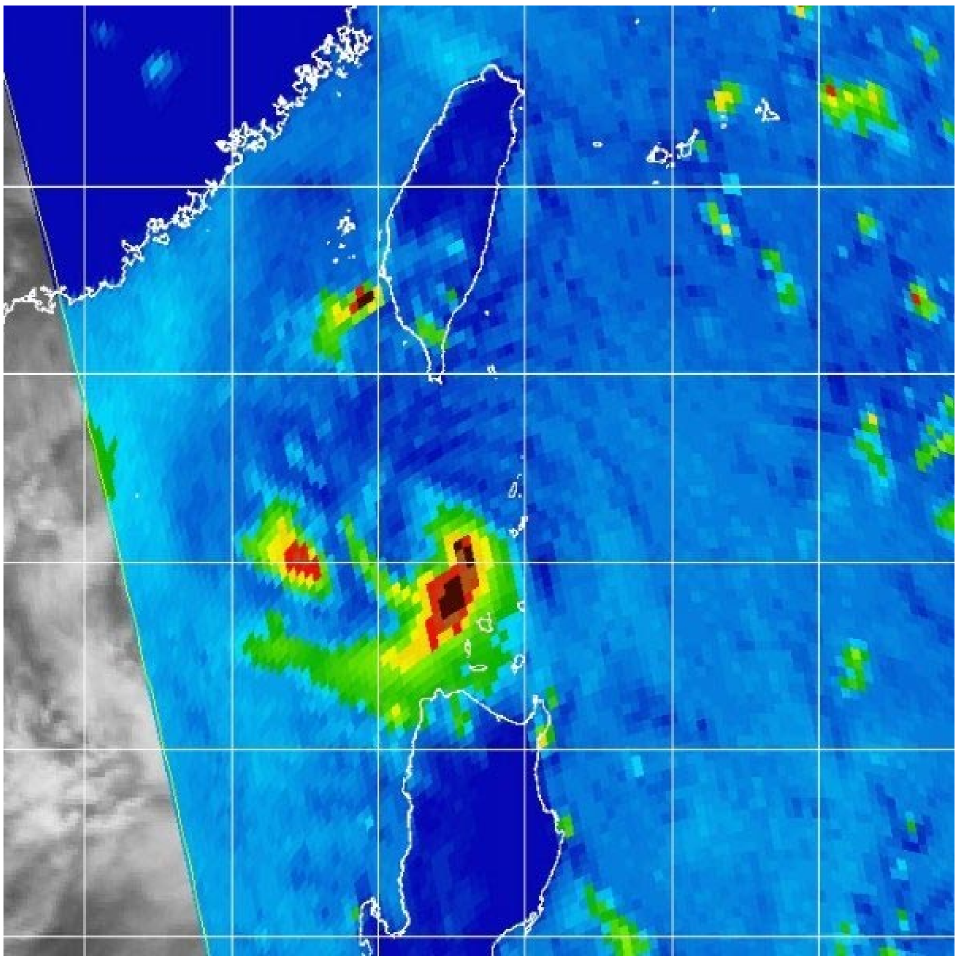


Figure 1-10W-1. 231303Z July 2001 85 GHz SSM/I image of TY 10W (Yutu) about 90 nm north of Luzon with an estimated intensity of 35 knots.

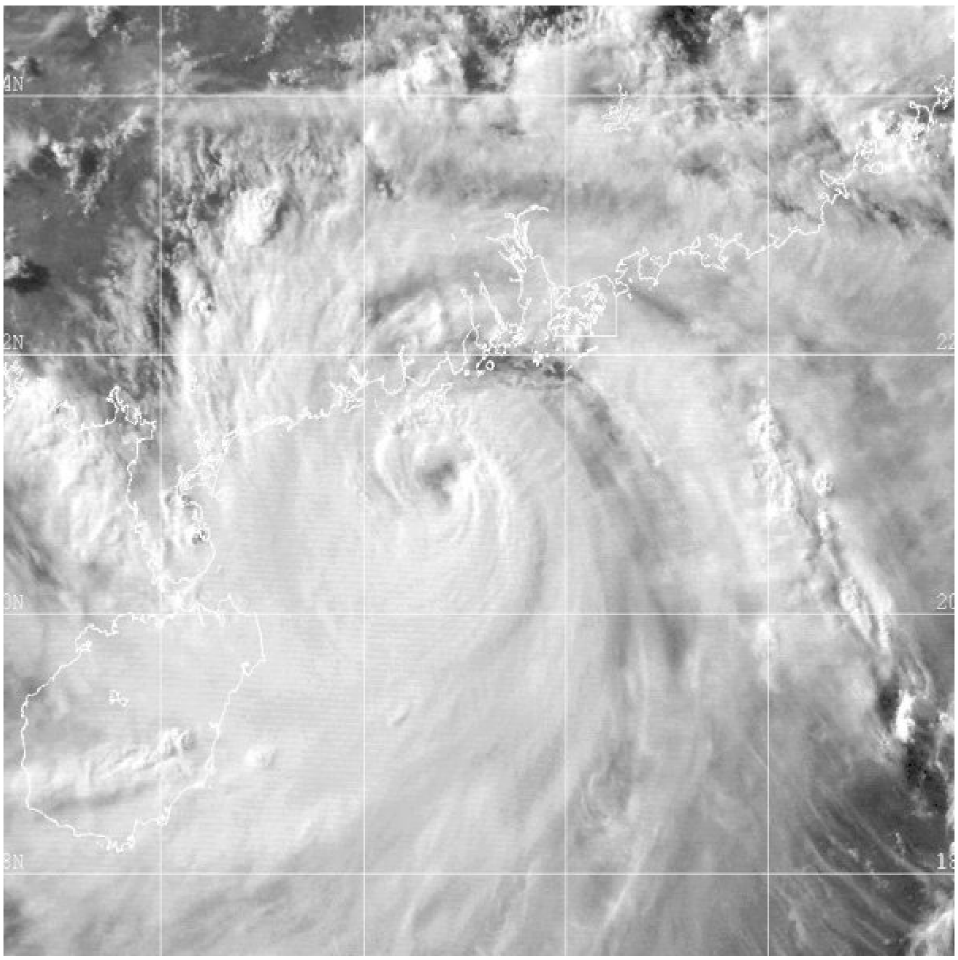


Figure 1-10W-2. 250931Z July 2001 GMS-5 visible imagery of TY 10W (Yutu) about 110 nm southwest of Hong Kong, China with an estimated intensity of 80 knots.

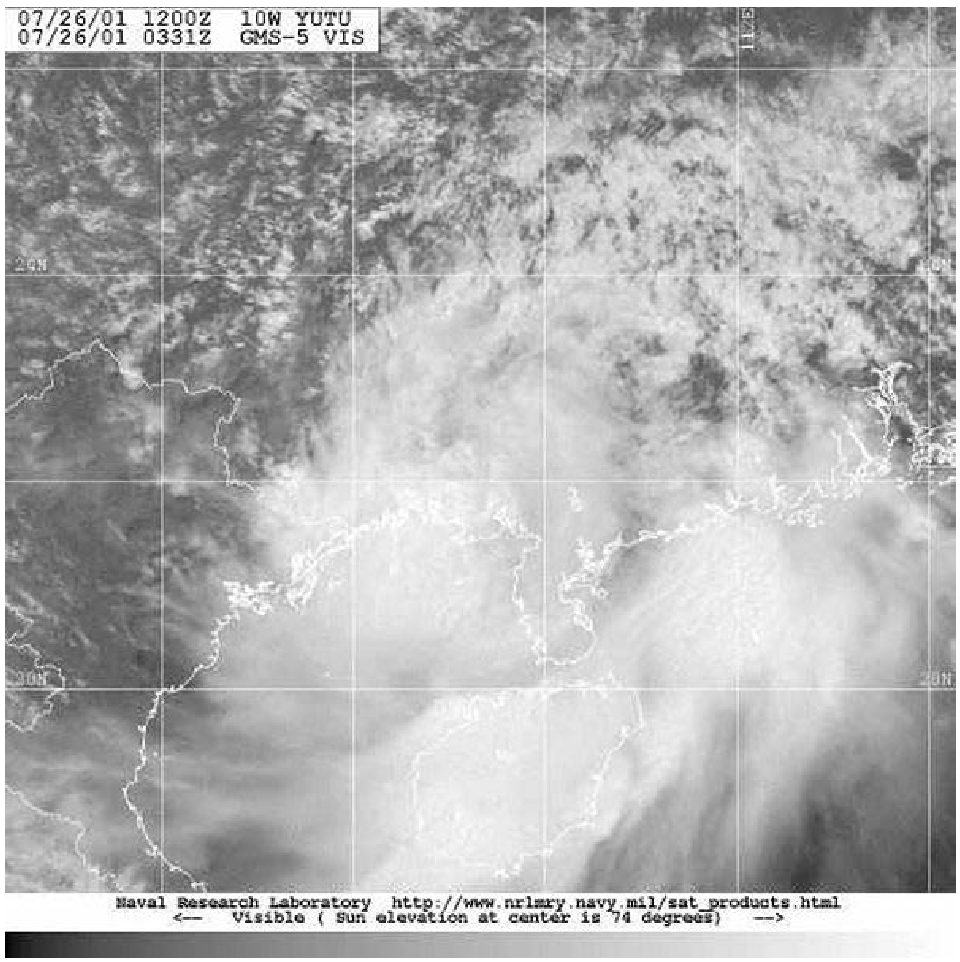
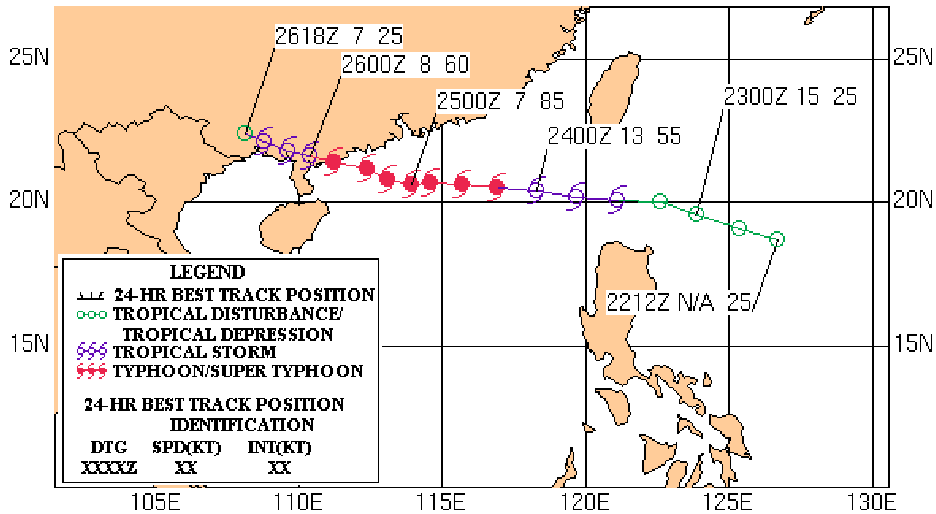


Figure 1-10W-3. 260331Z July 2001 GMS-5 visible imagery of TY 10W (Yutu) over southern China with an estimated intensity of 45 knots.

TYPHOON 10W (YUTU)
22 - 26 JULY



Typhoon (TY) 11W (Toraji*)

First Poor : 0600Z 24 Jul 01

First Fair : 0600Z 25 Jul 01

First TCFA : 1700Z 25 Jul 01

First Warning : 1800Z 25 Jul 01

Last Warning : 1200Z 31 Jul 01

Max Intensity : 100 kts, gusts To 125 kts

Landfall : 1600Z 29 Jul 01 eastern Taiwan, 1930Z 30 Jul 01 near Fuzhou, China

Total Warnings : 24

Remarks:

(1) Attained peak intensity of 100 kts at approximately 1800Z 29 July after making landfall.

(2) The Taipei Central News Agency reported 72 fatalities, making TY 11W the most lethal typhoon to hit Taiwan since 1961. Torrential rain and mudslides caused damage to the island's agriculture, forestry, fishery and livestock industries totaling $128 million, while hundreds of thousands of people were left without power and water.

(3) TY 11W made final landfall near Fuzhou, China at approximately 1930Z on July 30 before moving inland and dissipating. The China Meteorological Administration reported that this cyclone caused damage of over $47.5 million.

*Name assigned by RSMC Tokyo

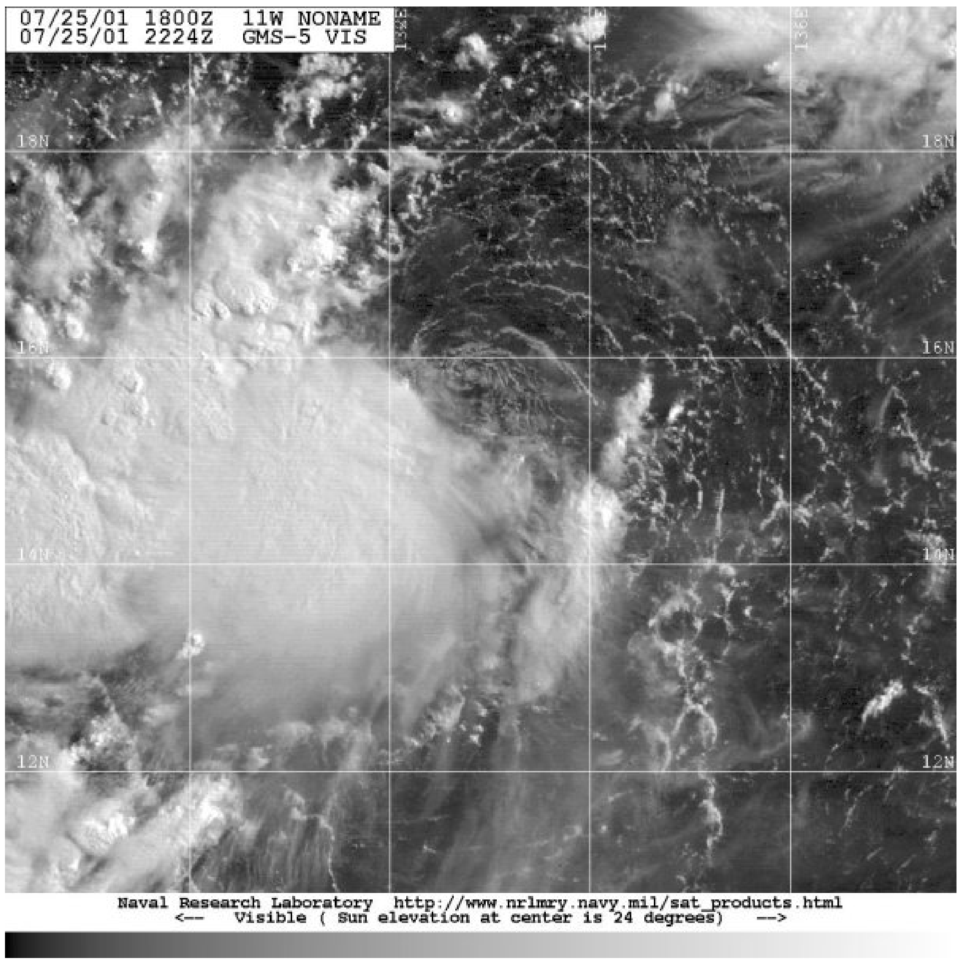


Figure 1-11W-1. 252224Z July 2001 GMS-5 visible imagery of TY 11W (Toraji) about 615 nm east of Luzon with an estimated intensity of 25 knots. Imagery indicates the deep convection was displaced to the southwest revealing a well-defined low-level circulation center.

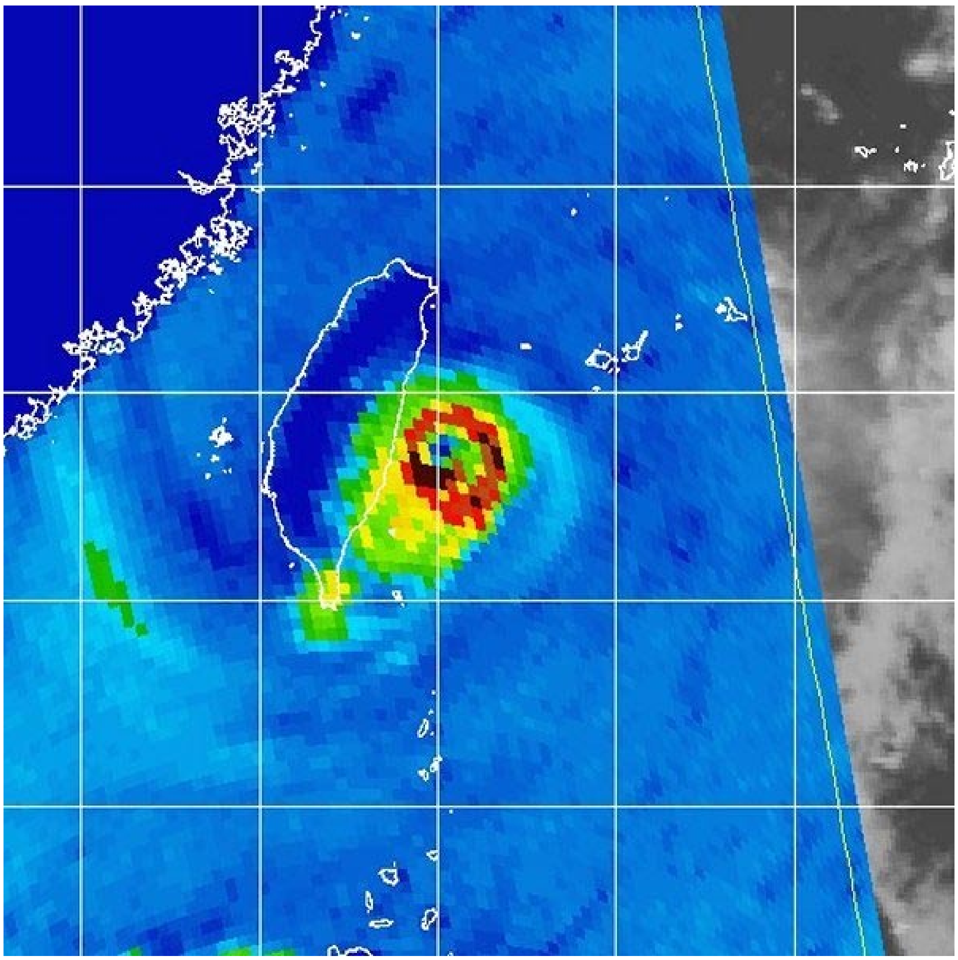


Figure 1-11W-2. 291318Z July 2001 85 GHz SSM/I image of TY 11W (Toraji), located about 110 nm south-southeast of Taipei, Taiwain. At this time, the system had a well-defined eye feature with an estimated intensity of 95 knots.

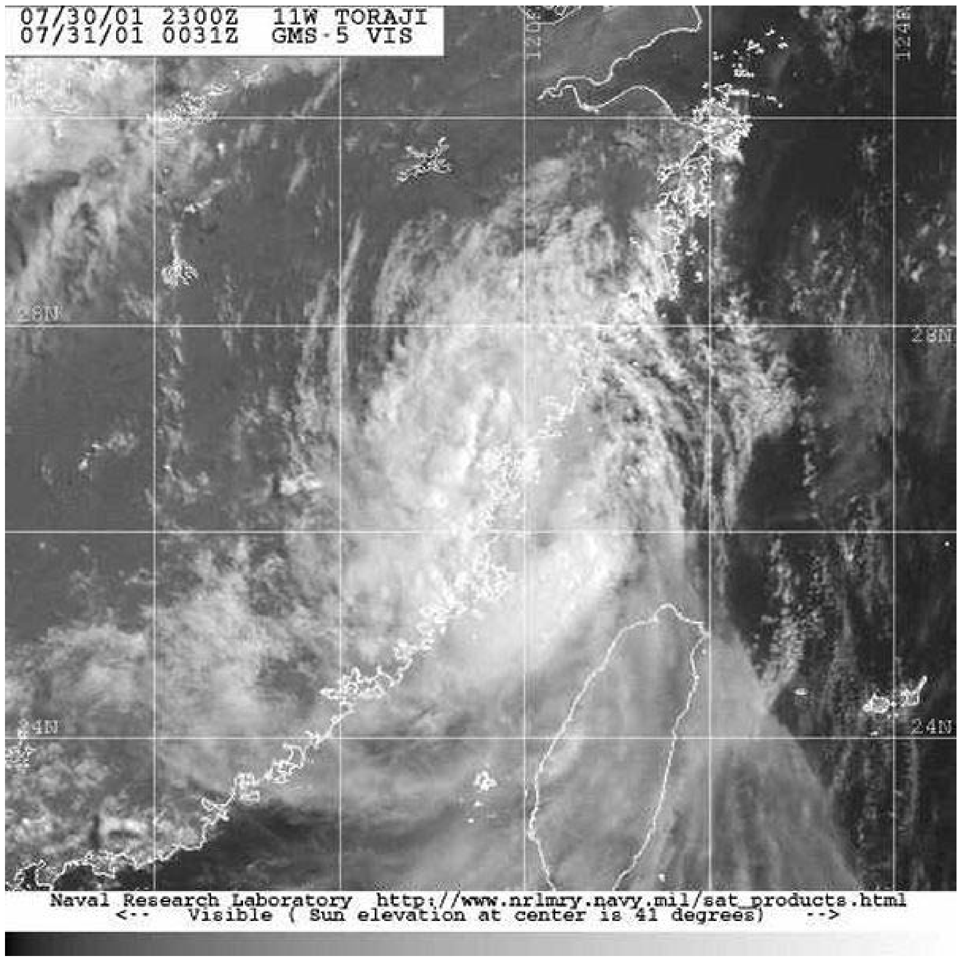
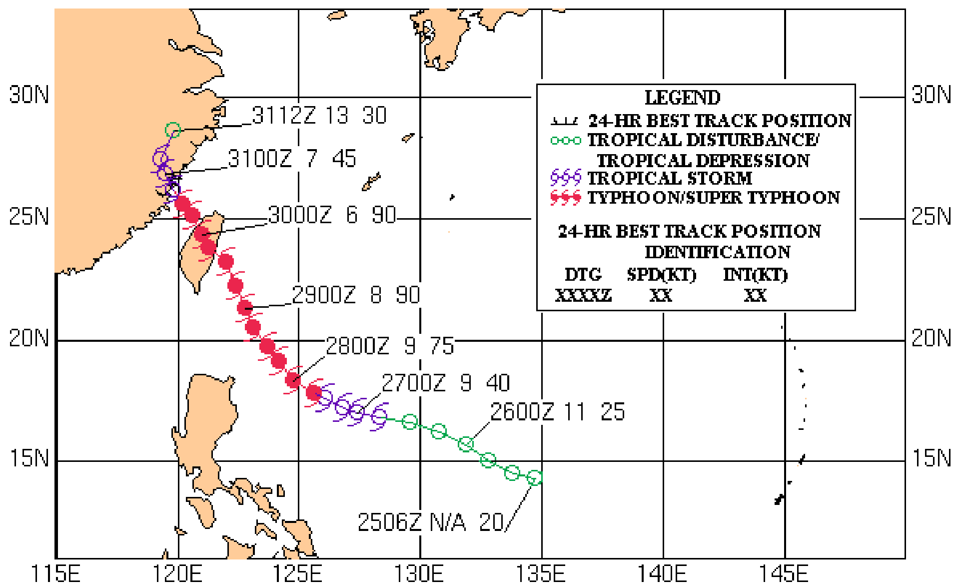


Figure 1-11W-3. 310031Z July 2001 GMS-5 visible imagery of TY 11W (Toraji) just after making landfall near Fuzhou, China. At this time, the system had an estimated intensity of 45 knots and was weakening due to interaction with land.

TYPHOON 11W (TORAJI)
26 - 31 JULY 2001



Typhoon (TY) 12W (Man-yi*)

First Poor : 0230Z 31 Jul 01

First Fair : 0600Z 31 Jul 01

First TCFA : 0100Z 01 Aug 01

First Warning : 1800Z 01 Aug 01

Last Warning : 1800Z 08 Aug 01

Max Intensity : 120 kts, gusts To 145 kts

Landfall : None

Total Warnings : 29

Remarks :

(1) TY 12W rapidly intensified in 36 hours from 55 knots to a peak intensity of 120 knots at 1200Z on 04 August. During the following 72-hour period, an eyewall replacement cycle occurred in which the cyclone weakened to 95 knots then reintensified to 115 knots on 06 August.

*Name assigned by RSMC Tokyo

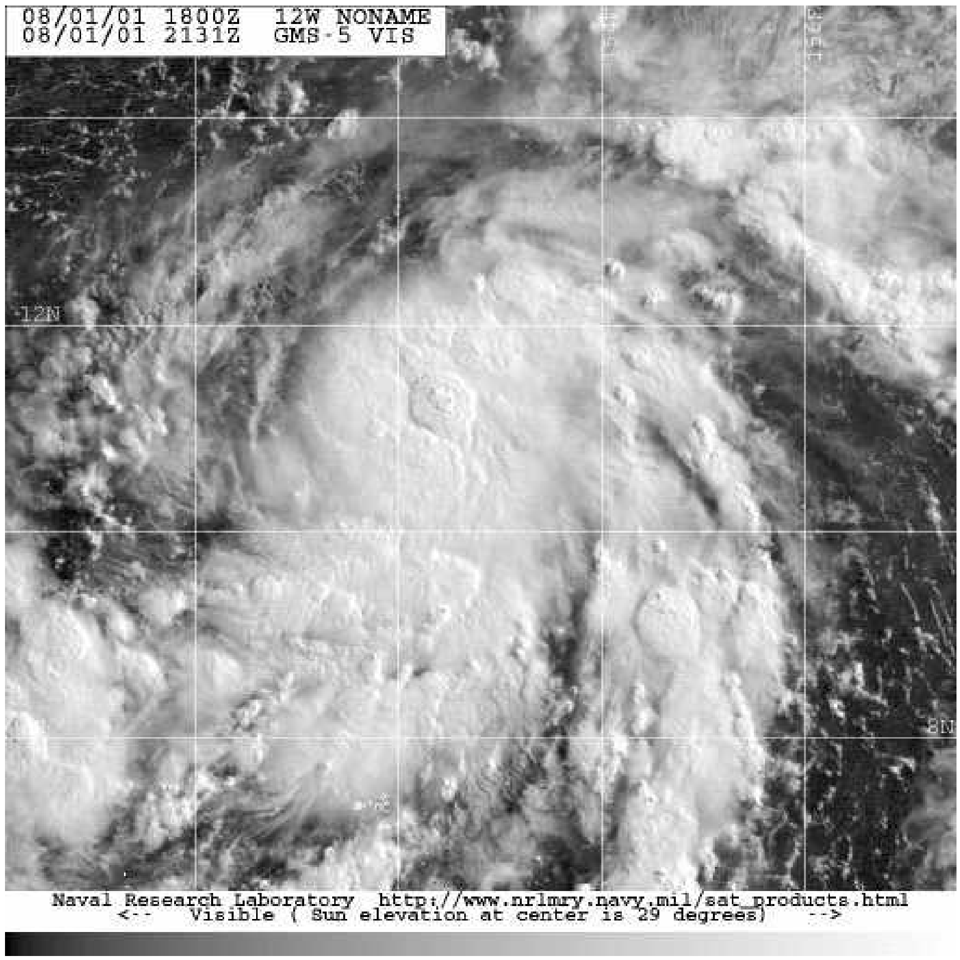


Figure 1-12W-1. 012131Z August 2001 GMS-5 visible imagery of TY 12W (Man-yi) about 500 nm east-southeast of Guam with an estimated intensity of 25 knots. At this time, the convection was increasing and becoming more consolidated over the low-level circulation center.

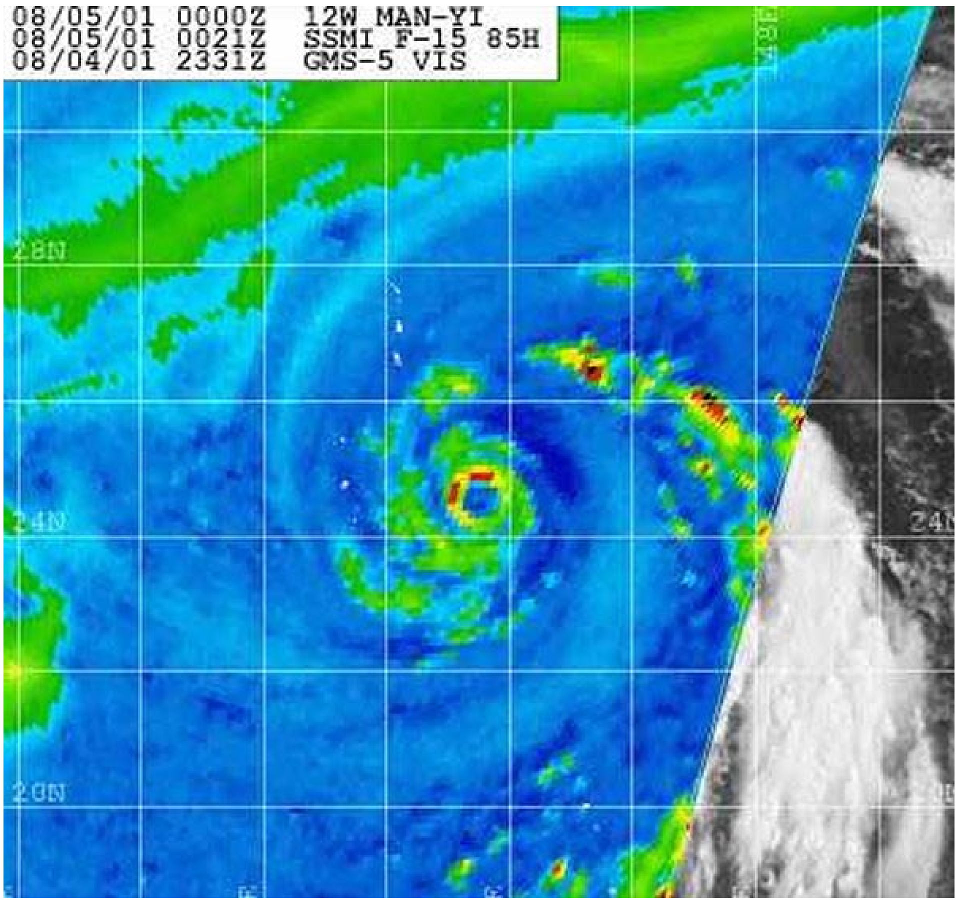


Figure 1-12W-2. 050021Z July 2001 85 GHz SSM/I image of TY 12W (Man-yi) about 120 nm east of Iwo Jima with an estimated intensity of 115 knots. Note the large eye and early signs of a concentric eyewall feature. At this time, the system was undergoing an eyewall replacement cycle.

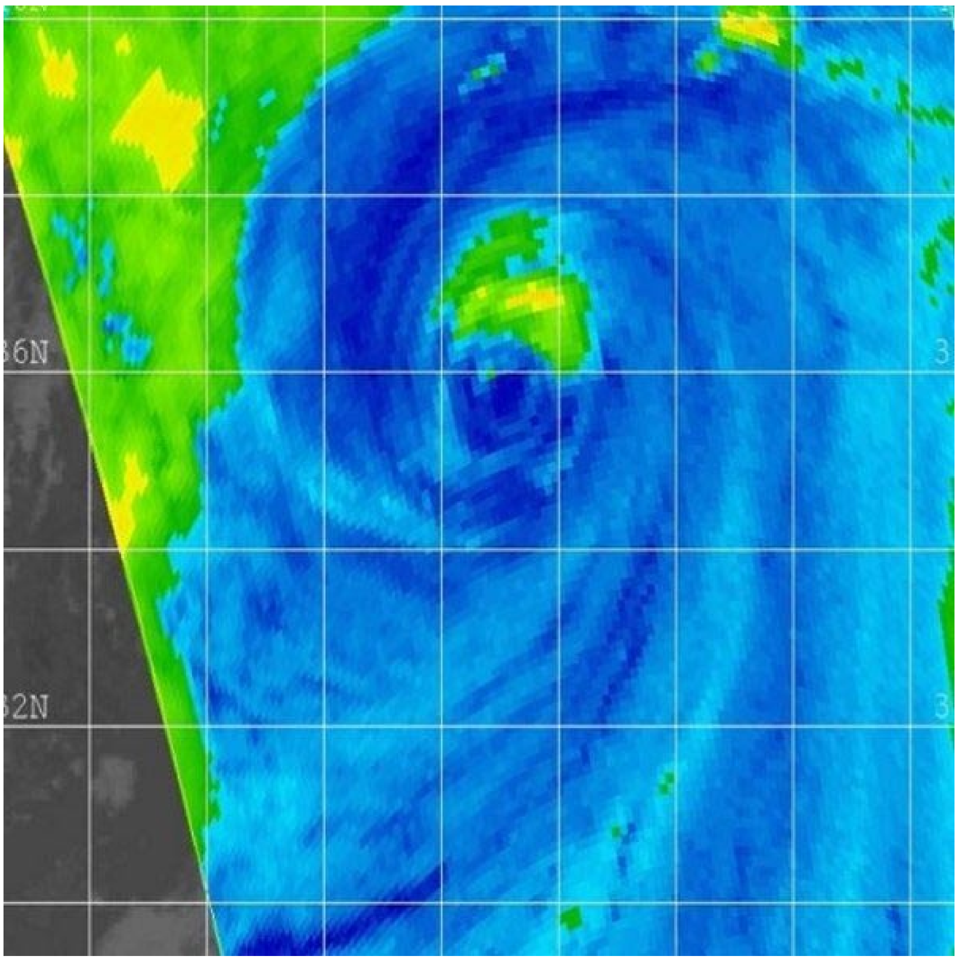
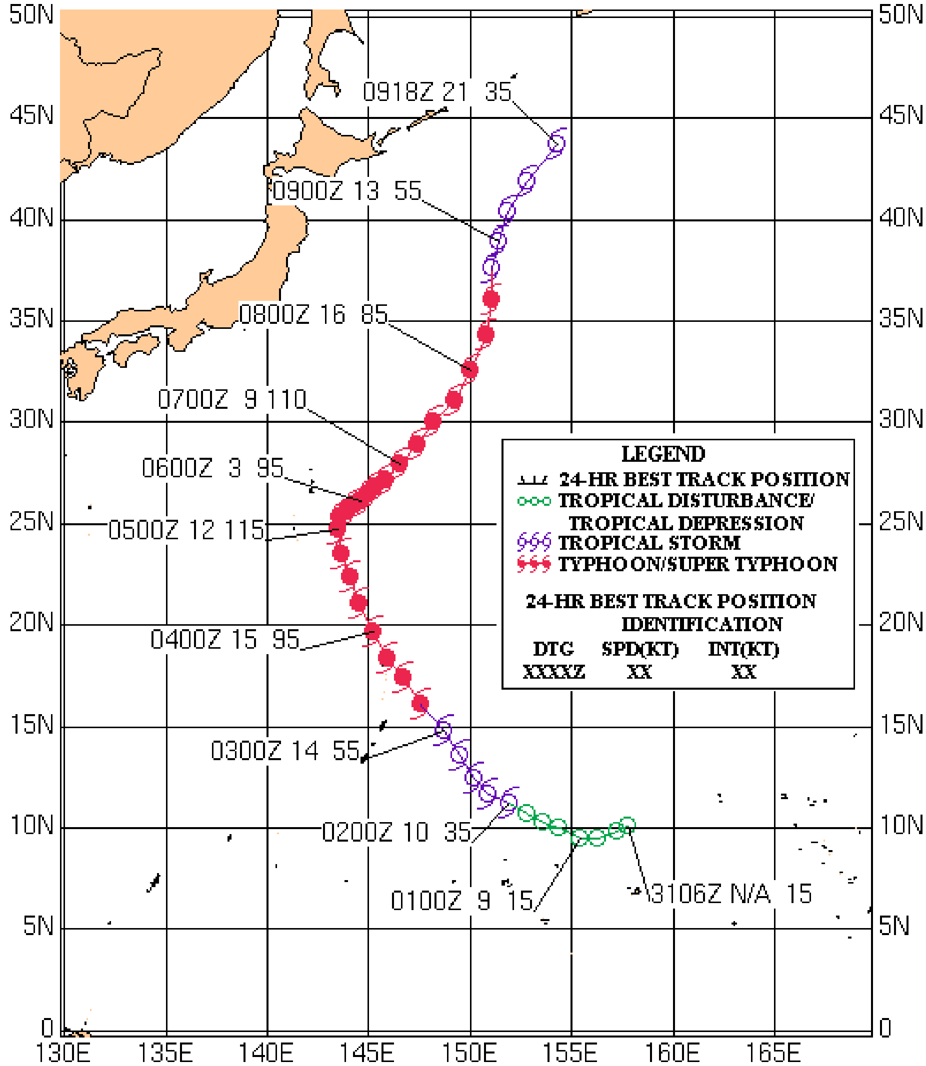


Figure 1-12W-3. 081056Z August 2001 85 GHz SSM/I image of TY 12W (Man-yi), located about 550 nm east of Tokyo, Japan with an estimated intensity of 65 knots. At this time, the system is becoming extratropical, and the low-level circulation center is exposed.

TYPHOON 12W (MAN-YI)
01 - 08 AUGUST 2001



Tropical Storm (TS) 13W (Usagi*)

First Poor : 0600Z 08 Aug 01

First Fair : 1800Z 08 Aug 01

First TCFA : None

First Warning : 0000Z 09 Aug 01

Last Warning : 1800Z 10 Aug 01

Max Intensity : 40 kts, gusts To 50 kts

Landfall : 1700Z 10 Aug 01

Total Warnings : 8

Remarks :

(1) TS 13W attained its maximum intensity prior to making landfall over Ha Tinh province, Vietnam. The Vietnam Hydrometeorological Service reported that this cyclone produced no severe damage or fatalities.

(2) Thai Meteorological Department reported that up to 177 people died and thousands were left homeless as heavy rain associated with the system caused flash floods in northern Thailand.

*Name assigned by RSMC Tokyo

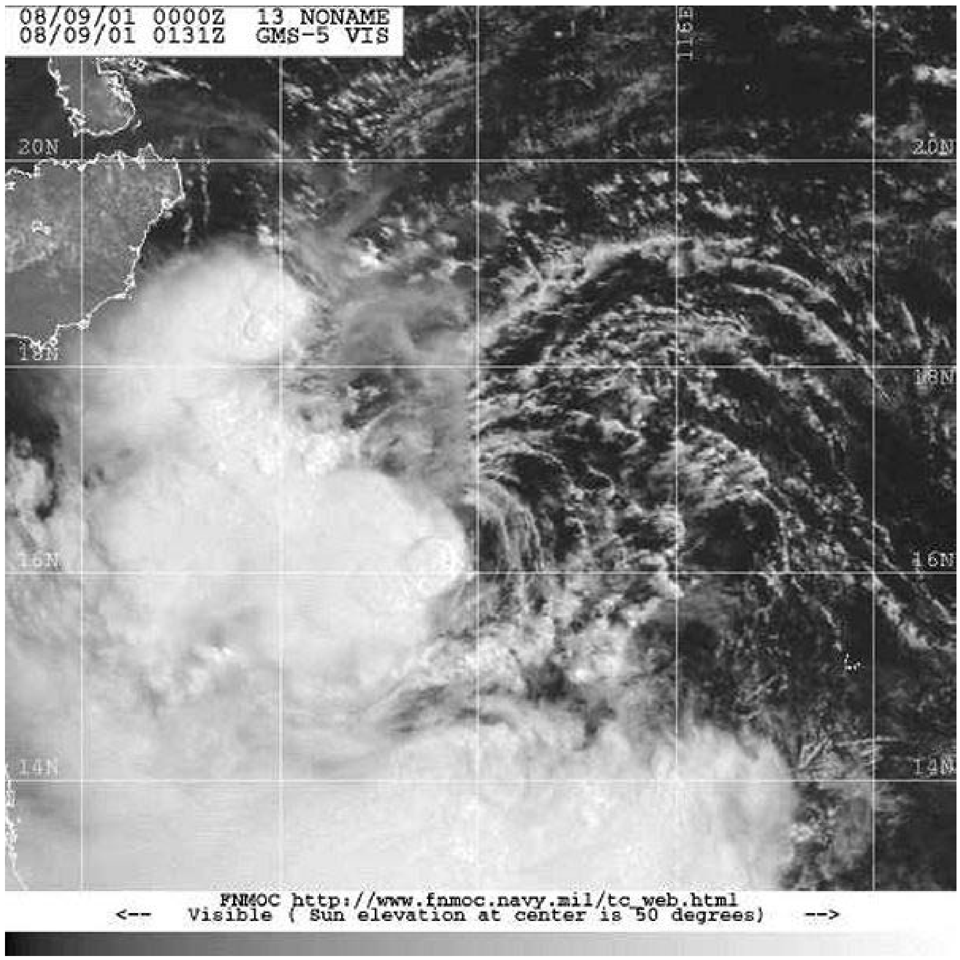


Figure 1-13W-1. 090131Z August 2001 GMS-5 visible imagery of TS 13W (Usagi) about 340 nm south of Hong Kong, China with an estimated intensity of 25 knots. Imagery indicates a deep burst of convection over a partially exposed low-level circulation center.

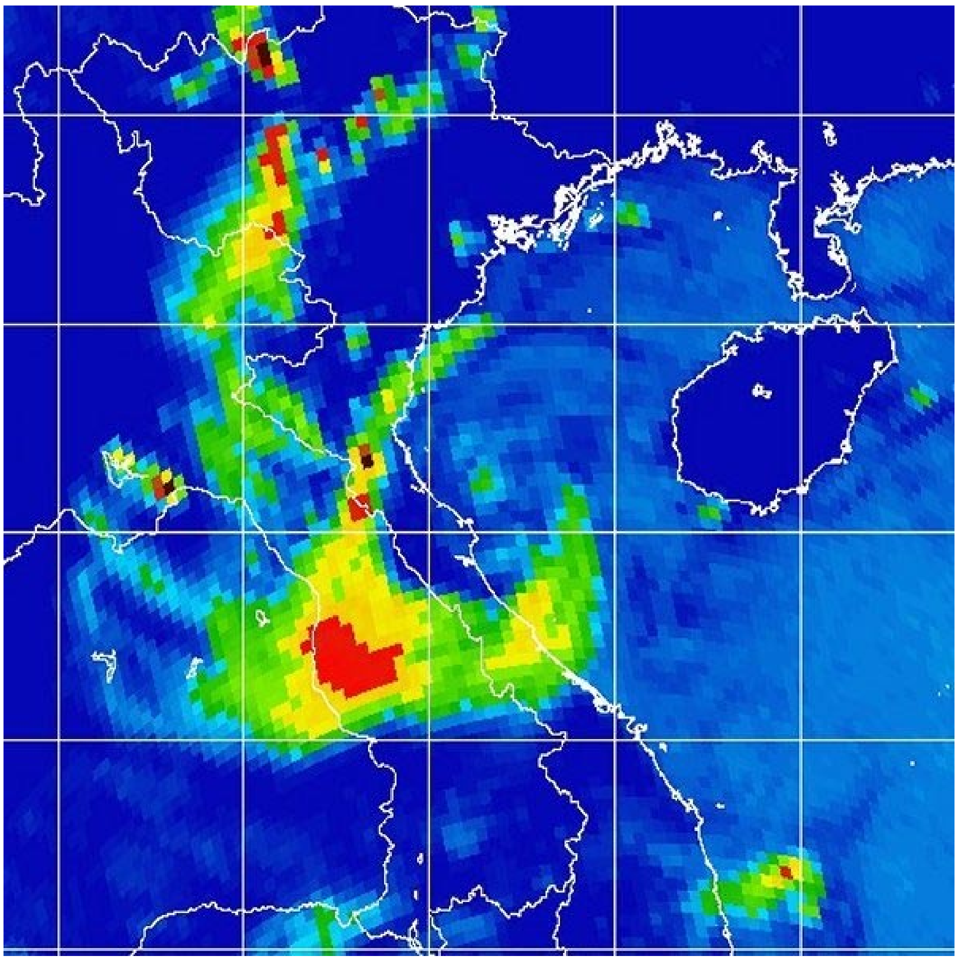
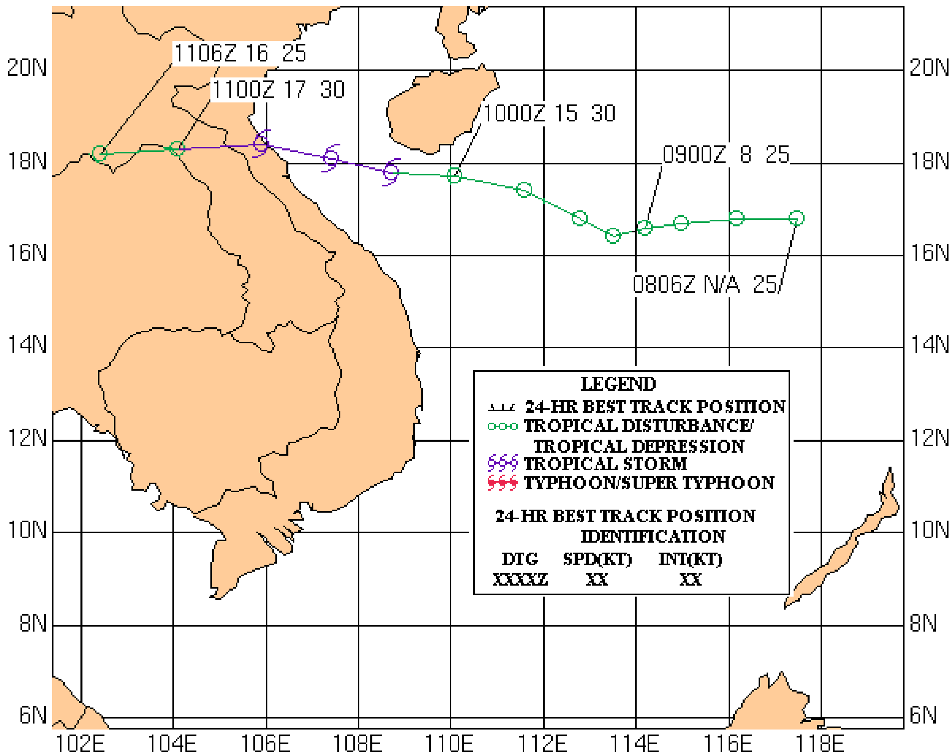


Figure 1-13W-2. 101316Z August 2001 85 GHz SSM/I image of TS 13W (Usagi) about 100 nm north of Hue, Vietnam at its peak intensity of 40 knots. Image indicates a well-organized convective band wrapping around the southern half of the low-level circulation.

TROPICAL STORM 13W (USAGI)
8 - 11 AUGUST 2001



Typhoon (TY) 14W (Pabuk*)

First Poor : None

First Fair : None

First TCFA : 2100Z 13 Aug 01

First Warning : 0000Z 14 Aug 01

Last Warning : 1800Z 22 Aug 01

Max Intensity : 90 kts, gusts To 110 kts

Landfall : 1200Z 21 Aug 01

Total Warnings : 36

Remarks :

(1) After forming in the northern Mariana Islands, TY 14W moved northwest and attained a maximum intensity of 90 knots east of Okinawa and south of Shikoku.

(2) Subsequently, the cyclone began turning northward east of Amami Shima then made landfall over Wakayama Prefecture, Japan, south of Kyoto. Heavy rain and high winds caused the evacuation of 7,000 residents, over 4,000 power outages, and mass transportation delays according to the Japan Times.

(3) The Japan Meteorological Agency reported eight fatalities and 30 people injured due to this cyclone.

*Name assigned by RSMC Tokyo

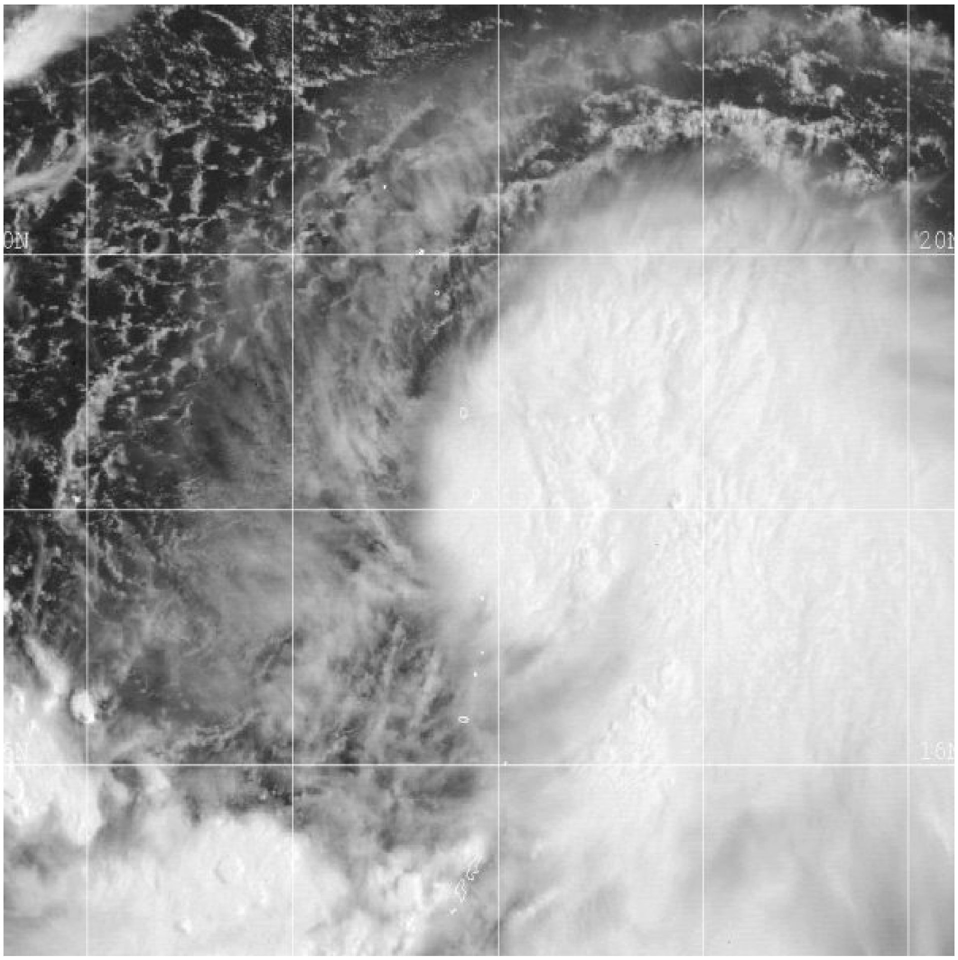


Figure 1-14W-1. 132331Z August 2001 GMS-5 visible imagery of TY 14W (Pabuk) about 300 nm north of Guam with an estimated intensity of 30 knots. Convective bands were beginning to develop and become more organized near the low-level circulation center.

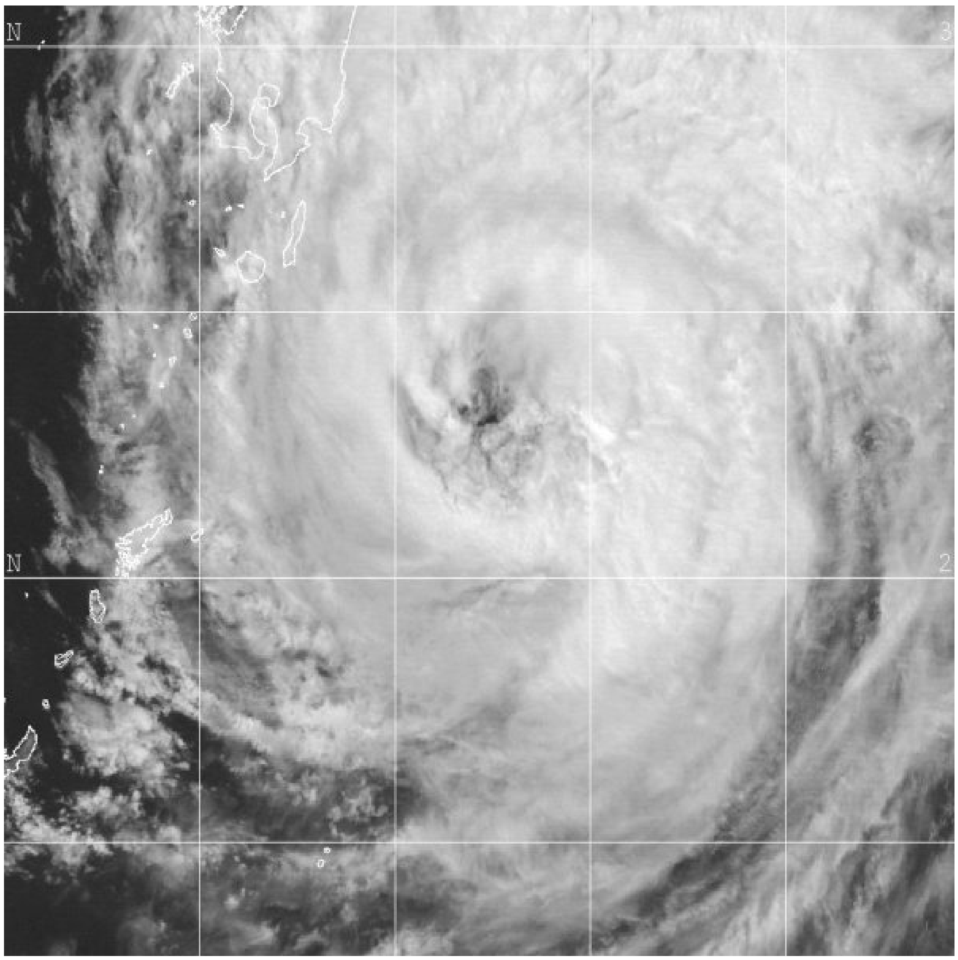


Figure 1-14W-2. 200501Z August 2001 GMS-5 visible imagery of TY 14W (Pabuk) about 280 nm southeast of Sasebo, Japan with an estimated intensity of 80 knots and a ragged eye.

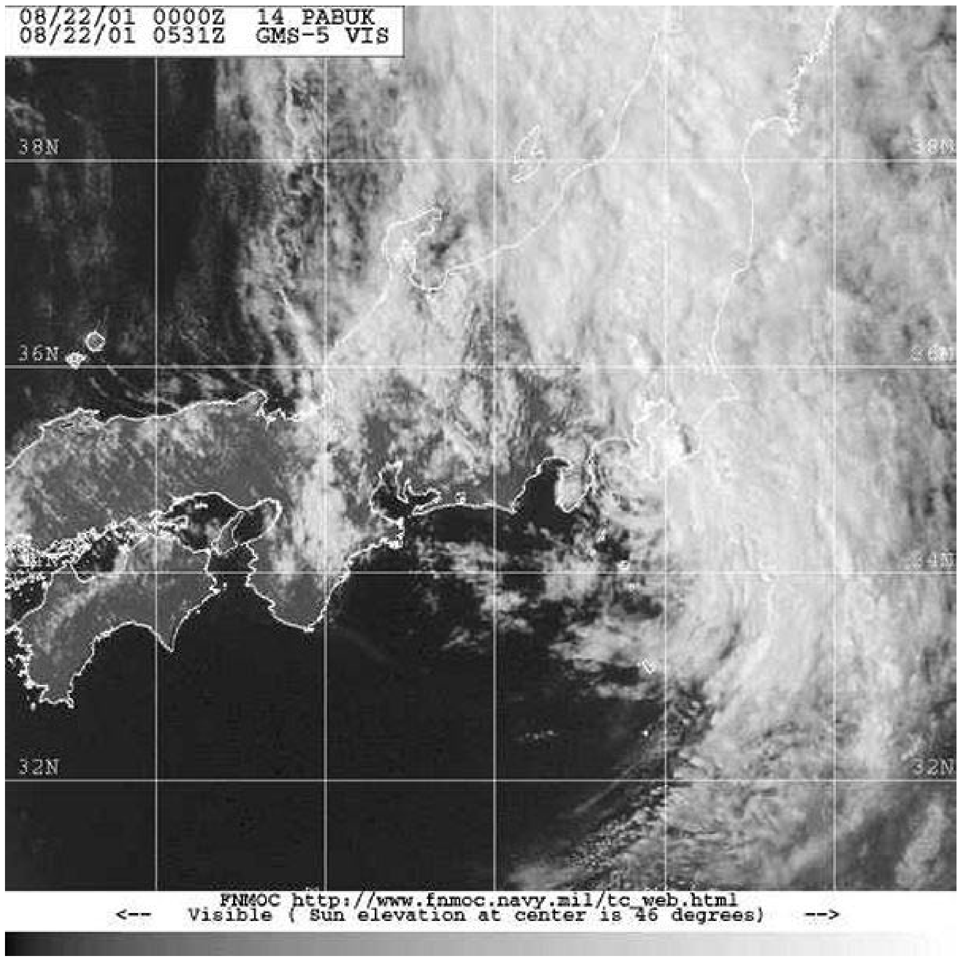
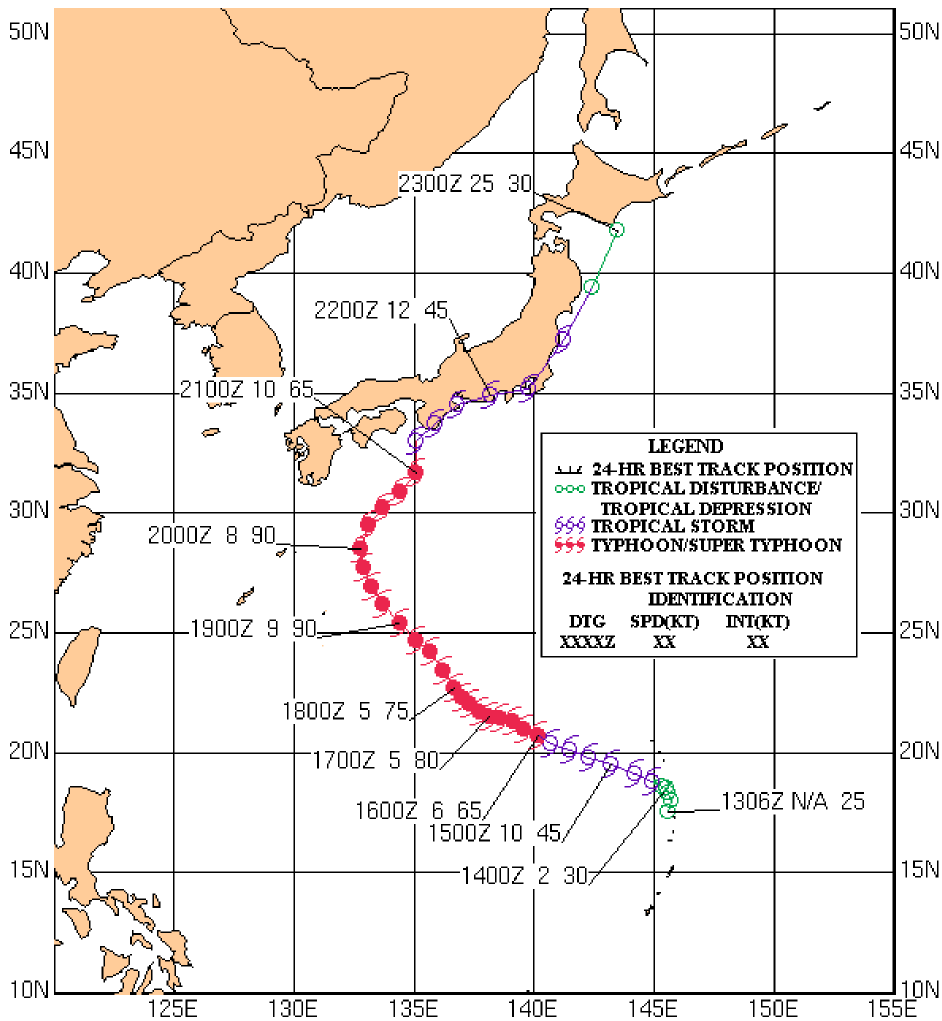


Figure 1-14W-3. 220531Z August 2001 GMS-5 visible imagery of TY 14W (Pabuk) about 20 nm south of Tokyo, Japan, near Yokosuka, Japan with an estimated intensity of 40 knots. The convective pattern has become elongated, indicating the system has begun its transition into an extratropical system.

TYPHOON 14W (PABUK)
14 - 22 AUGUST 2001



Tropical Depression (TD) 15W

First Poor : 0600Z 23 Aug 01

First Fair : 2100Z 23 Aug 01

First TCFA : 1500Z 24 Aug 01

First Warning : 1800Z 24 Aug 01

Last Warning : 0600Z 25 Aug 01

Max Intensity : 30 kts, gusts To 40 kts

Landfall : None

Total Warnings : 3

Remarks : None

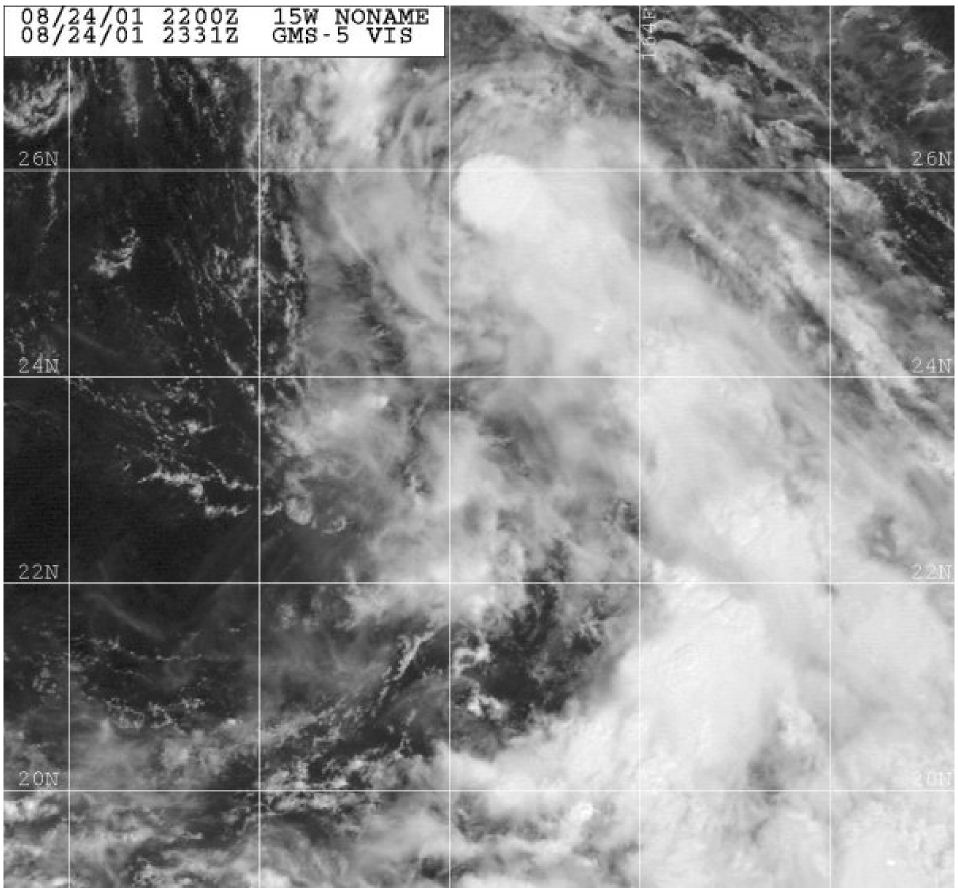
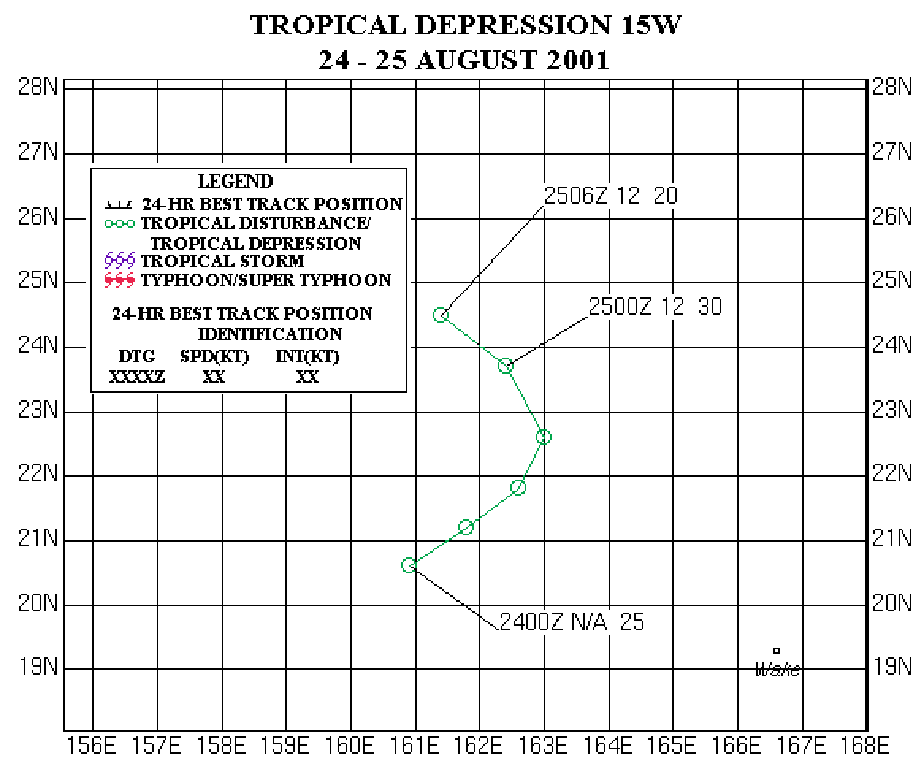


Figure 1-15W-1. 242331Z August 2001 GMS-5 visible satellite imagery of TD 15W at peak intensity of 30 knots.


TROPICAL DEPRESSION 15W
24 - 25 AUGUST 2001
LEGEND
24-HR BEST TRACK POSITION
TROPICAL DISTURBANCE/
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON/SUPER TYPHOON
24-HR BEST TRACK POSITION
IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX
2506Z 12 20
2500Z 12 30
2400Z N/A 25
Wake
28N
27N
26N
25N
24N
23N
22N
21N
20N
19N
156E 157E 158E 159E 160E 161E 162E 163E 164E 165E 166E 167E 168E

Super Typhoon (STY) 16W (Wutip*)

First Poor : 0600Z 25 Aug 01

First Fair : 0130Z 26 Aug 01

First TCFA : 0400Z 26 Aug 01

First Warning : 0000Z 27 Aug 01

Last Warning : 1800Z 02 Sep 01

Max Intensity : 130 kts, gusts To 160 kts

Landfall : None

Total Warnings : 28

Remarks :

(1) The first supertyphoon of the 2001 season.

(2) STY 16W rapidly intensified from 45 to 120 knots in 36 hours just prior to attaining its maximum intensity on 29 August.

*Name assigned by RSMC Tokyo

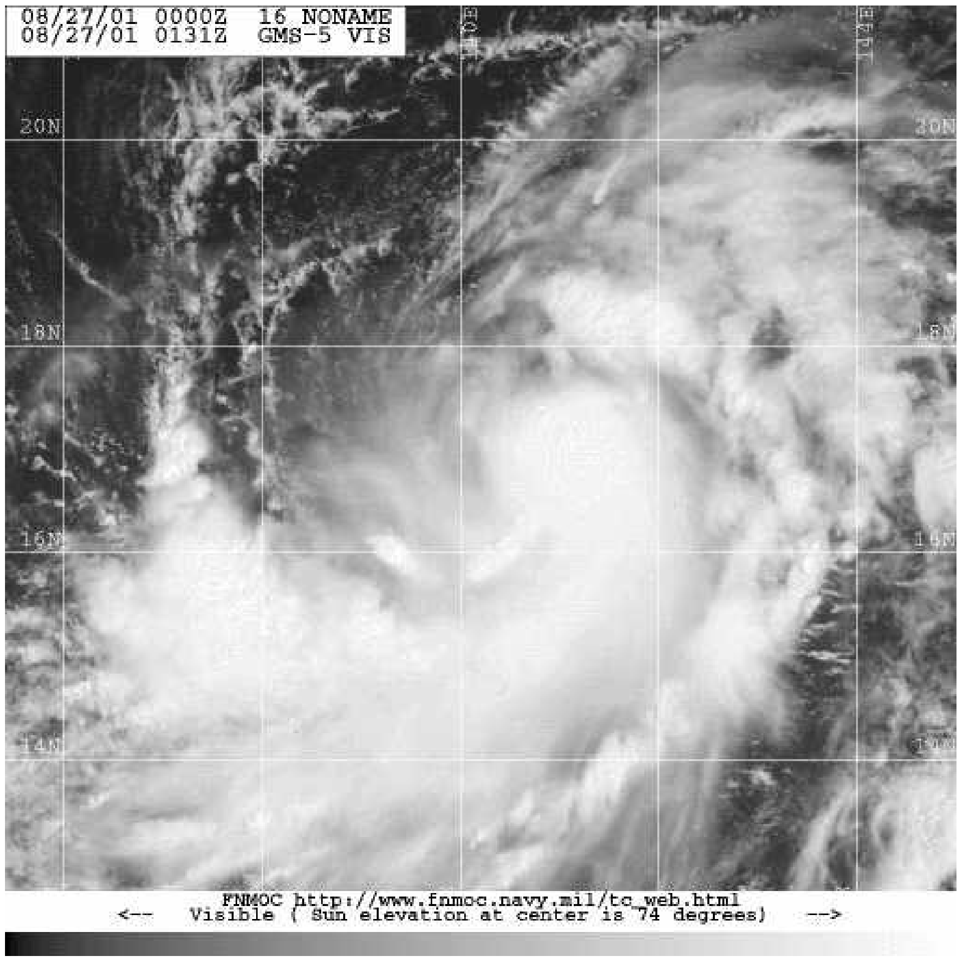


Figure 1-16W-1. 270131Z August 2001 GMS-5 visible imagery of STY 16W (Wutip) about 320 nm northwest of Guam with an estimated intensity of 35 knots. Imagery indicates an organized convective band wrapping around the southern half of the circulation.

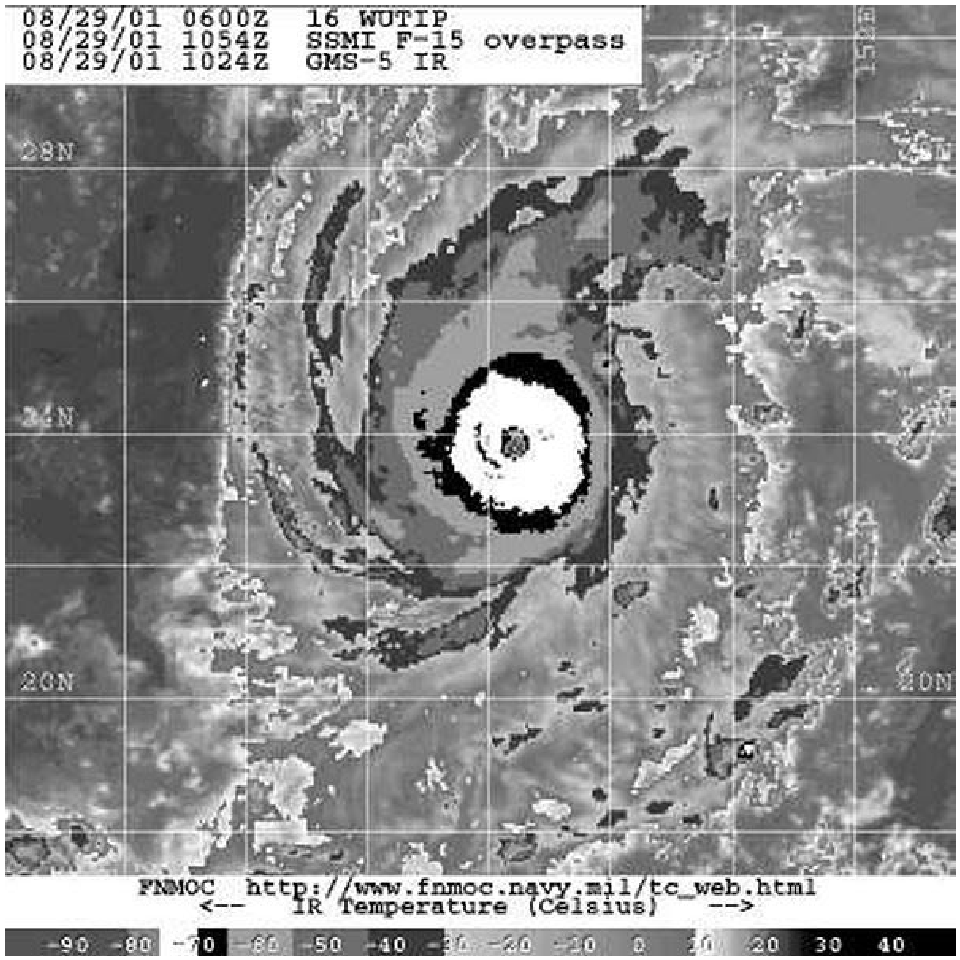


Figure 1-16W-2. 291054Z August 2001 DMSP enhanced infrared imagery of STY 16W (Wutip) about 280 nm east of Iwo Jima at peak intensity of 130 knots.

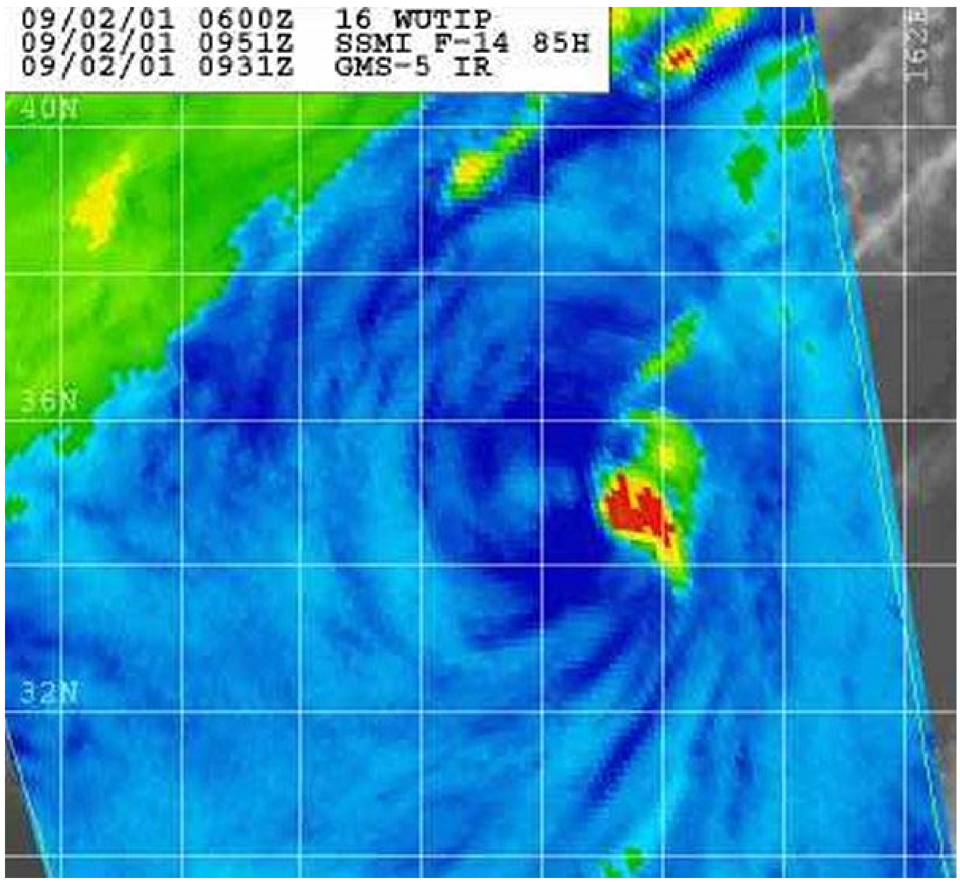
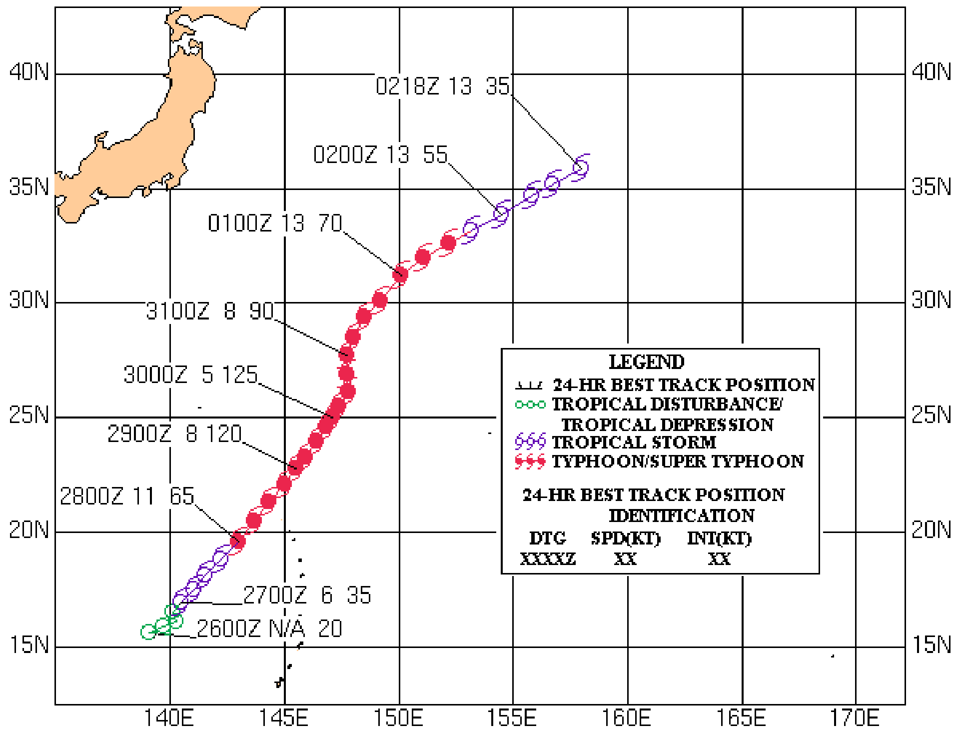


Figure 1-16W-3. 020951Z September 2001 85 GHz SSM/I image of STY 16W (Wutip), located about 820 nm east of Tokyo, Japan with an estimated intensity of 40 knots. The system was weakening with the convection displaced to the east of the low-level circulation center.

SUPER TYPHOON 16W (WUTIP)
26 AUGUST - 2 SEPTEMBER 2001



Tropical Storm (TS) 17W (Sepat*)

First Poor : 0600Z 19 Aug 01

First Fair : 0600Z 26 Aug 01

First TCFA : 1700Z 26 Aug 01

First Warning : 0000Z 27 Aug 01

Last Warning : 0000Z 30 Aug 01

Max Intensity : 45 kts, gusts To 55 kts

Landfall : None

Total Warnings : 13

Remarks : None

*Name assigned by RSMC Tokyo

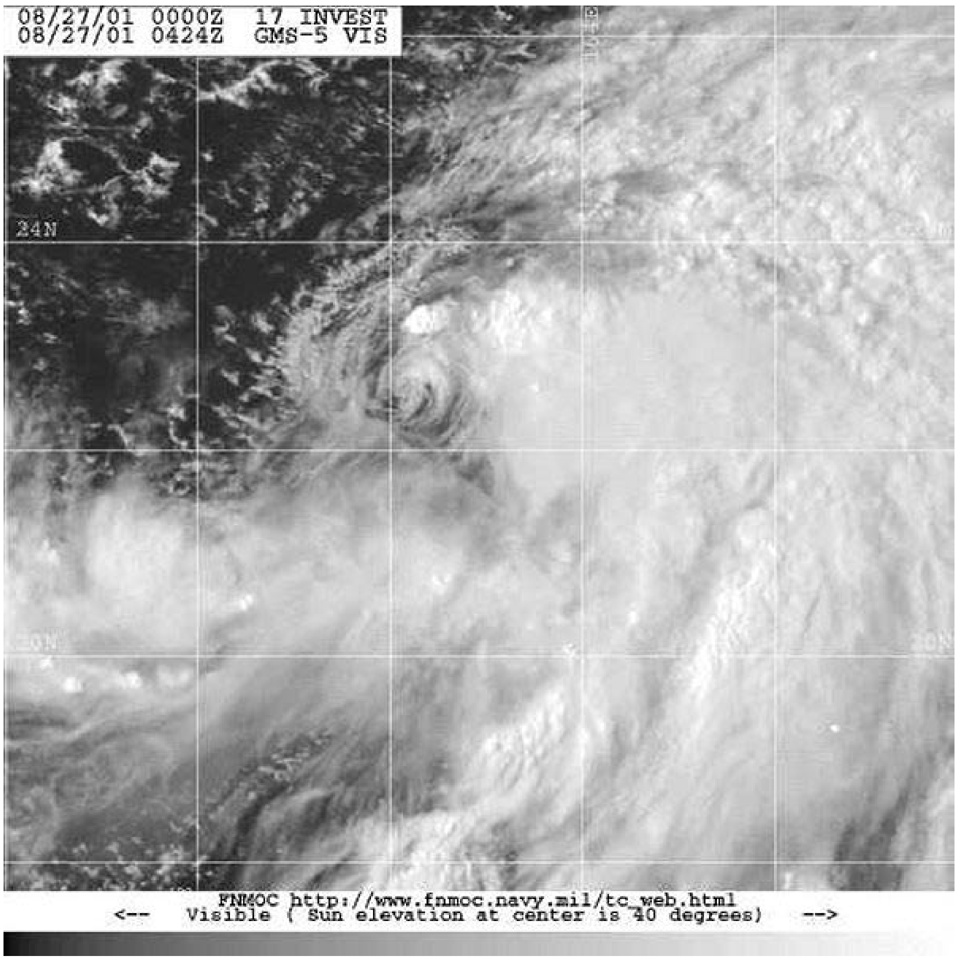


Figure 1-17W-1. 270424Z August 2001 GMS-5 visible imagery of TS 17W (Sepat) about 320 nm northwest of Wake Island with an estimated intensity of 30 knots. The system had an exposed low-level circulation, while the convection was increasing east of the center.

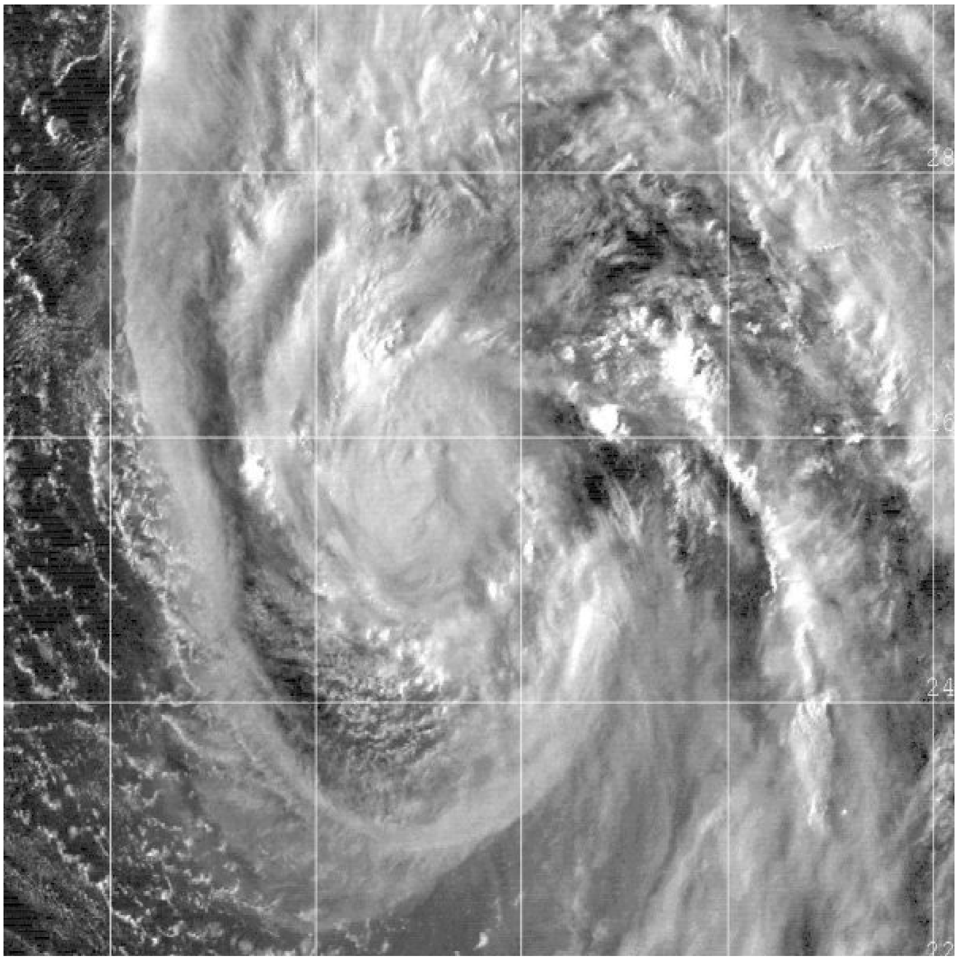


Figure 1-17W-2. 280631Z August 2001 GMS-5 visible image of TS 17W (Sepat) about 460 nm northwest of Wake Island at peak intensity of 45 knots.

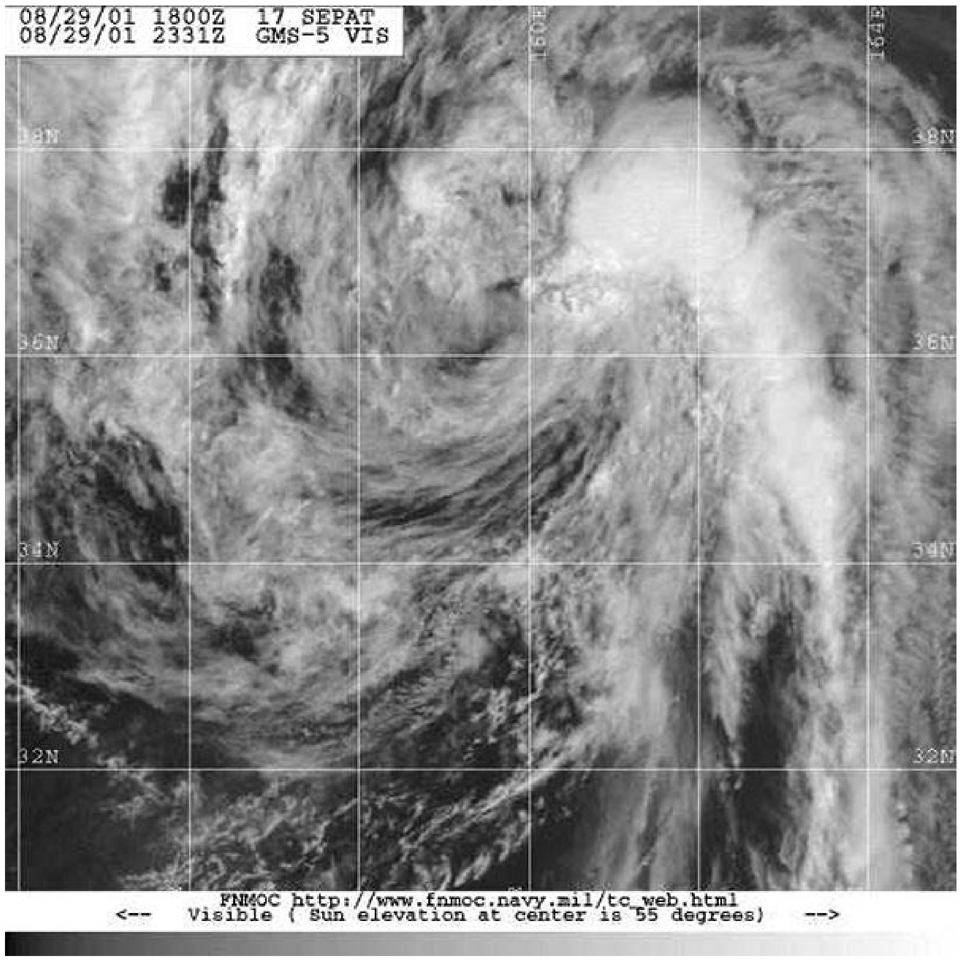
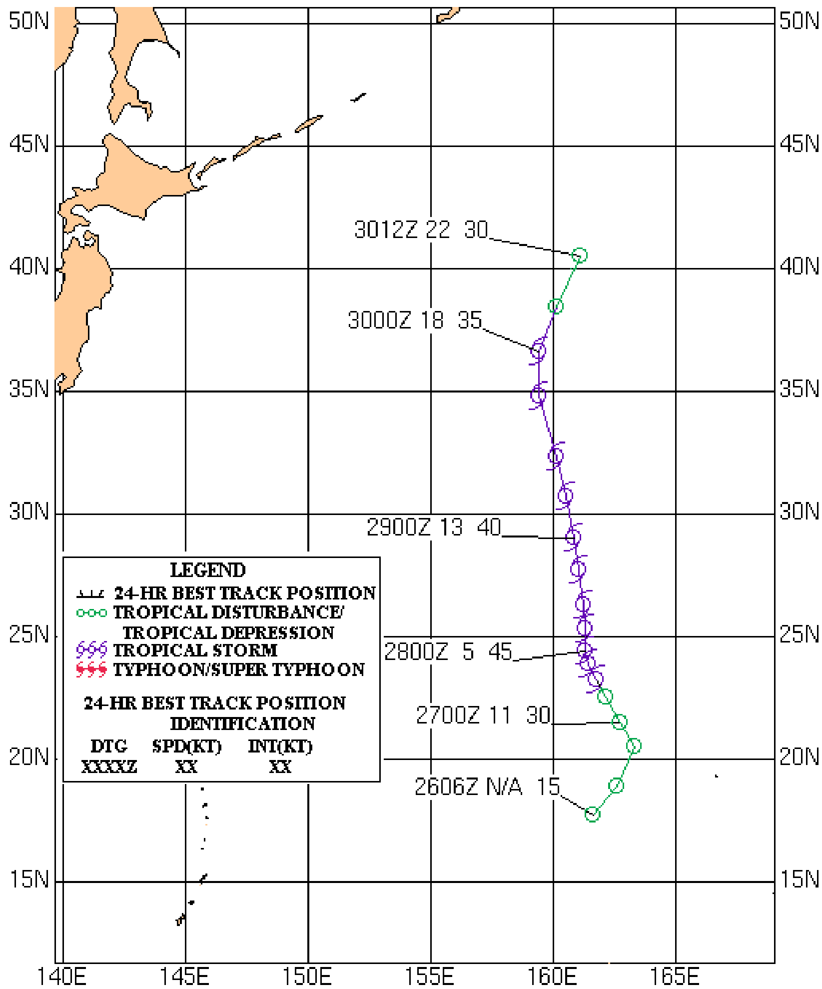


Figure 1-17W-3. 292331Z August 2001 GMS-5 visible imagery of TS 17W (Sepat) about 950 nm east of Tokyo, Japan with an estimated intensity of 35 knots. The system was becoming extratropical with the convection displaced northeast of the low-level circulation center.

TROPICAL STORM 17W (SEPAT)
26 - 30 AUGUST 2001



Tropical Storm (TS) 18W (Fitow*)

First Poor : 0600Z 26 Aug 01

First Fair : 0600Z 27 Aug 01

First TCFA : 0930Z 28 Aug 01

First Warning : 0000Z 29 Aug 01

Last Warning : 1200Z 31 Aug 01

Max Intensity : 45 kts, gusts To 55 kts

Landfall : 1200Z 29 Aug 01 over Hainan Island, 1500Z 31 Aug 01 over Beihai, Guangxi province

Total Warnings : 11

Remarks :

(1) The China Meteorological Administration reported damages of $224 million dollars to China.

*Name assigned by RSMC Tokyo

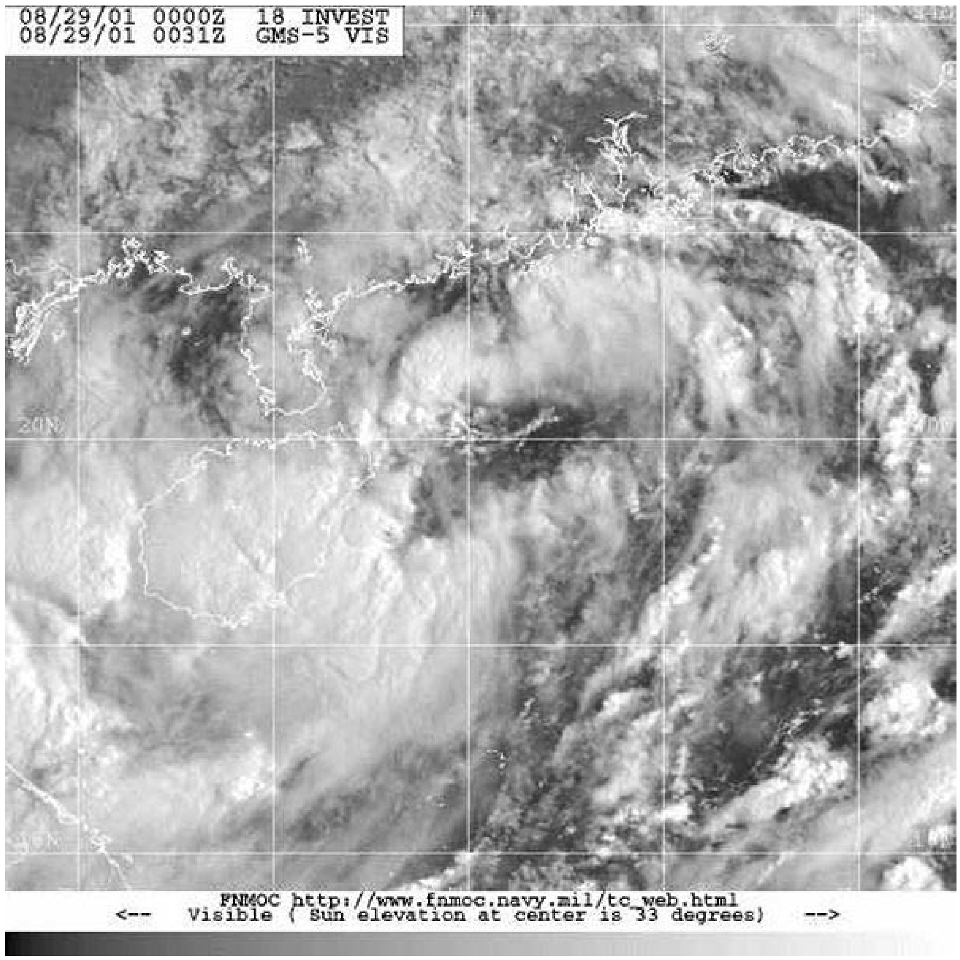


Figure 1-18W-1. 290131Z August 2001 GMS-5 visible imagery of TS 18W (Fitow) about 60 nm east of Hainan Island with an estimated intensity of 25 knots.

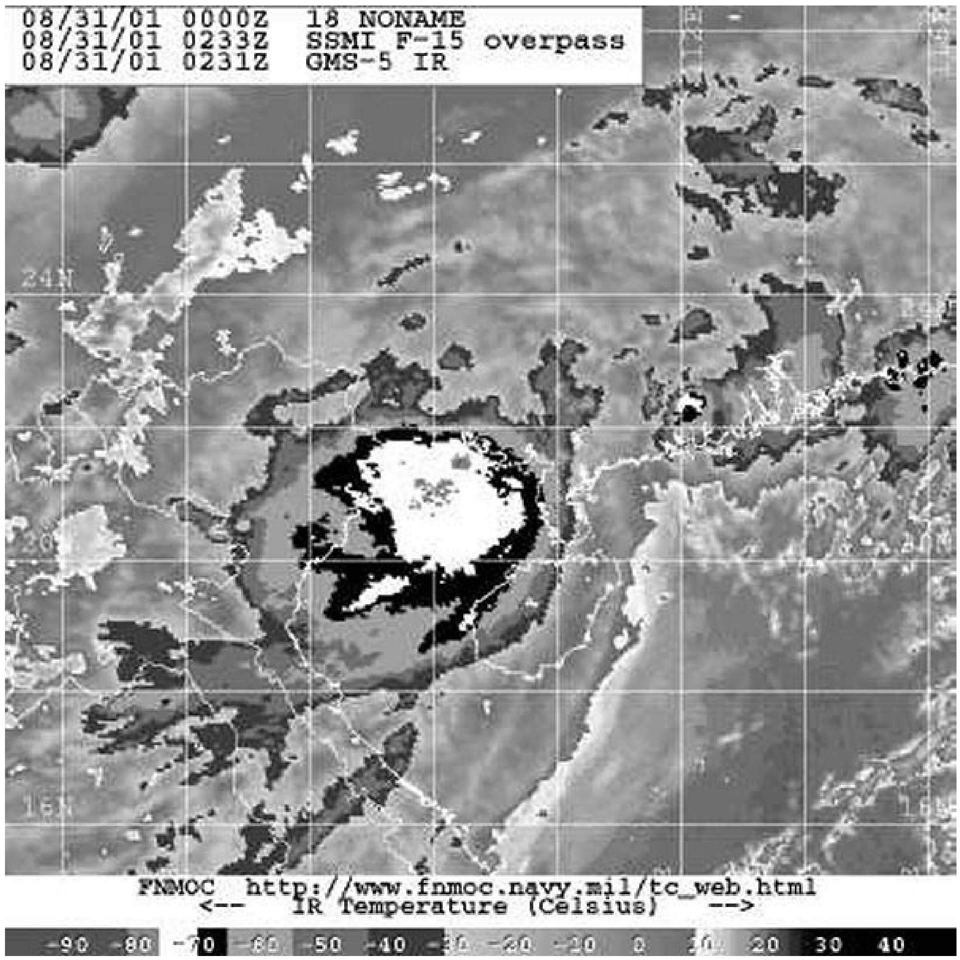
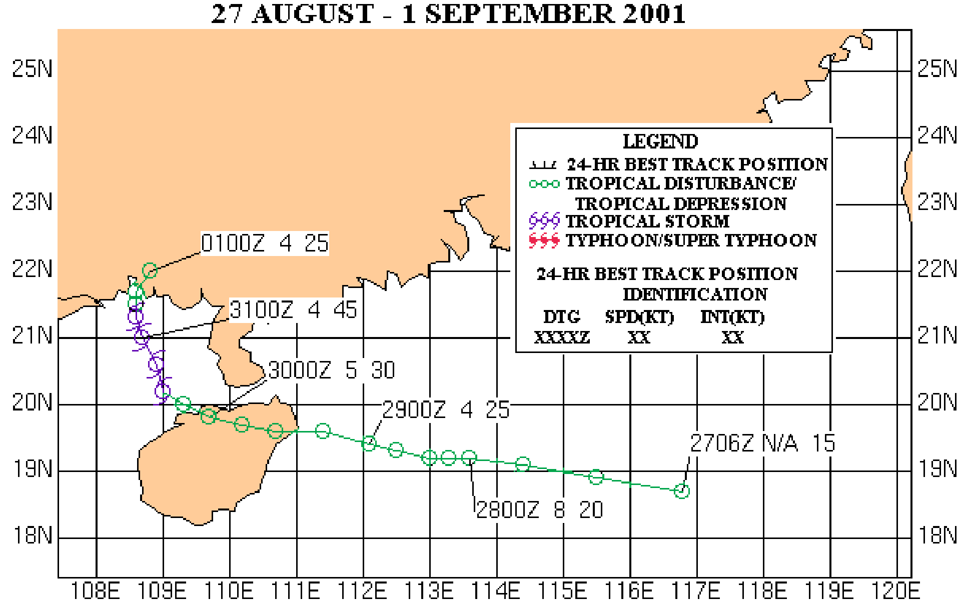


Figure 1-18W-2. 310233Z August 2001 SSM/I enhanced infrared imagery of TS 18W (Fitow) about 75 nm north-northwest of Hainan Island, China, in the Gulf of Tonkin with an estimated intensity of 45 knots.

TROPICAL STORM 18W (FITOW)
27 AUGUST - 1 SEPTEMBER 2001



Typhoon (TY) 19W (Danas*)

First Poor : 0200Z 02 Sep 01

First Fair : None

First TCFA : 2130Z 02 Sep 01

First Warning : 0000Z 03 Sep 01

Last Warning : 0600Z 12 Sep 01

Max Intensity : 105 kts, gusts To 130 kts

Landfall : 0000Z 11 Sep 01 Kanto region, Honshu, Japan

Total Warnings : 38

Remarks :

(1) Attained maximum intensity on the 7th and 8th of September near Iwo Jima after tracking north of the Mariana Islands.

(2) Tracking slowly northeastward along the east coast of Honshu, TY 19W made landfall approximately 6 nautical miles southwest of Yokosuka and then moved northeast over Tokyo. NAVPACMETOCCEN Yokosuka reported sustained winds of 65 knots with gusts to 75 knots.

(3) The Japan Meteorological Agency and the Japan Times reported that torrential rains triggered landslides and floods, causing six fatalities, 45 injuries and seriously disrupting public transportation. Total rainfall amounts ranged as high as 895 mm in the Kanto region.

*Name assigned by RSMC Tokyo

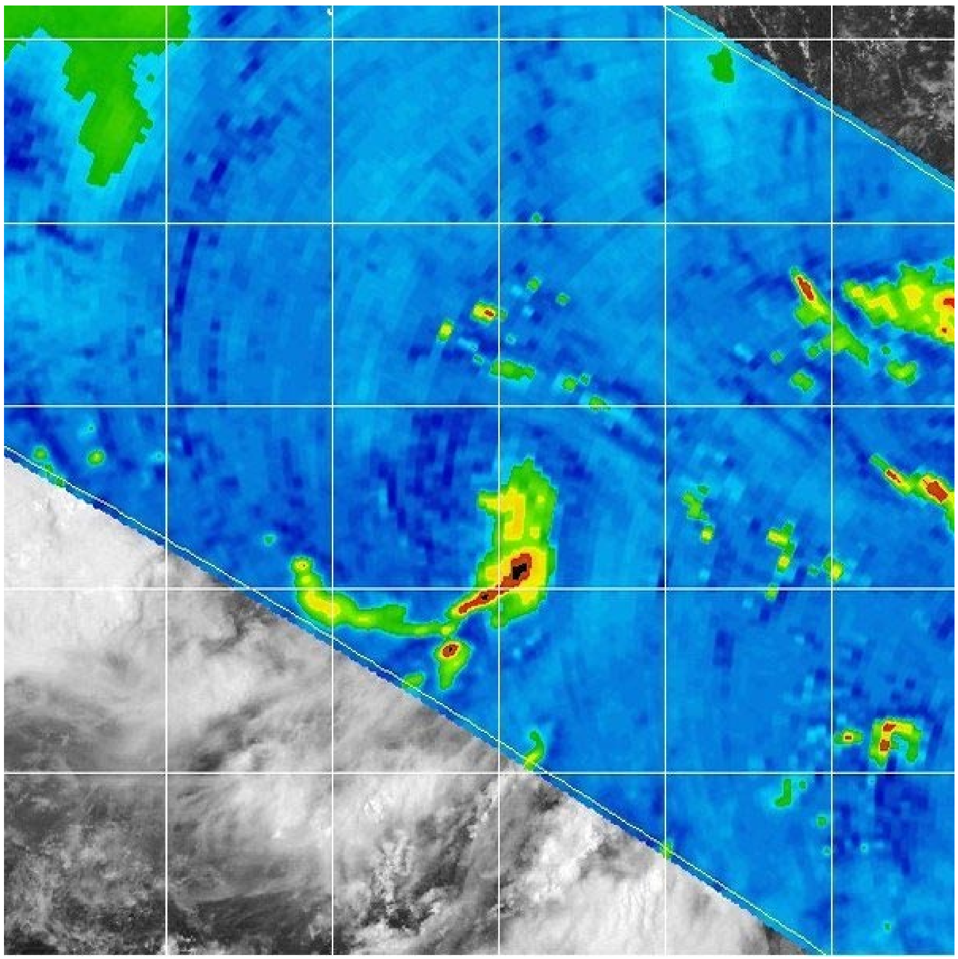


Figure 1-19W-1. 030511Z September 2001 85 GHz TRMM image of TY 19W (Danas) about 700 nm east-northeast of Guam with an estimated intensity of 25 knots. A band of convection was beginning to develop southeast of the low level circulation.

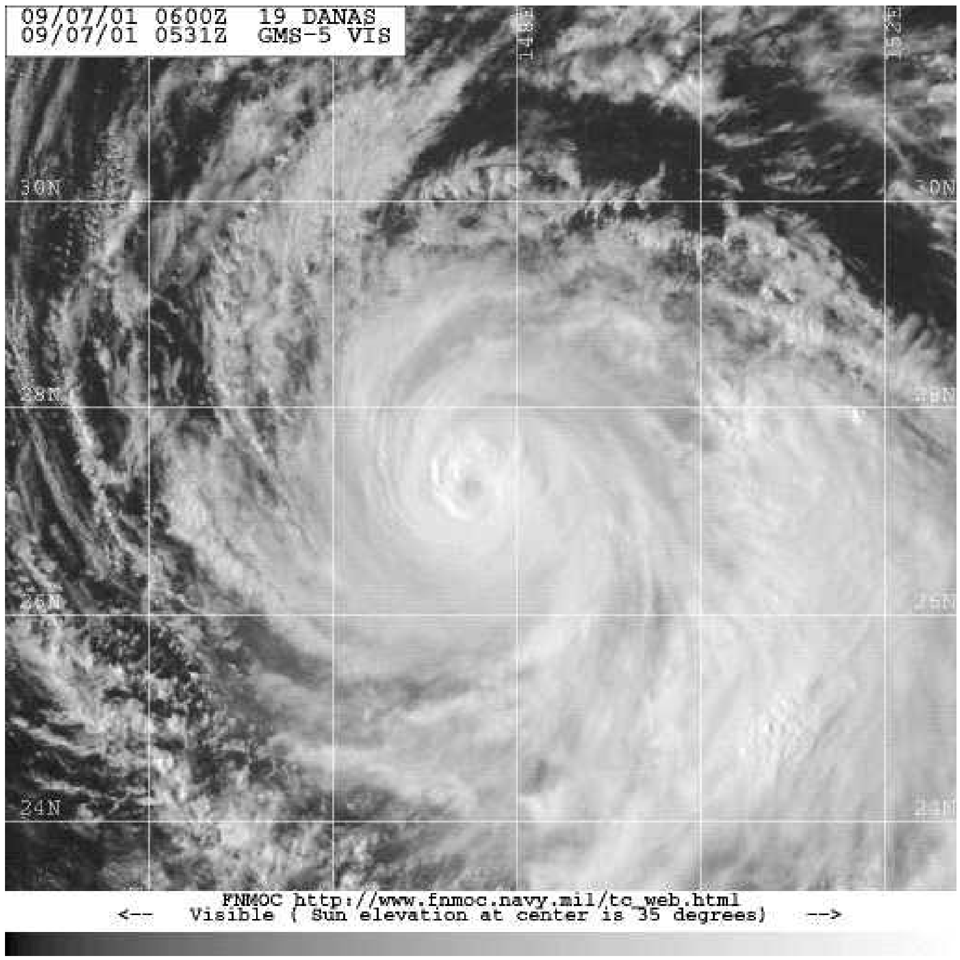


Figure 1-19W-2. 070531Z September 2001 GMS-5 visual image of TY 19W (Danas) about 370 nm east-northeast of Iwo Jima at peak intensity of 105 knots.

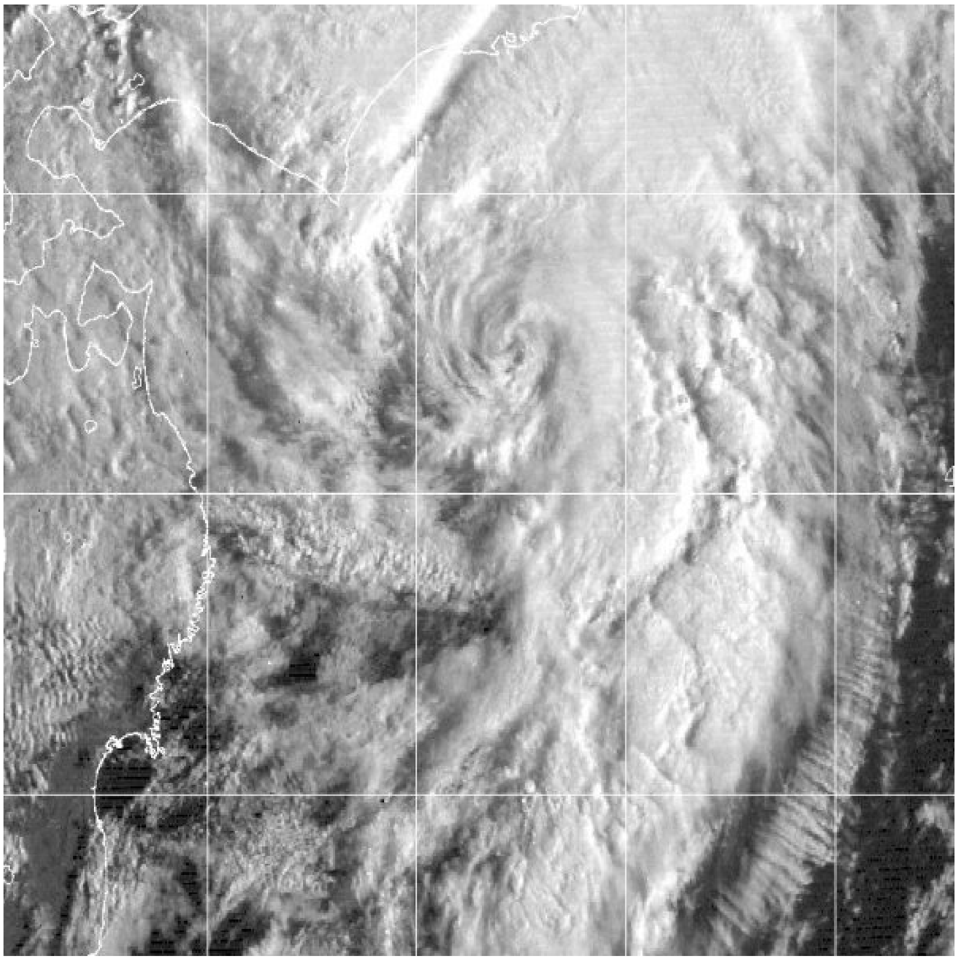
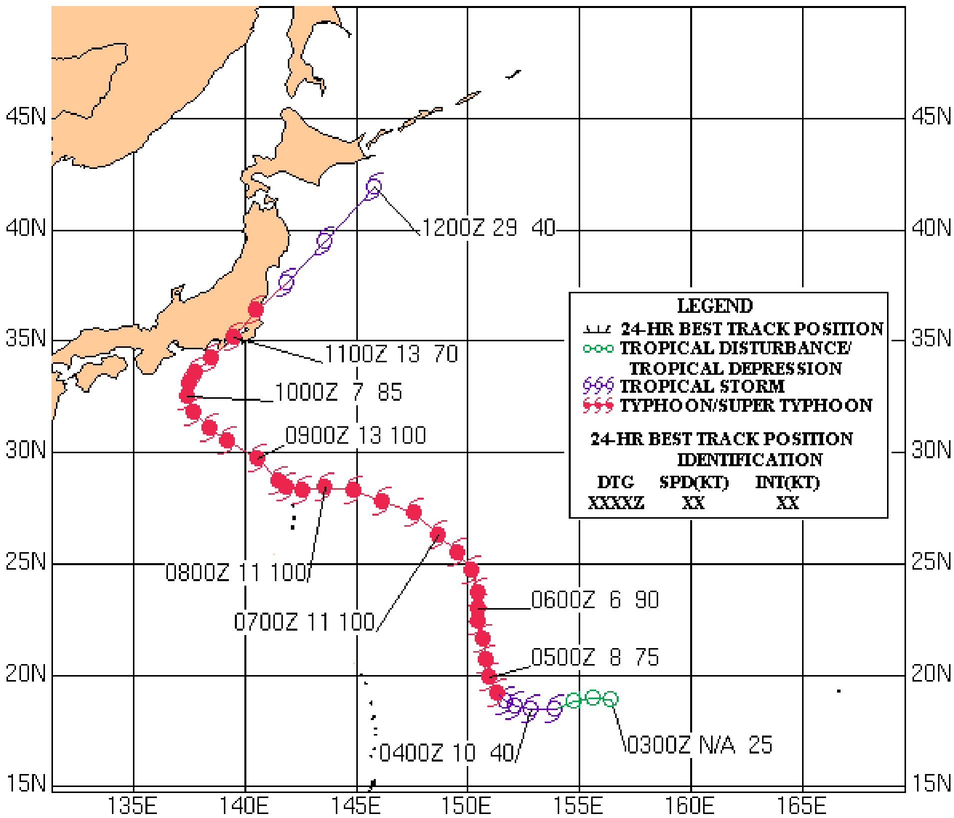


Figure 1-19W-3. 112131Z September 2001 GMS-5 visual image of TY 19W (Danas) becoming extratropical about 220 nm east-northeast of Misawa, Japan with an estimated intensity of 40 knots.

TYPHOON 19W (DANAS)
3 - 12 SEPTEMBER 2001



Typhoon (TY) 20W (Nari*)

First Poor : 0600Z 03 Sep 01

First Fair : 1200Z 05 Sep 01

First TCFA : 1930Z 05 Sep 01

First Warning : 0000Z 06 Sep 01

Last Warning : 0000Z 21 Sep 01

Max Intensity : 100 kts, gusts To 125 kts

Landfall : 1500Z 16 Sep 01 near Lu-tong, northeast Taiwan; 0600Z 20 Sep 01 over southern China

Total Warnings : 61

Remarks :

(1) TY 20W formed east of Taipei, Taiwan, tracked northeastward over the southwestern tip of Okinawa at 0000Z on 6 September before sharply turning westward passing back over the island at approximately 1800Z on the same day. The cyclone rapidly intensified from 50 to 70 knots in a 6-hour period during the second pass over the island.

(2) Kadena AB, Okinawa observed maximum sustained surface winds of 66 knots with gusts up to 99 knots. No casualties or major damage were reported.

(3) The track of TY 20W exhibited three cyclonic loops west of Okinawa from 7 to 14 September before heading southwestward toward Taiwan. The cyclone reached its peak intensity of 100 knots during this triple cyclonic loop period.

(4) TY 20W made landfall near the city of Lo-tung in northeastern Taiwan and tracked south-southwestward along the east coast as a tropical storm.

(5) According to BBC News, the heaviest recorded rainfall in Taiwan history resulted in widespread flooding and landslides, causing at least 66 fatalities, 10,000 evacuations, power and water outages to 650,000 households, and disruption of telephone service to 360,000 households. The Council of Agriculture reported more than $2.3 million in damage to agriculture, fishery and livestock products and equipment.

(6) The Central Weather Bureau reported the greatest single-day rainfall in Taiwan of up to 800 millimeters (31.5 inches) since records began 70 years ago. Some areas reported up to 50 inches of rain in two days.

(7) After passing westward over southern Taiwan and slightly re-intensifying to 55 knots over the South China Sea, TY 20W made landfall east of Hong Kong. No casualties or damage were reported.

*Name assigned by RSMC Tokyo

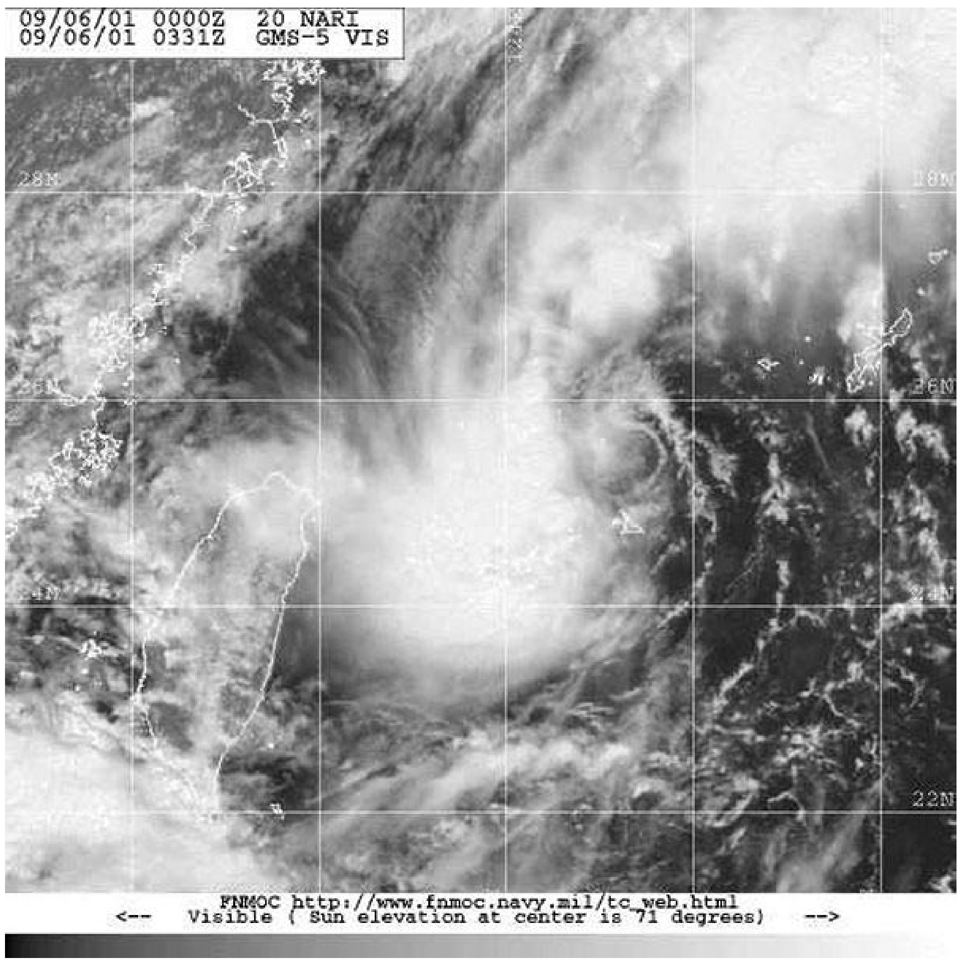


Figure 1-20W-1. 060331Z September 2001 GMS-5 visual imagery of TY 20W (Nari) about 150 nm west-southwest of Naha, Japan with an estimated intensity of 25 knots. Convection was beginning to develop southwest of the low level circulation center as the system encountered vertical wind shear in the early stages.

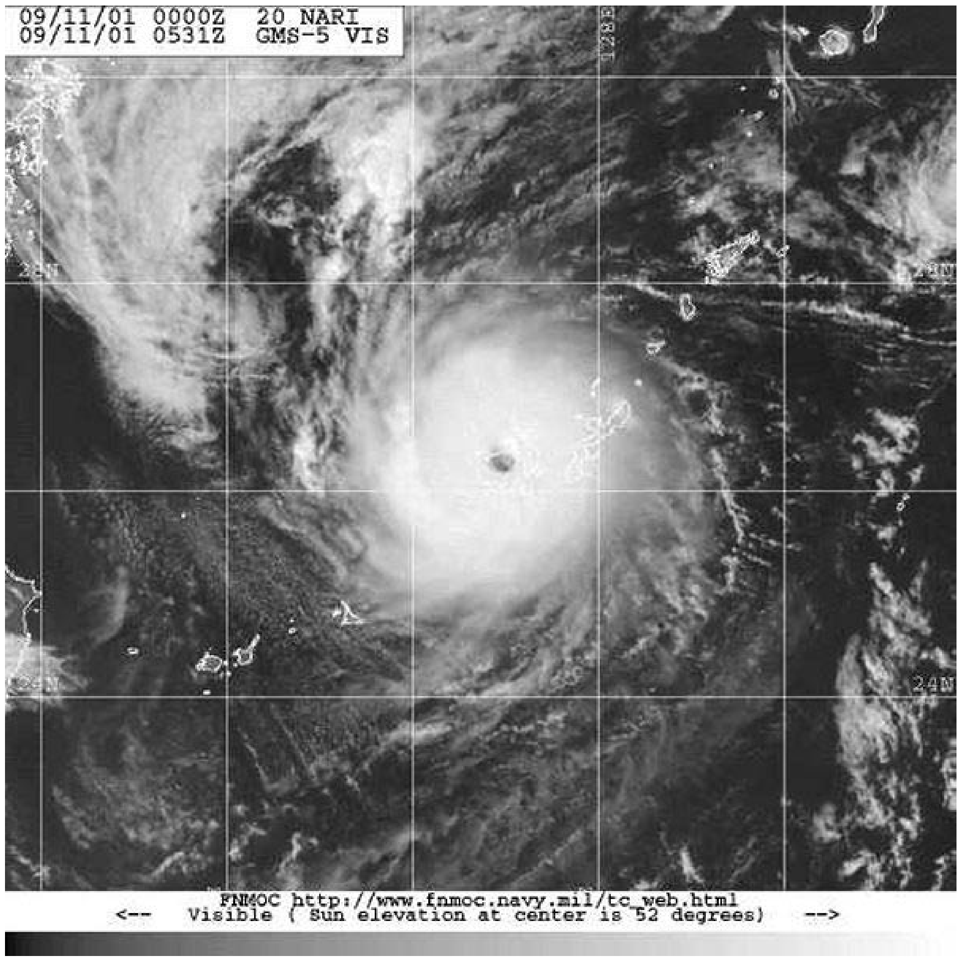


Figure 1-20W-2. 110531Z September 2001 GMS-5 visual imagery of TY 20W (Nari) about 45 nm west-northwest of Naha, Japan with an estimated intensity of 95 knots. The system had a well-defined eyewall feature while it was quasi-stationary west of Okinawa.

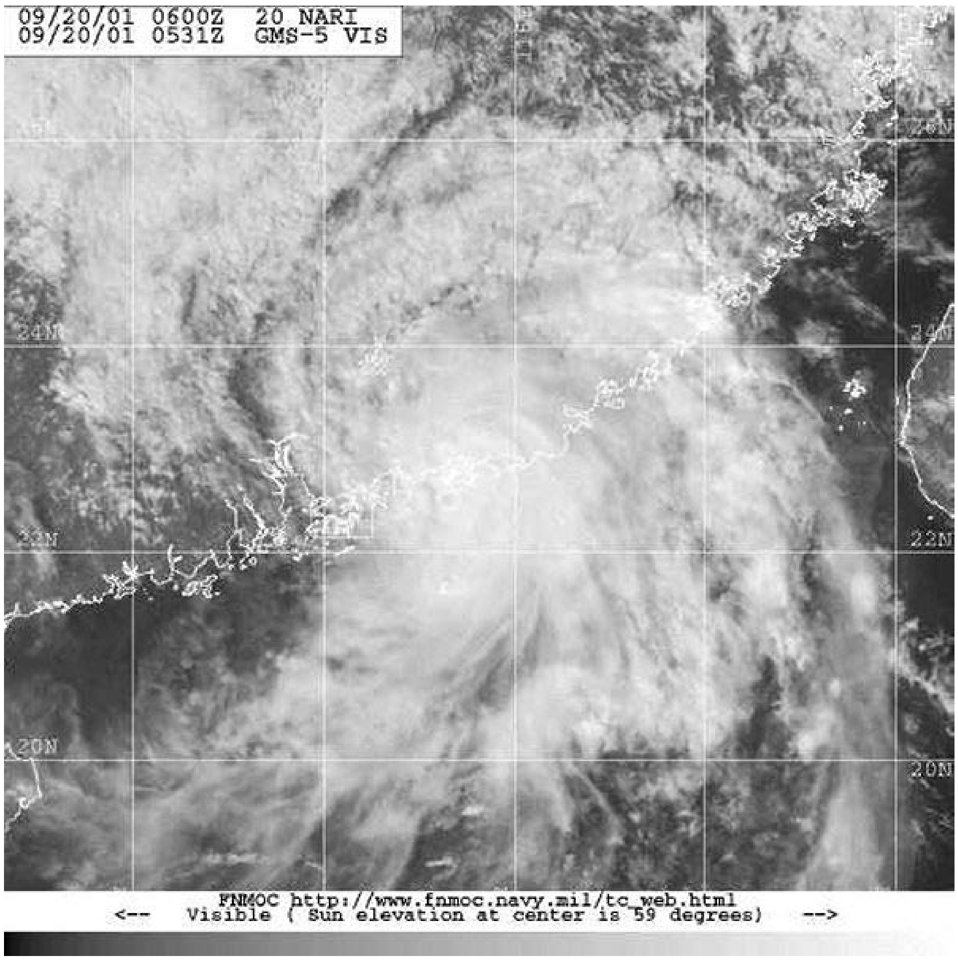
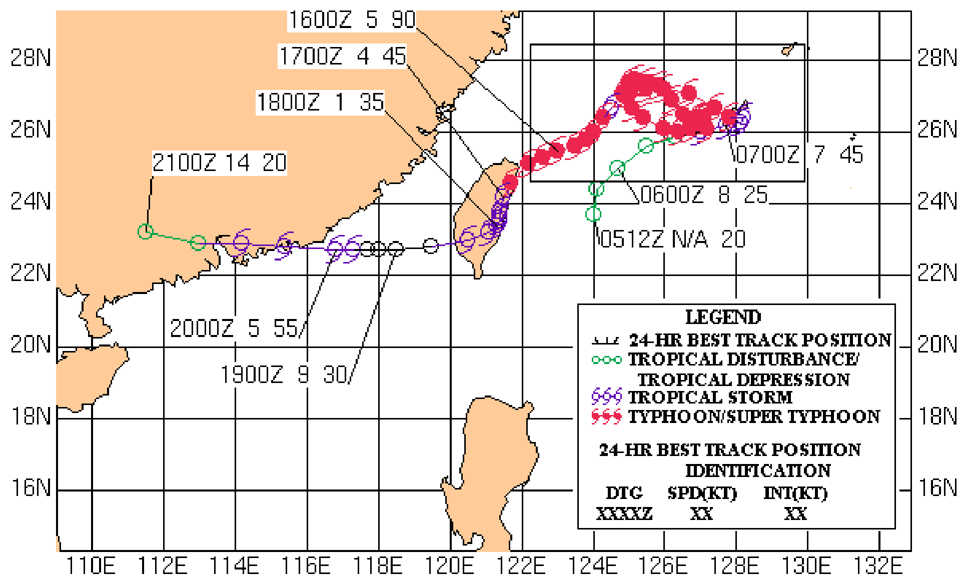
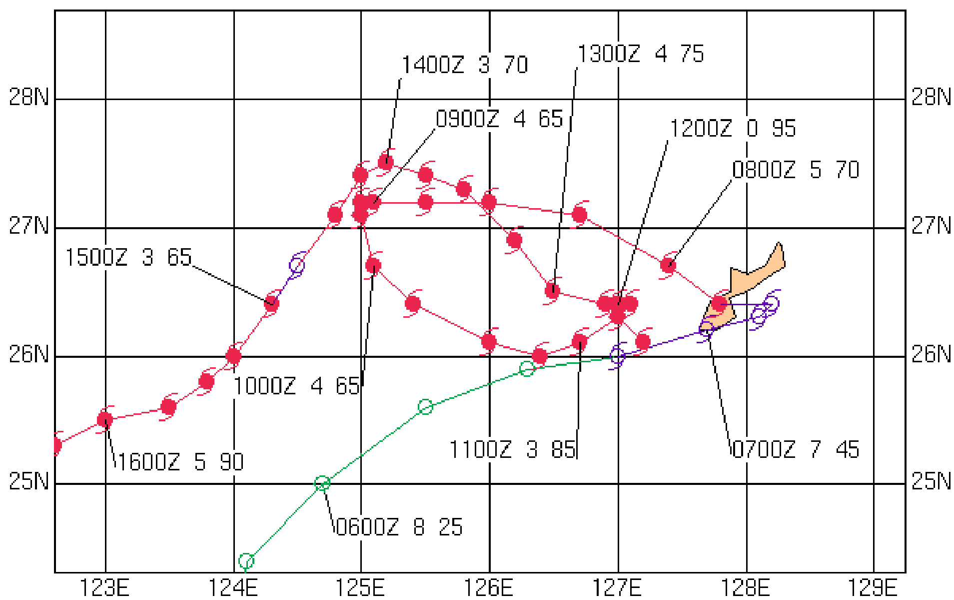


Figure 1-20W-3. 200531Z September 2001 GMS-5 visual imagery of TY 20W (Nari) about 80 nm east-northeast of Hong Kong, China with an estimated intensity of 55 knots. The system made final landfall along the southeastern coast of China.

TYPHOON 20W (NARI)
5 - 21 SEPTEMBER 2001



See next page to view inset detail


1400Z 3 70
1300Z 4 75
0900Z 4 65
1200Z 0 95
0800Z 5 70
1500Z 3 65
1000Z 4 65
1100Z 3 85
0700Z 7 45
1600Z 5 90
0600Z 8 25
28N
27N
26N
25N
123E
124E
125E
126E
127E
128E
129E

Typhoon (TY) 21W (Vipa*)

First Poor : 0600Z 16 Sep 01

First Fair : 1500Z 16 Sep 01

First TCFA : 2230Z 16 Sep 01

First Warning : 0000Z 17 Sep 01

Last Warning : 1800Z 21 Sep 01

Max Intensity : 75 kts, gusts To 90 kts

Landfall : None

Total Warnings : 20

Remarks : None

*Name assigned by RSMC Tokyo

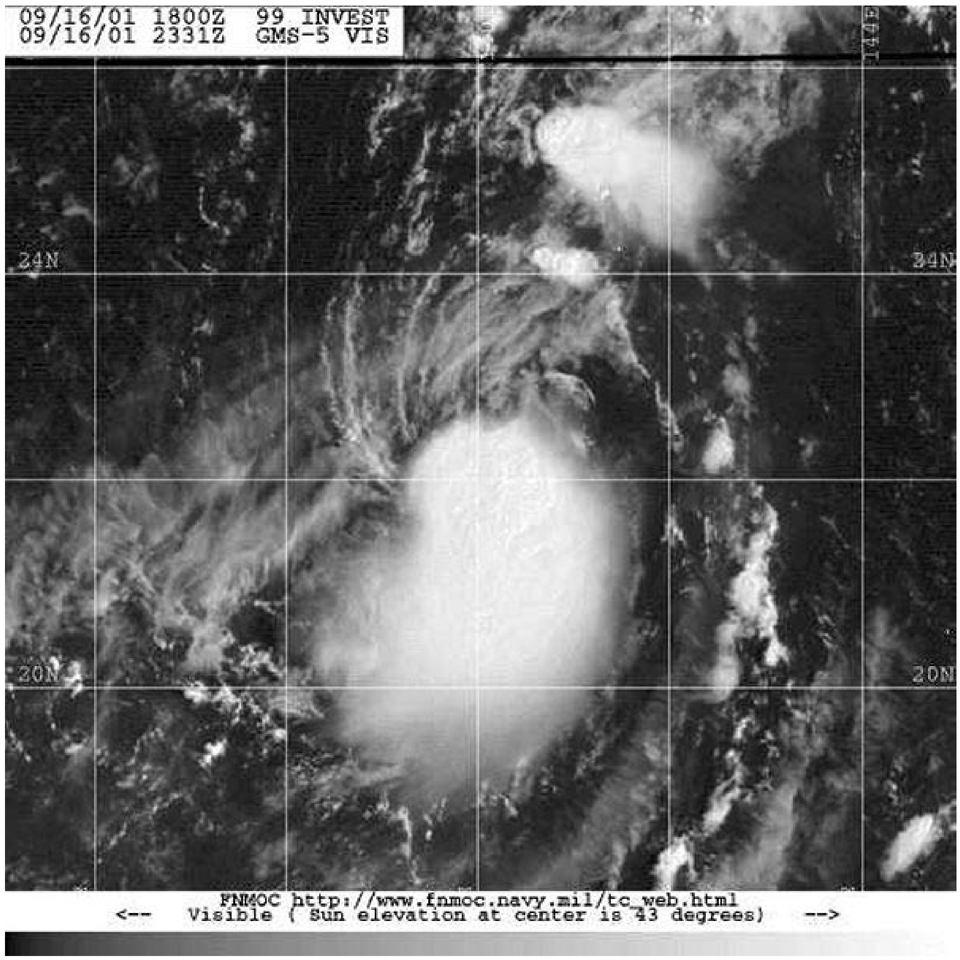


Figure 1-21W-1. 162331Z September 2001 GMS-5 visual imagery of TY 21W (Vipa) about 150 nm south-southwest of Iwo Jima with an estimated intensity of 25 knots. Low-level cumulus lines with the low-level circulation center beneath an organized area of deep convection indicate that the system was beginning to intensify and become better organized.

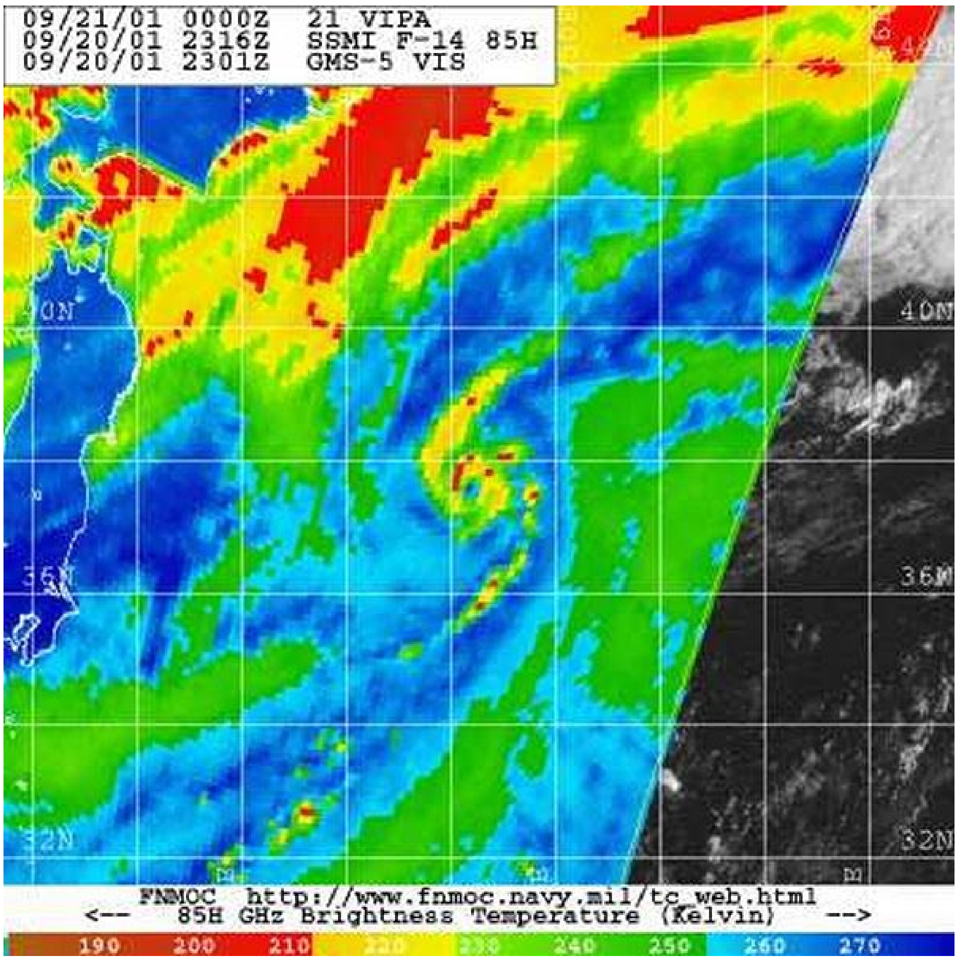


Figure 1-21W-2. 202316Z September 2001 85 GHz SSM/I image of TY 21W (Vipa) about 440 nm east-northeast of Tokyo, Japan at its peak intensity of 75 knots.

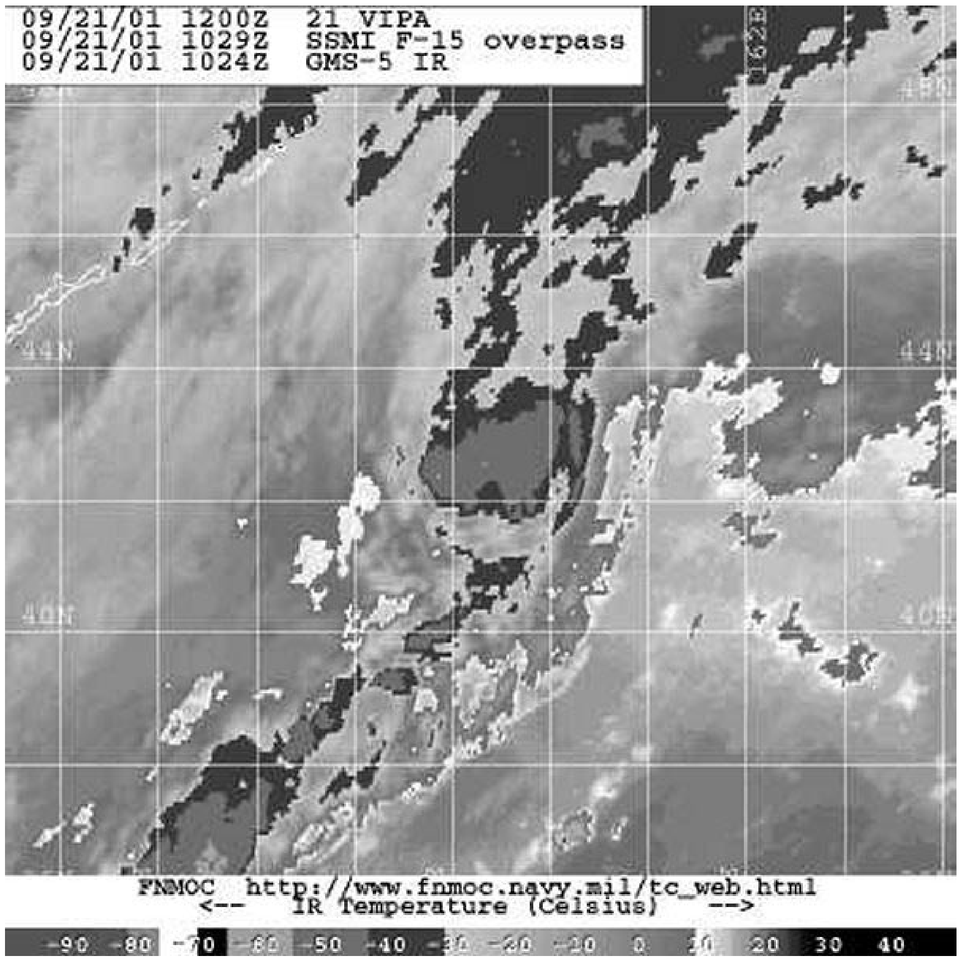
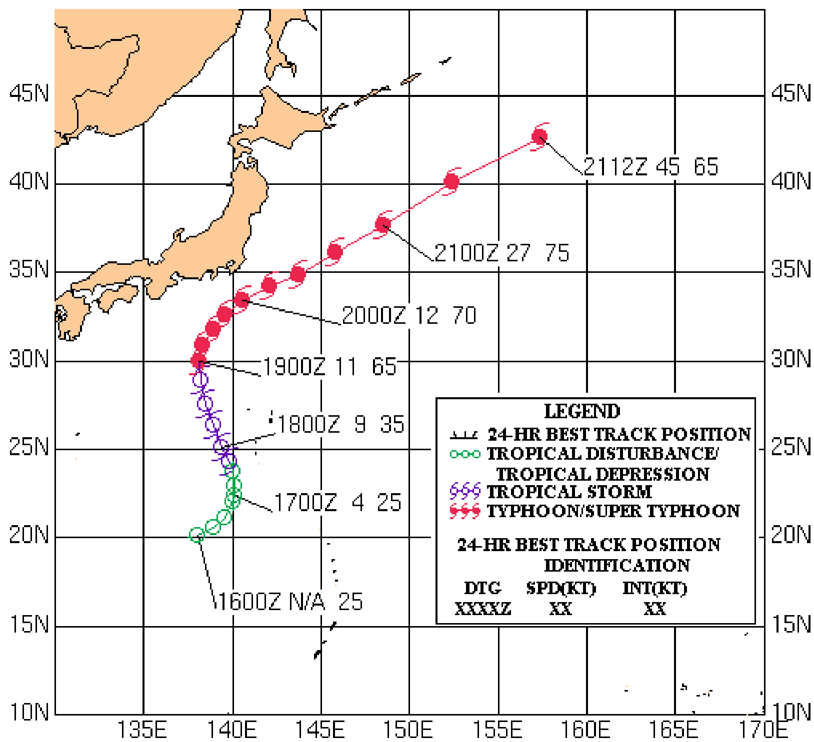


Figure 1-21W-3. 211029Z September 2001 DMSP enhanced infrared image of TY 21W (Vipa) about 730 nm east-northeast of Misawa, Japan with an estimated intensity of 65 knots. At this time, TY 21W was embedded in the mid-latitude westerlies and becoming extratropical.

TYPHOON 21W (VIPA)
16 - 21 SEPTEMBER 2001



Typhoon (TY) 22W (Francisco*)

First Poor : 0600Z 15 Sep 01

First Fair : 2300Z 16 Sep 01

First TCFA : 1200Z 18 Sep 01

First Warning : 0000Z 19 Sep 01

Last Warning : 1800Z 25 Sep 01

Max Intensity : 100 kts, gusts To 125 kts

Landfall : None

Total Warnings : 28

Remarks : None

*Name assigned by RSMC Tokyo

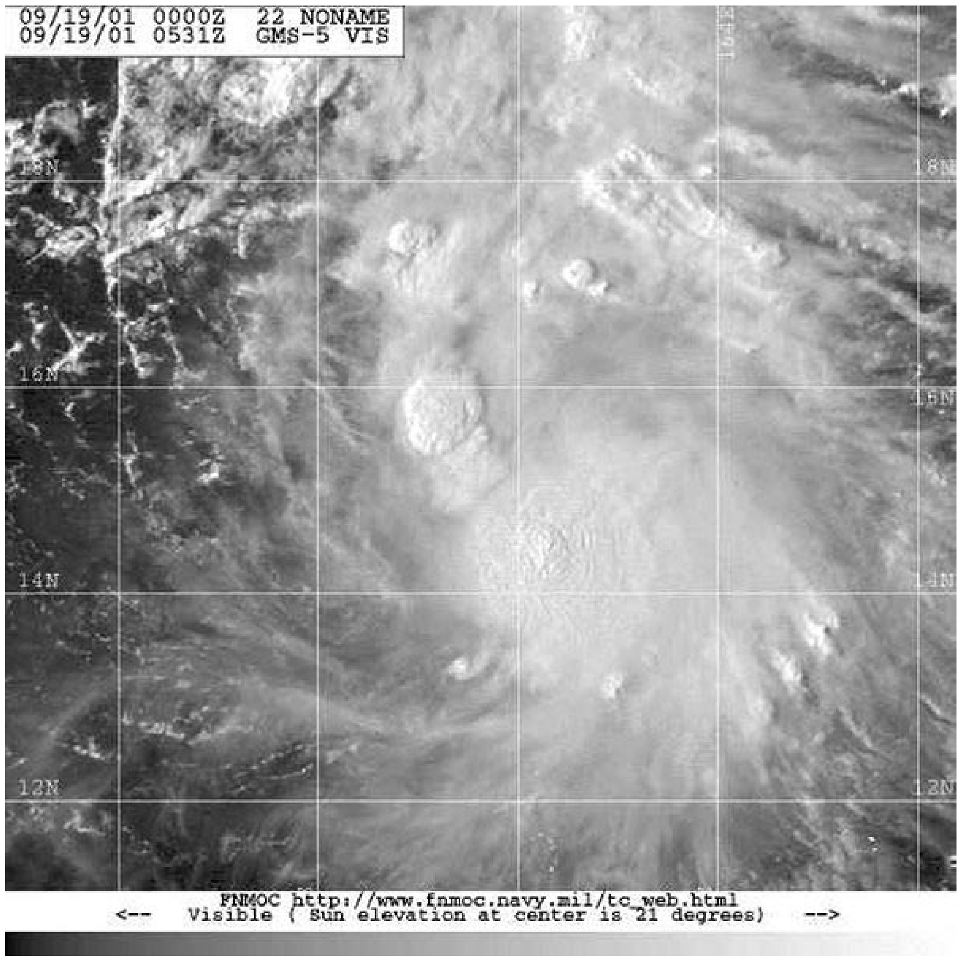


Figure 1-22W-1. 190531Z September 2001 GMS-5 visual imagery of TY 22W (Francisco) about 400 nm southwest of Wake Island with an estimated intensity of 30 knots.

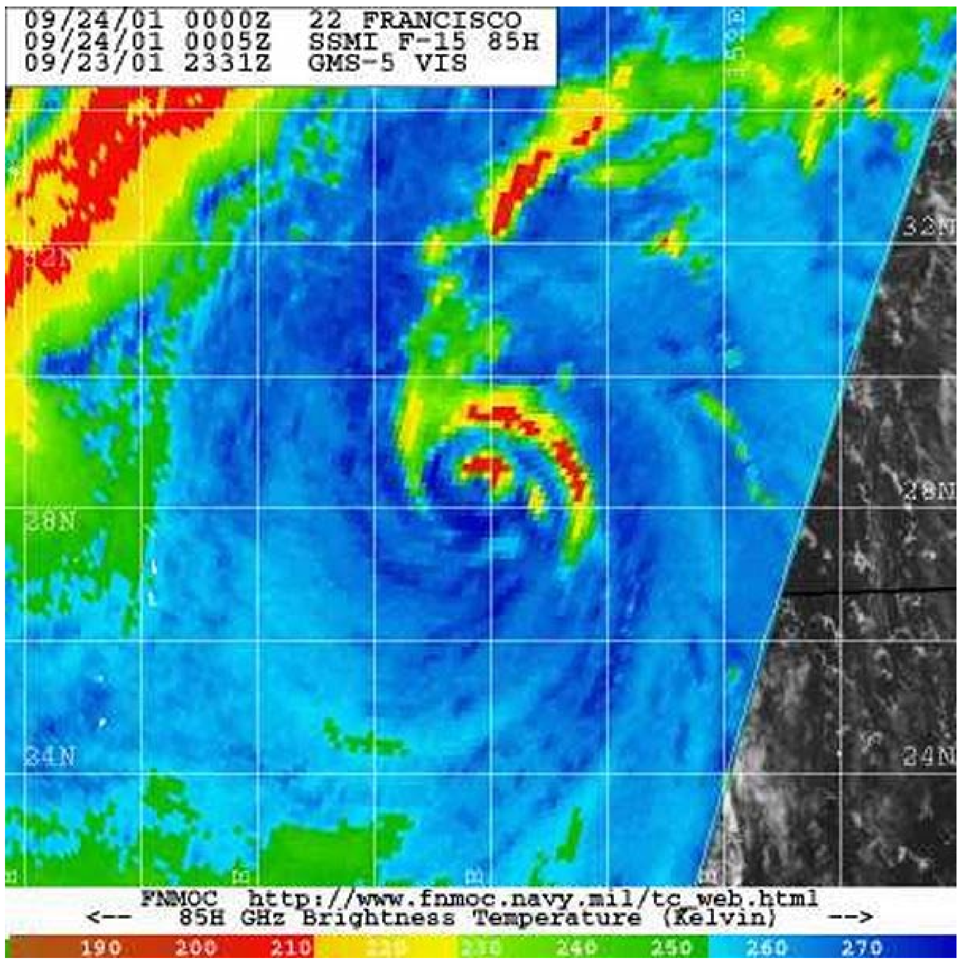


Figure 1-22W-2. 240005Z September 2001 85 GHz SSM/I imagery of TY 22W (Francisco) about 410 nm northeast of Iwo Jima at peak intensity of 100 knots with a partial eyewall feature.

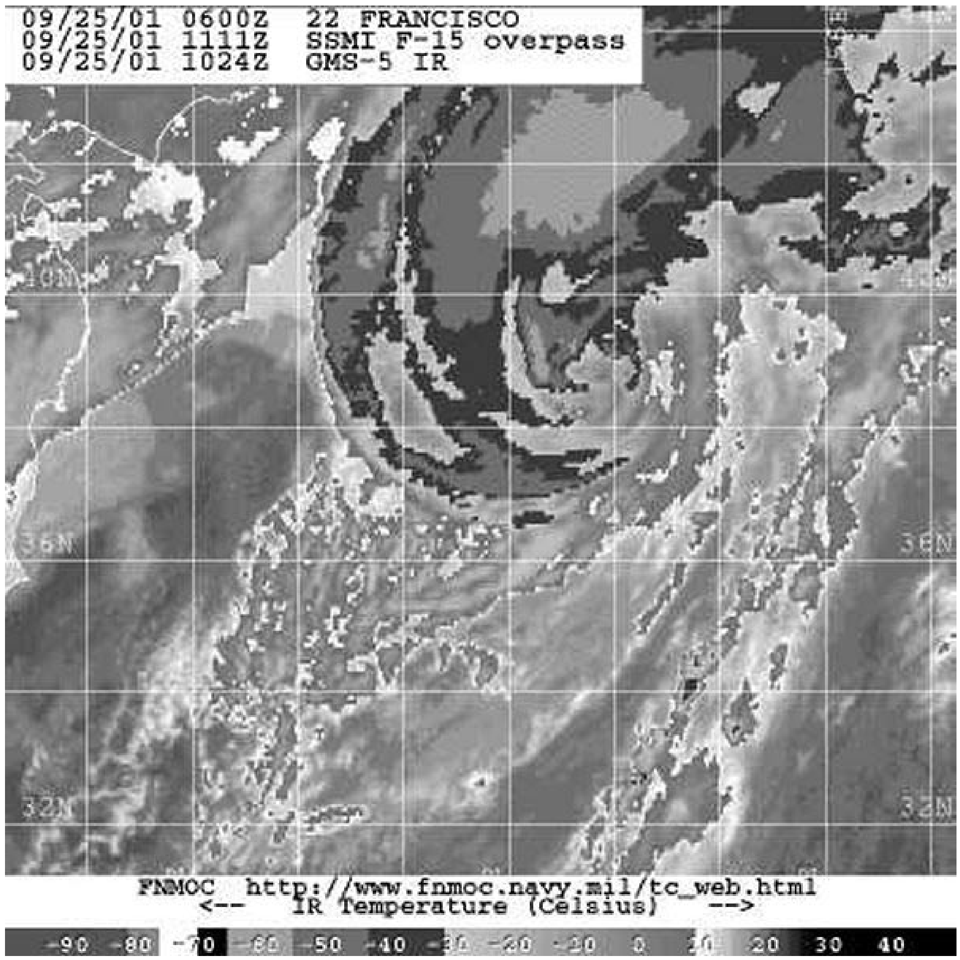
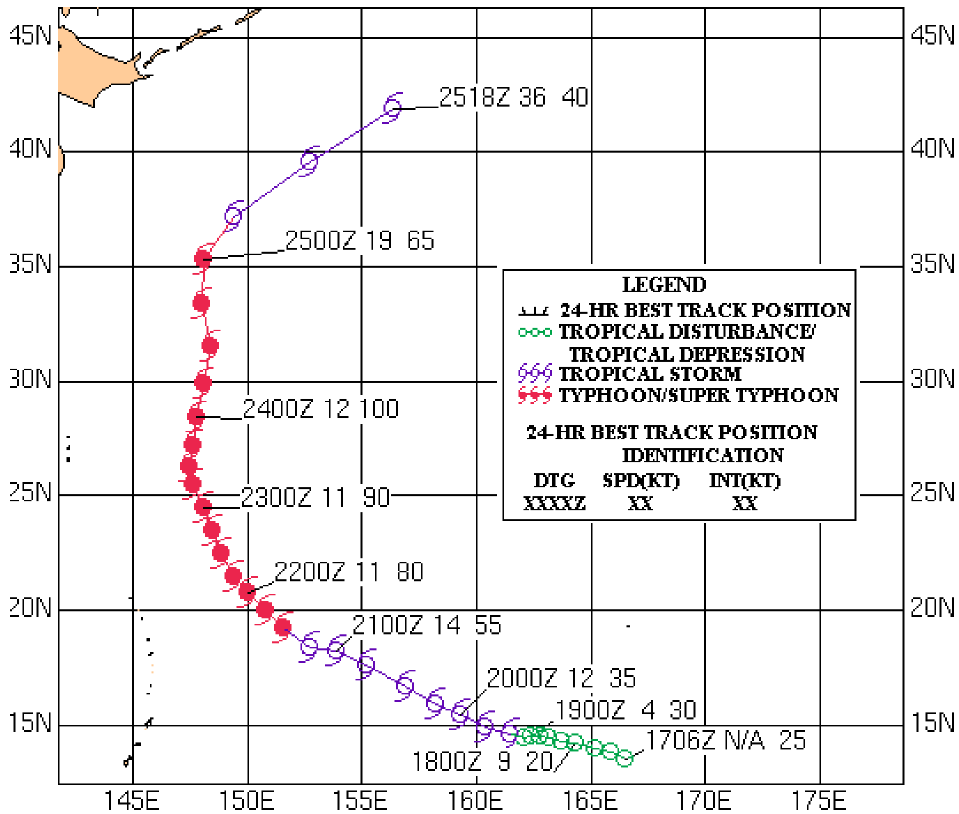


Figure 1-22W-3. 251111Z September 2001 DMSP imagery of TY 22W (Francisco) about 530 nm east of Misawa, Japan with an estimated intensity of 55 knots. The system was weakening and becoming extratropical as indicated by the convection displaced towards the northeast and exposed low level circulation.

TYPHOON 22W (FRANCISCO)
17 - 25 SEPTEMBER 2001



Typhoon (TY) 23W (Lekima*)

First Poor : 2300Z 19 Sep 01

First Fair : 0230Z 21 Sep 01

First TCFA : 1900Z 21 Sep 01

First Warning : 0000Z 22 Sep 01

Last Warning : 1800Z 29 Sep 01

Max Intensity : 95 kts, gusts TO 115 kts

Landfall : 0900Z 26 Jul 01, southern Taiwan

Total Warnings : 32

Remarks :

(1) TY 23W formed in the Philippine Sea and initially moved west for approximately 72 hours after which the cyclone abruptly turned north and made landfall over the southern tip of Taiwan.

(2) JTWC post-analysis determined that the cyclone attained a maximum intensity of 95 knots during the north movement phase in the Luzon Strait. Post-analysis further indicated that the cyclone passed over southern and western Taiwan before dissipating in the Taiwan Strait in the coastal waters near Fuzhou, China.

(3) TY 23W was the eighth tropical cyclone to hit Taiwan this year. No severe casualties or damage were reported.

Note: Contrary to JTWC, independent reviews received by JTWC suggested that TY 23W moved north along the east coast of Taiwan and dissipated near Lo-tung, Taiwan. These same reviews further indicated that a lee-side cyclone developed during 23W's movement along east Taiwan and that this lee-side cyclone moved into the Taiwan Strait and dissipated near Fuzhou, China.

*Name assigned by RSMC Tokyo

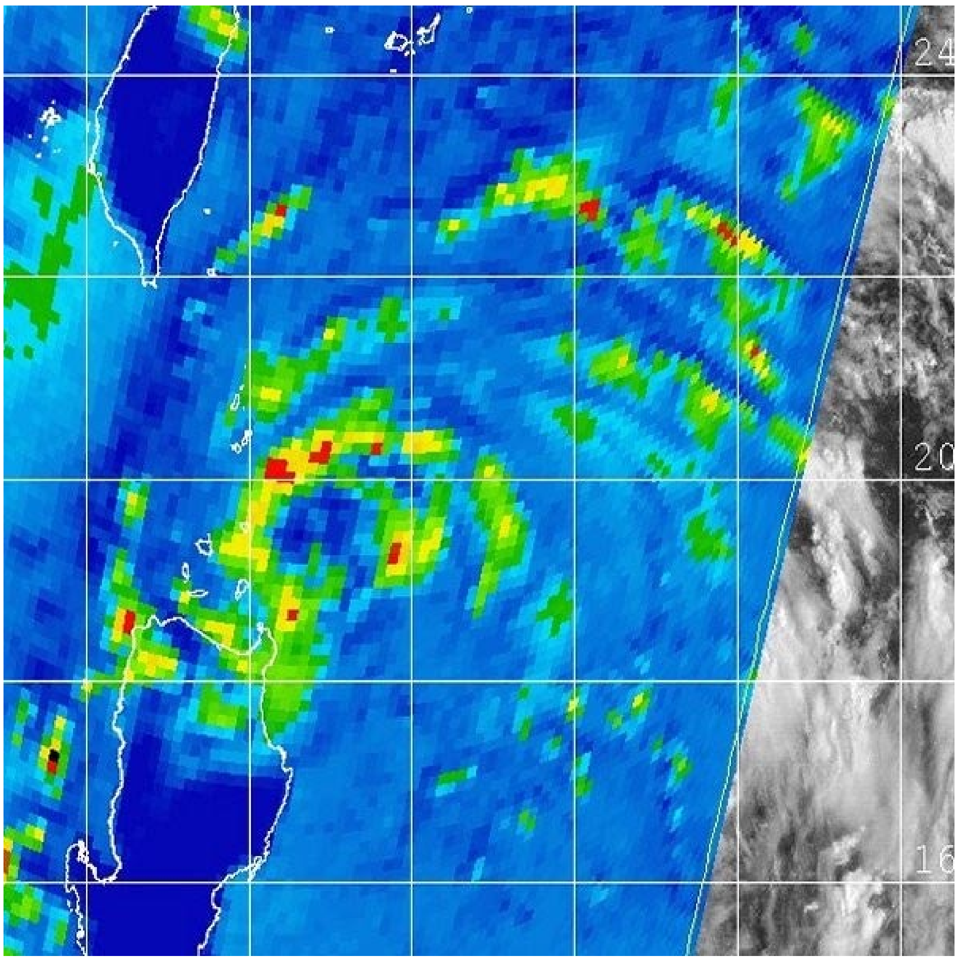


Figure 1-23W-1. 230037Z September 2001 85 GHz SSM/I image shows TS 23W (Lekima) beginning to consolidate just north of Luzon with an estimated intensity of 35kts.

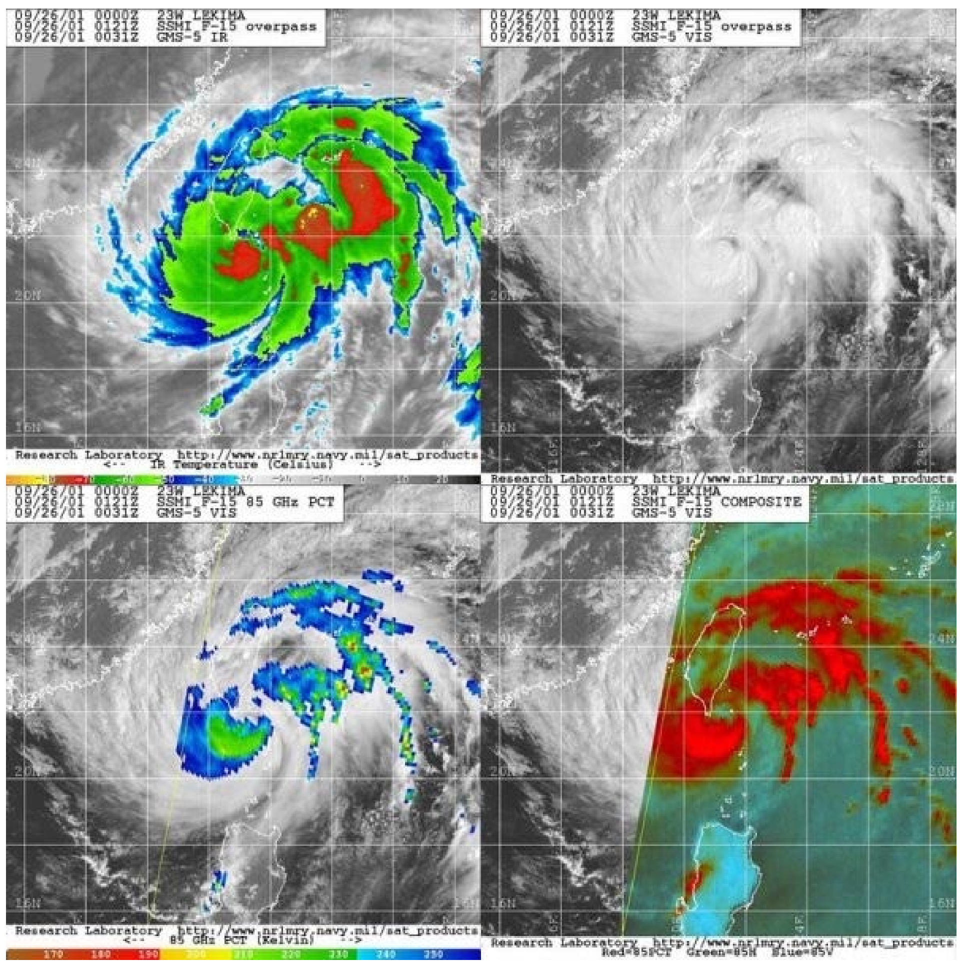
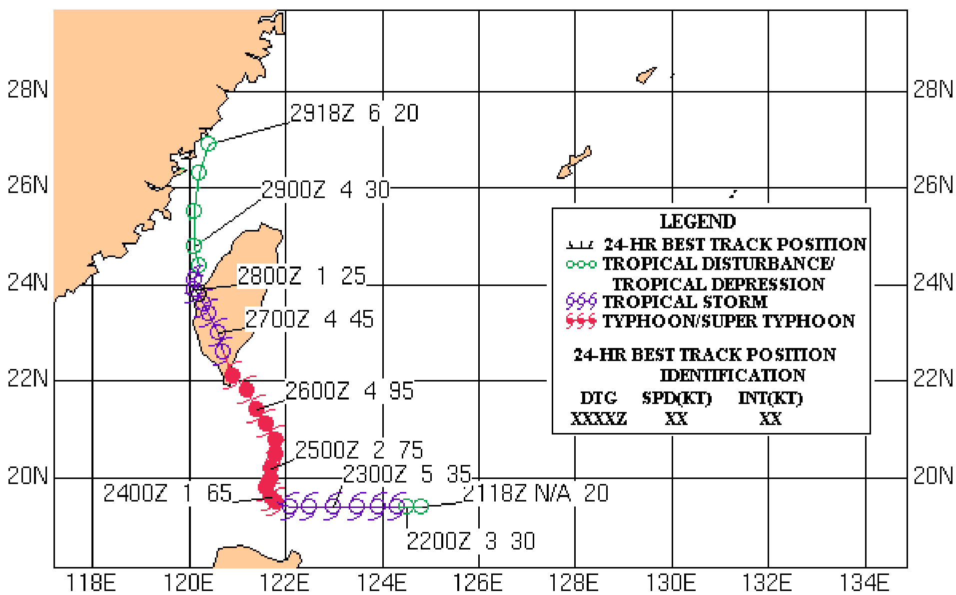


Figure 1-23W-2. 260031Z September 2001 GMS-5 enhanced infrared (top left), visible (top right) and 260121Z 85 GHz SSM/I images (bottom) of TY 23W (Lekima), as it approaches the southern tip of Taiwan with an estimated intensity of 95 knots. A ragged eye feature was more evident in the SSM/I imagery (bottom right).

TYPHOON 23W (LEKIMA)
21 - 29 SEPTEMBER 2001



Typhoon (TY) 24W (Krosa*)

First Poor : 0600Z 03 Oct 01

First Fair : 0630Z 03 Oct 01

First TCFA : 1630Z 03 Oct 01

First Warning : 1800Z 03 Oct 01

Last Warning : 0600Z 09 Oct 01

Max Intensity : 105 kts, gusts To 130 kts

Landfall : None

Total Warnings : 23

Remarks :

(1) Developed east of Guam, tracked northwestward and attained maximum intensity on 5 October before recurving northeastward.

*Name assigned by RSMC Tokyo

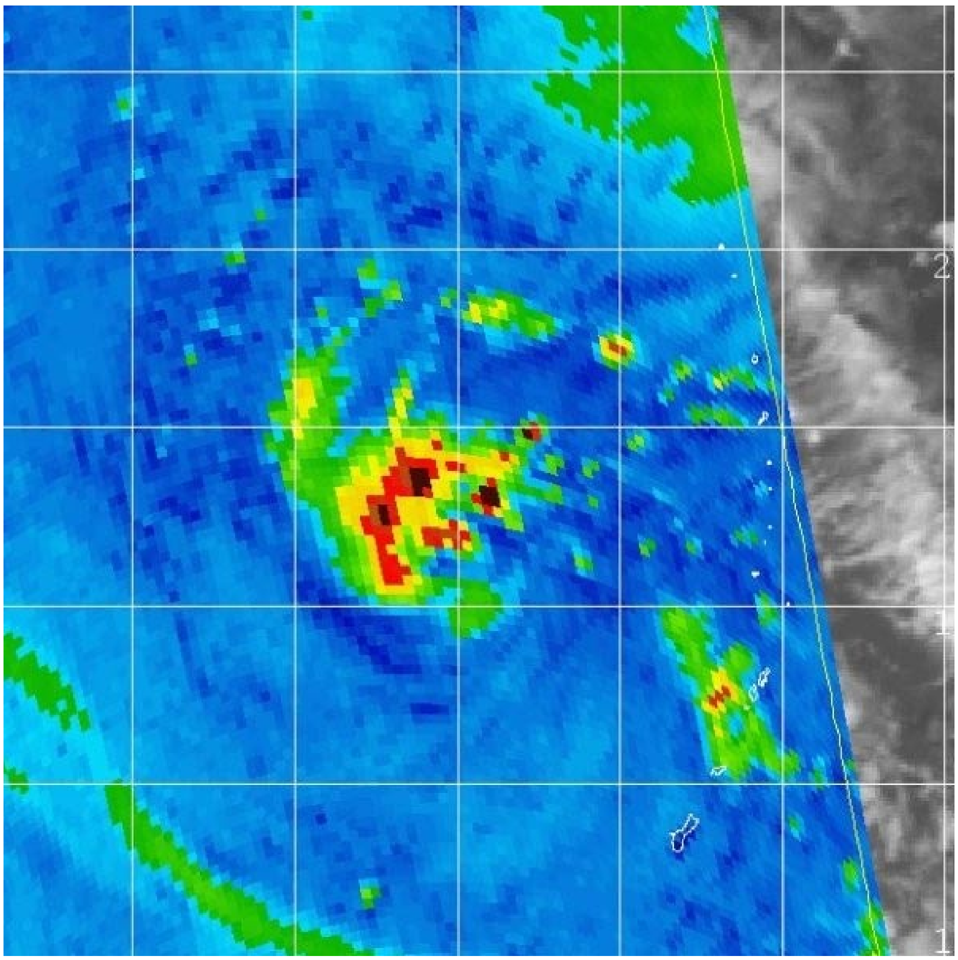


Figure 1-24W-1. 041102Z October 2001 85 GHz SSM/I image of TY 24W (Krosa), in the Philippine Sea northwest of Guam with an estimated intensity of 50 knots. System was becoming more consolidated with a banding feature wrapping north and west of the low level circulation center, and reached typhoon strength 12 hours later.

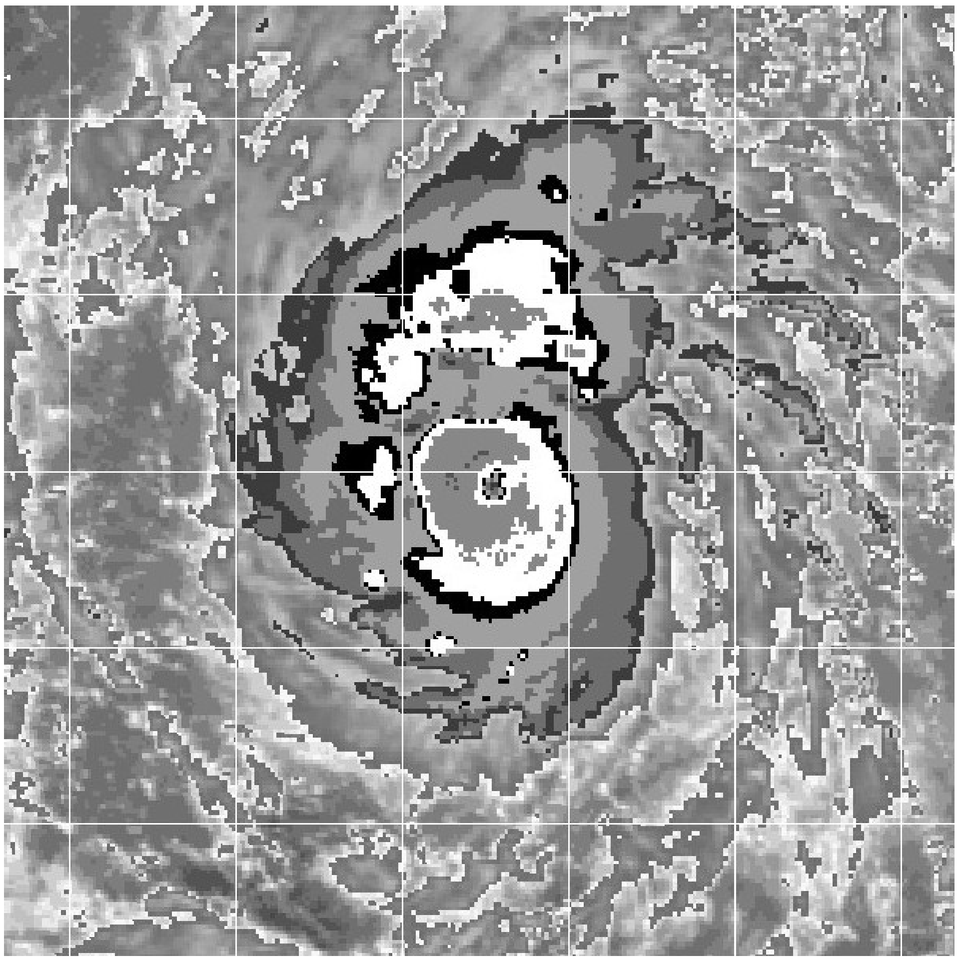


Figure 1-24W-2. 051231Z October 2001 GMS-5 enhanced infrared image of TY 24W (Krosa) depicting a well-defined eye with very cold surrounding cloud tops. The system was near its peak intensity of 105kts.

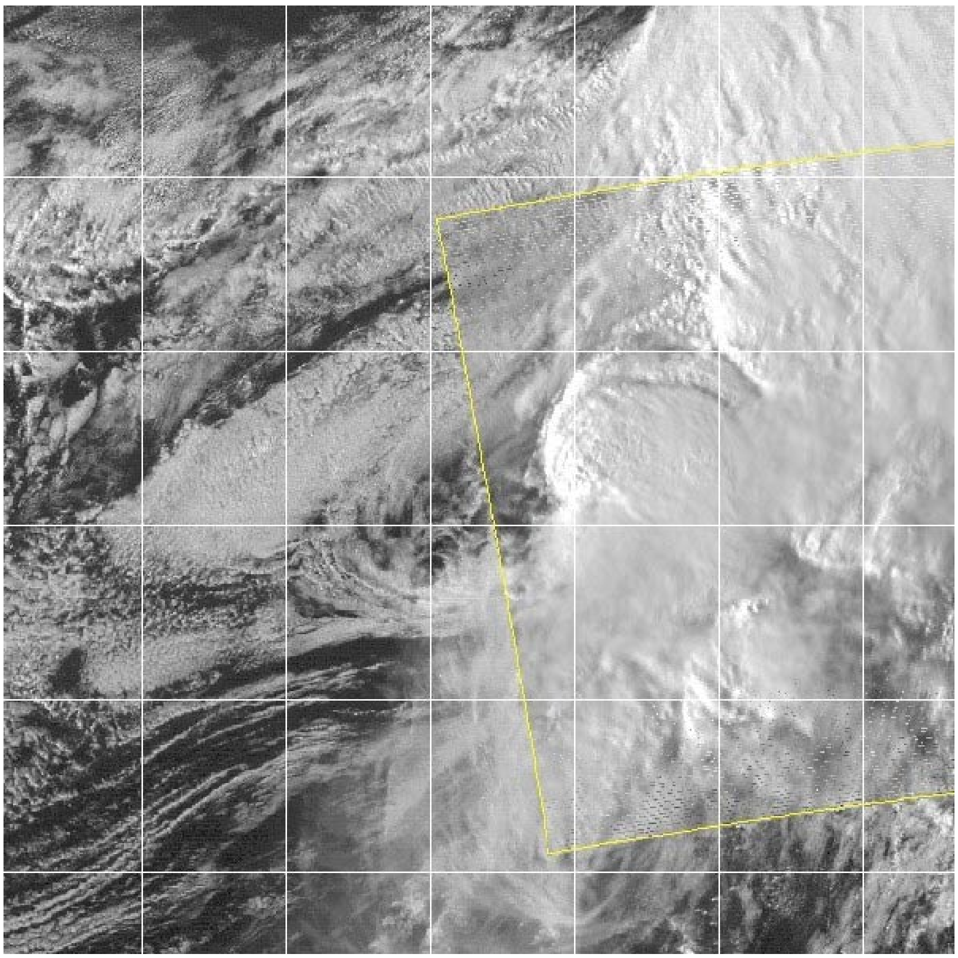
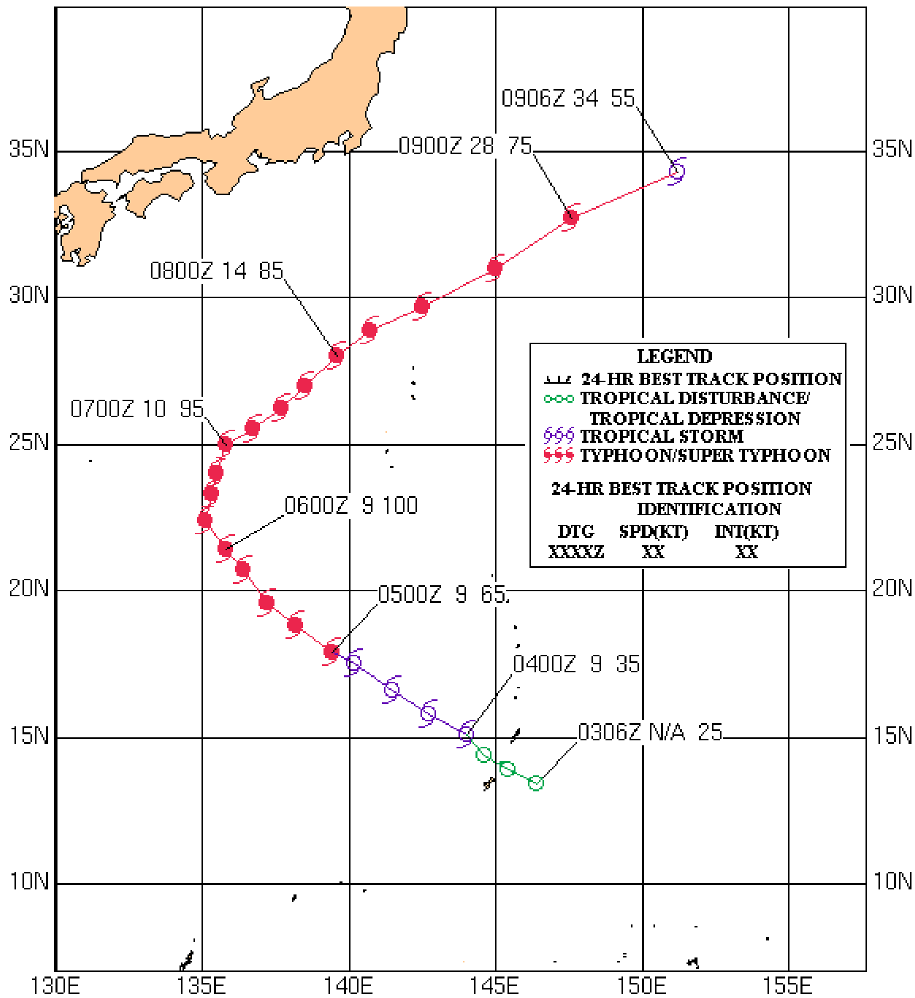


Figure 1-24W-3. 090531Z October 2001 GMS-5 visible image of TY 25W (Krosa) as it undergoes extratropical transition. The low level circulation center is exposed as the system weakens to 55kts.

TYPHOON 24W (KROSA)
03 - 09 OCTOBER 2001



Typhoon (TY) 25W (Haiyan*)

First Poor : 0000Z 08 Oct 01

First Fair : 1400Z 10 Oct 01

First TCFA : 0700Z 11 Oct 01

First Warning : 1200Z 11 Oct 01

Last Warning : 1800Z 17 Oct 01

Max Intensity : 90 kts, gusts To 110 kts

Landfall : None

Total Warnings : 26

Remarks :

(1) Developed in the Philippine Sea, tracked north then northwestward, attained maximum intensity on 15 October approximately 180 nm southwest of Okinawa, and then recurved northeastward passing over Amami Shima on the 17th.

(2) Kadena AB, Okinawa reported maximum sustained surface winds of 41 knots with gusts up to 59 knots as the storm passed 75 nm north.

(3) No casualties or damage were reported.

*Name assigned by RSMC Tokyo

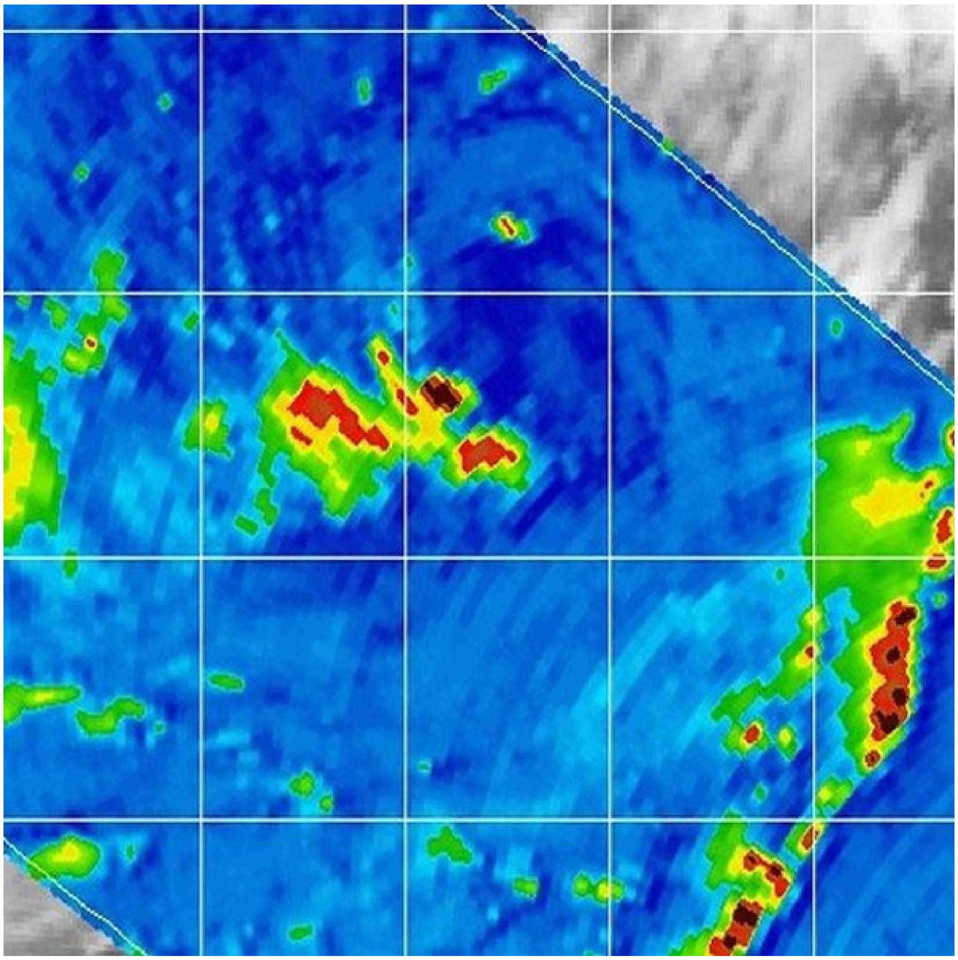


Figure 1-25W-1. A 121136Z October 2001 85 GHz TRMM image of TY 25W (Haiyan), developing approximately 450 nm east of Luzon with an estimated intensity of 35 knots. Note partially exposed low-level circulation with deep convection displaced to the southwest.

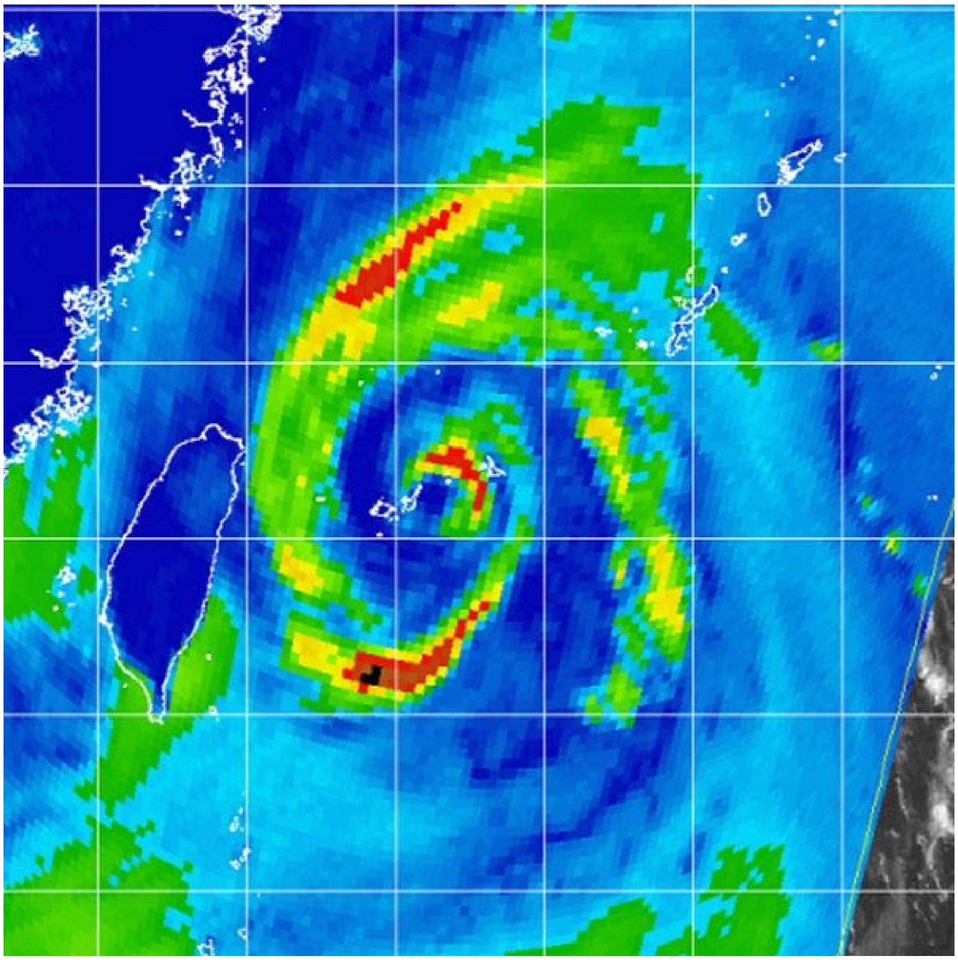


Figure 1-25W-2. 160028Z October 2001 85 GHz SSM/I image of TY 25W (Haiyan) tracking northwestward approximately 170 nm east of Taipei, Taiwan at its maximum intensity of 90 knots. Imagery depicts a partial eyewall feature with tightly-curved convective banding.

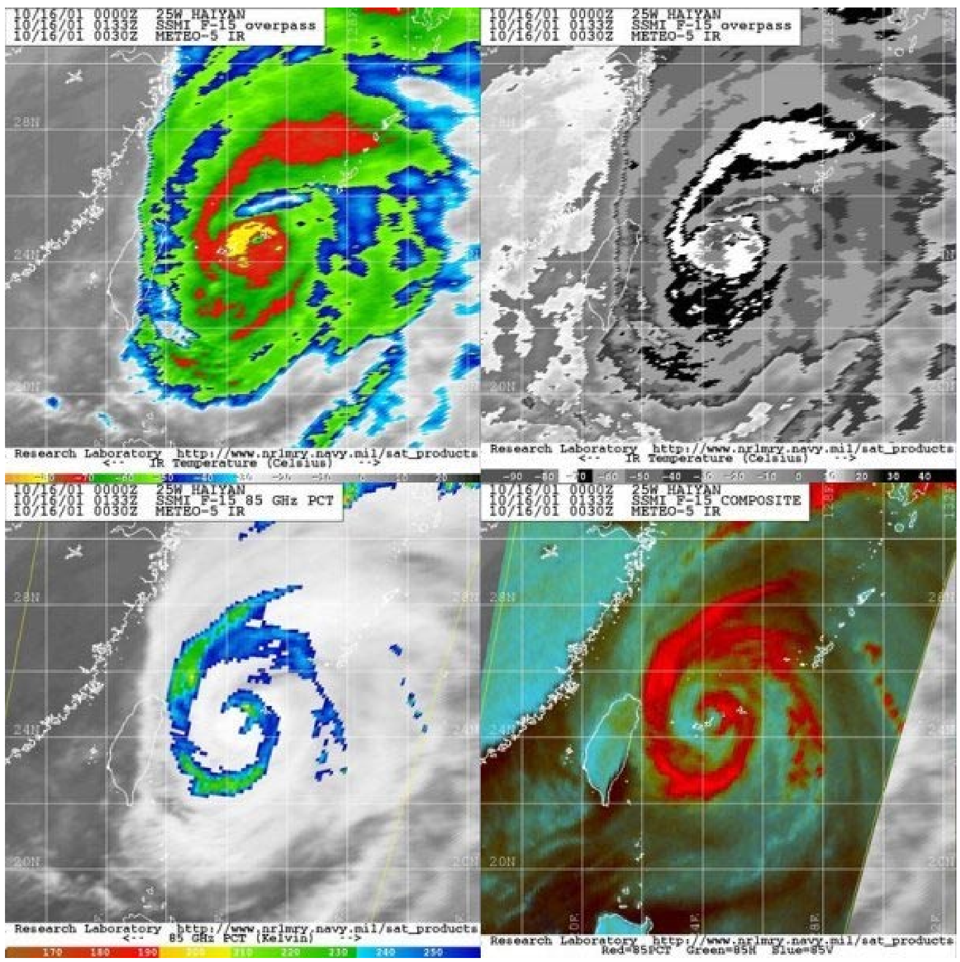


Figure 1-25W-3. 160133Z October 2001 enhanced infrared (top) and 85 GHz SSM/I (bottom) images of TY 25W (Haiyan) approximately 170 nm east of Taipei, Taiwan at its maximum intensity of 90 knots. Imagery depicts a partial eyewall feature with tightly-curved convective banding.

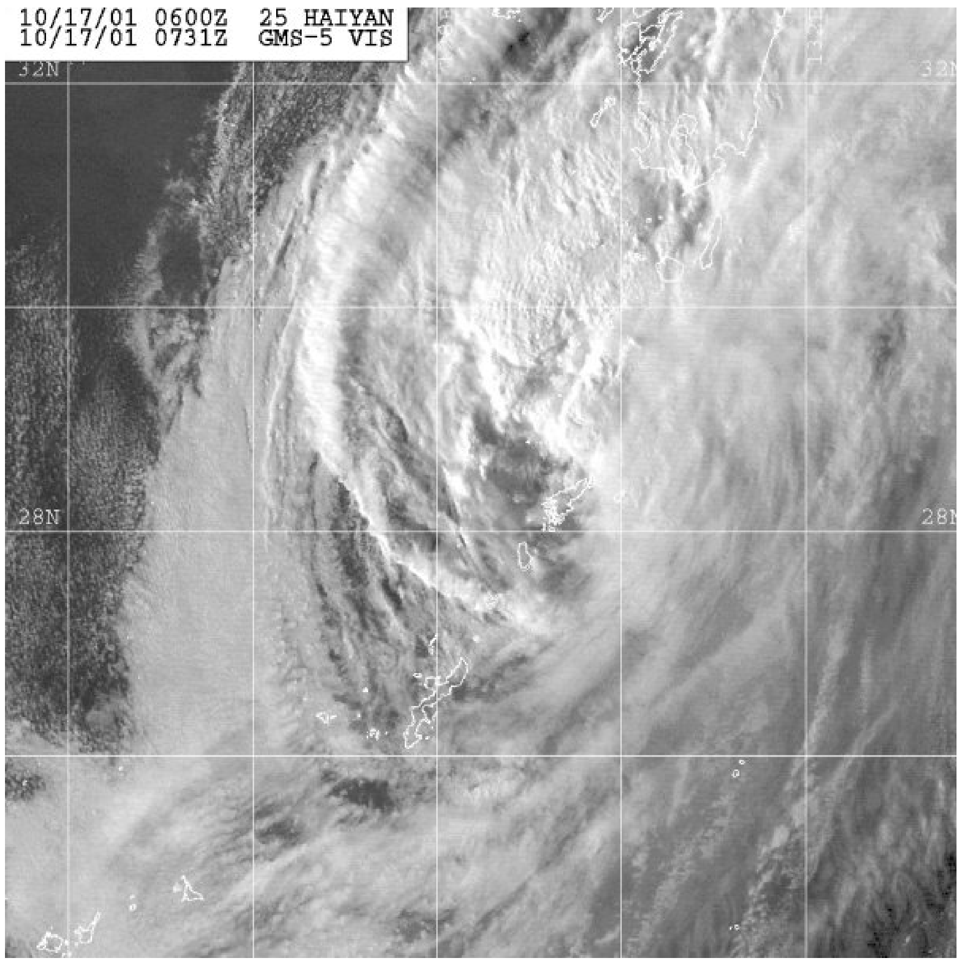
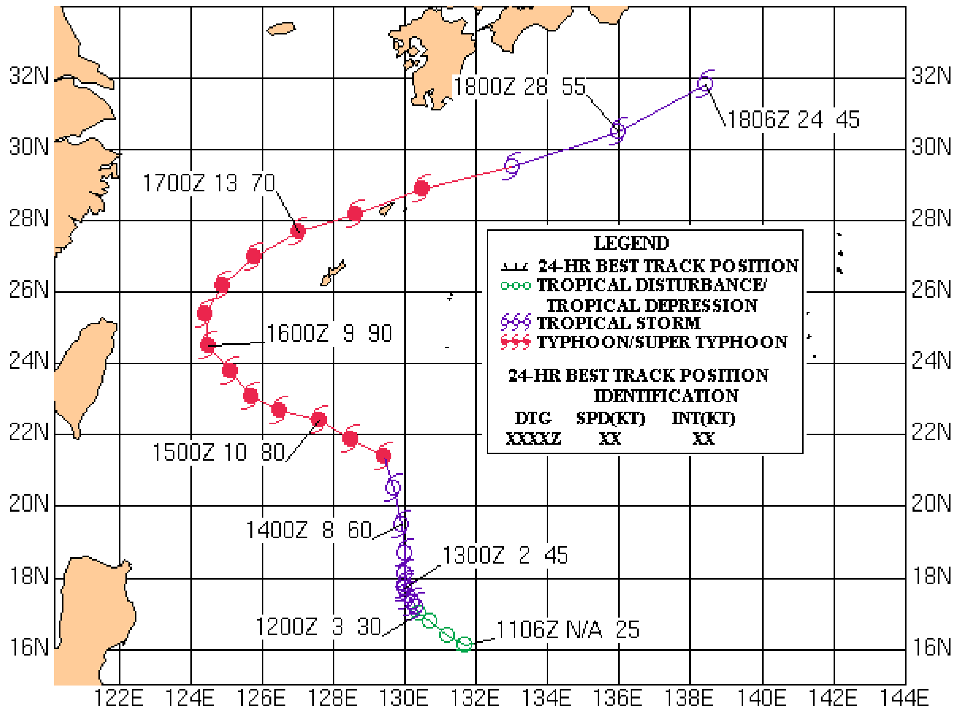


Figure 1-25W-4. A 170731Z October 2001 GMS-5 visible image of TY 25W (Haiyan) located south of Kyushu, Japan with an estimated intensity of 70 knots. At the time of this image, the system was undergoing extratropical transition as it interacted with a mid latitude trough. Note the stratocumulus in the southwest quadrant.

TYPHOON 25W (HAIYAN)
11 - 18 OCTOBER 2001



Super Typhoon (STY) 26W (Podul*)

First Poor : 0600Z 16 Oct 01

First Fair : 1230Z 17 Oct 01

First TCFA : 2230Z 17 Oct 01

Second TCFA : 2230Z 18 Oct 01

First Warning : 0000Z 19 Oct 01

Last Warning : 1800Z 27 Oct 01

Max Intensity : 140 kts, gusts To 170 kts

Landfall : None

Total Warnings : 36

Remarks :

(1) Developed south of Pohnpei Island, tracked aclimatologically northward through its entire lifetime. Even though it reached super typhoon strength, STY 26W did not affect any land.

*Name assigned by RSMC Tokyo

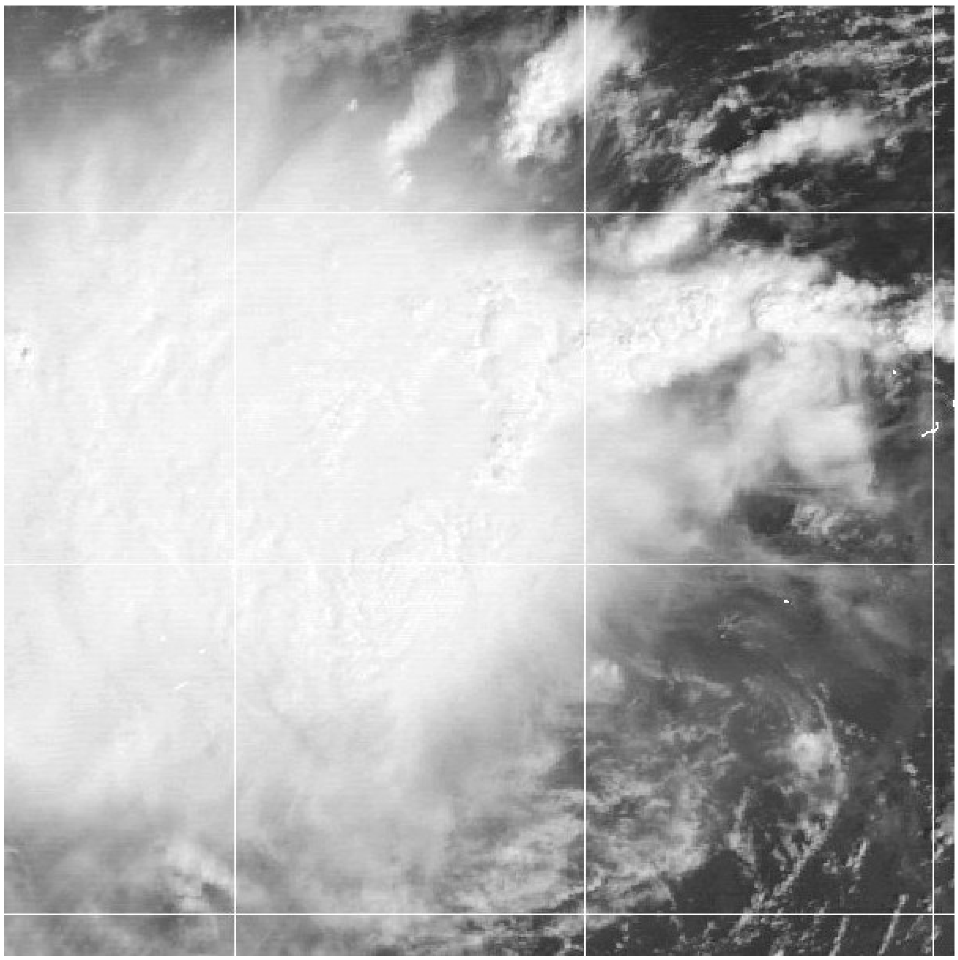


Figure 1-26W-1. A 182331Z October 2001 GMS-5 visible image of STY 26W (Podul) with an intensity estimated at 30kts. The low level circulation was partially exposed as the system experienced weak to moderate vertical wind shear.

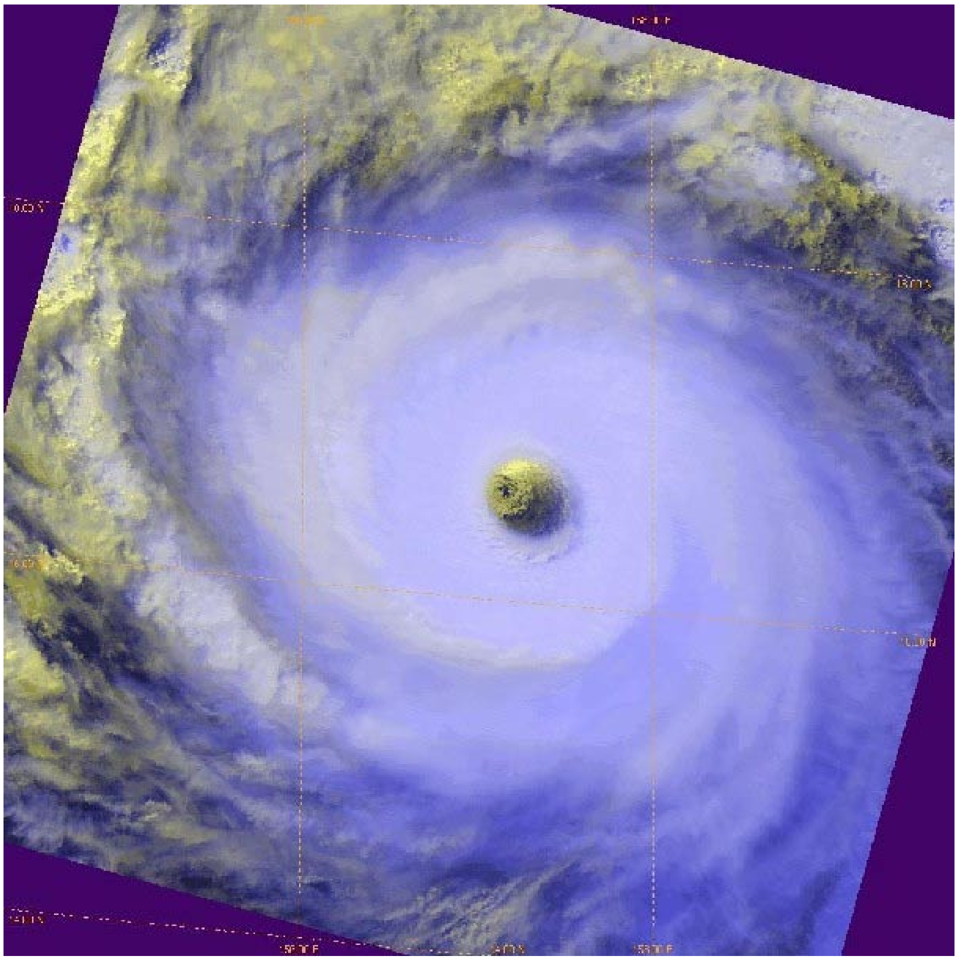


Figure 1-26W-2. A 232334Z October 2001 DMSP multi-spectral image of STY 26W (Podul) near peak intensity of 140kts with a very well-defined eye with low level cloud field within the eye.

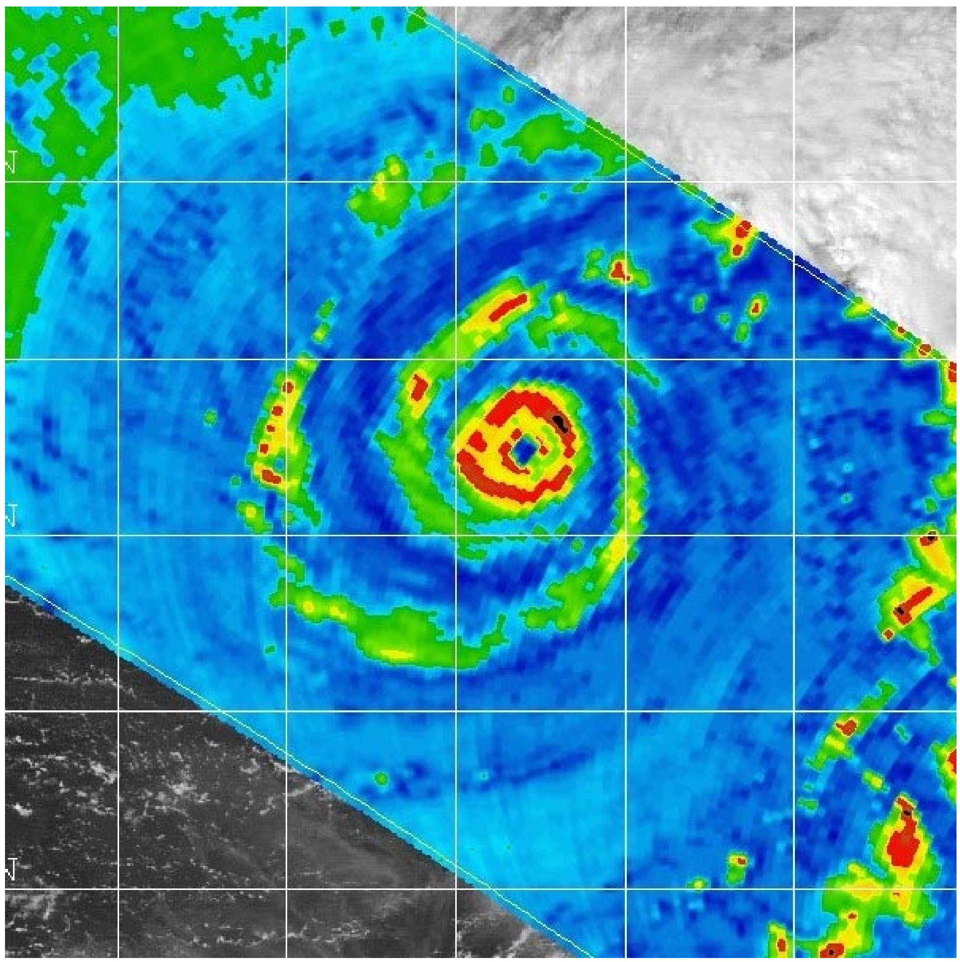
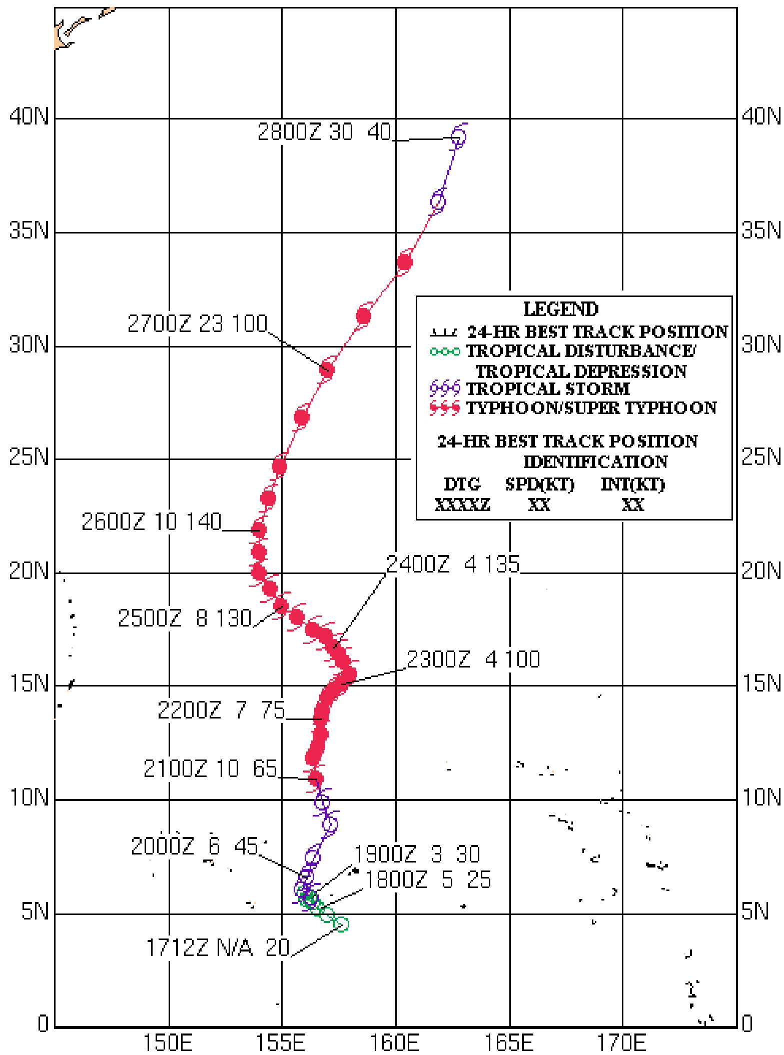


Figure 1-26W-3. A 240351Z October 2001 85 GHz TRMM image of STY 26W (Podul) near its peak intensity of 140kts. The system was undergoing a concentric eyewall cycle.

SUPER TYPHOON 26W (PODUL)
19 - 27 OCTOBER 2001



Typhoon (TY) 27W (Lingling*)

First Poor : 1900Z 03 Nov 01

First Fair : 0600Z 05 Nov 01

First TCFA : 2030Z 05 Nov 01

First Warning : 0000Z 06 Nov 01

Last Warning : 0600Z 12 Nov 01

Max Intensity : 115 kts, gusts To 140 kts

Landfall : 1800Z 11 Nov 01 over central Vietnam

Total Warnings : 26

Remarks :

(1) Originating in the Philippine Sea, TY 27W tracked over Central Philippines into the South China Sea making landfall near Qui Nhon, Vietnam.

(2) This cyclone entered the South China Sea as a weak tropical storm, but rapidly intensified while tracking along the southern edge of a strong northeasterly monsoon surge.

(3) TY 27W was a weak system as it passed over the resort island of Camiguin in central Philippines, but tracked very slowly and drenched the area with torrential rains. CNN reported that 171 people were confirmed dead, 118 missing, and thousands of homes damaged in the areas affected.

(4) TY 27W also produced heavy rains and high winds over central Vietnam. CNN reported 18 deaths, hundreds of injuries, and over 1000 homes destroyed.

*Name assigned by RSMC Tokyo

Figure 1-27W-1. 060031Z November 2001 visible image of TY 27W (Lingling)approximately 75 nm east of Mindanao with an estimated intensity of 25 knots.

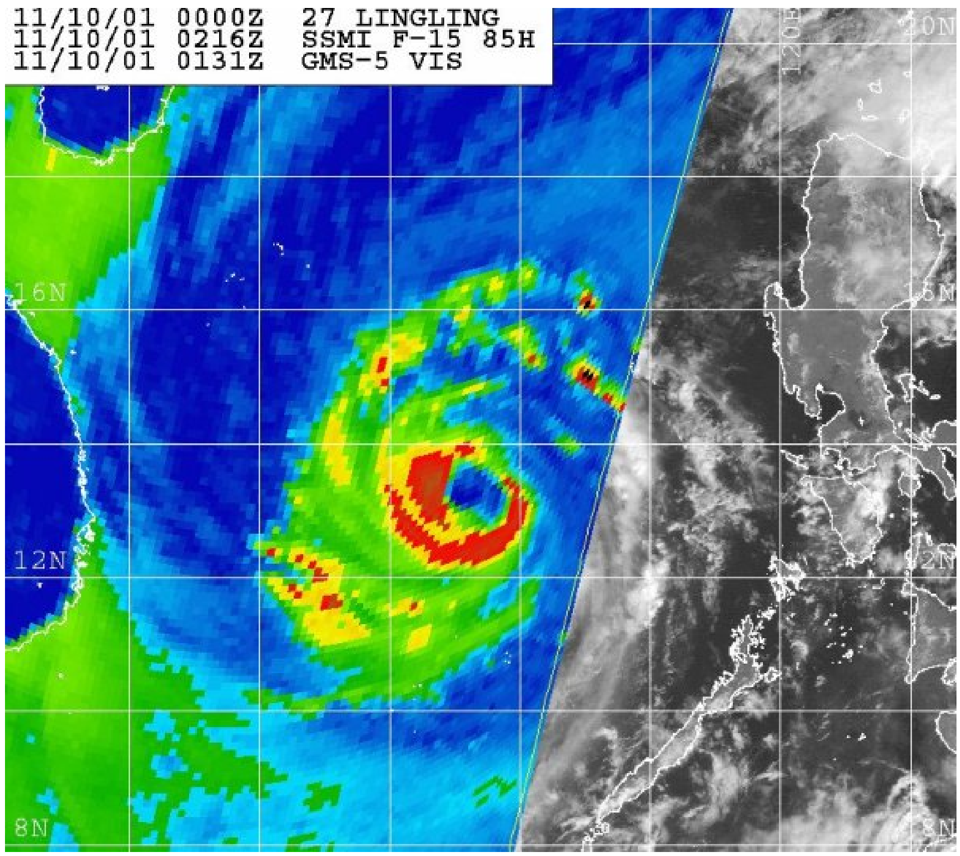


Figure 1-27W-2. 100216Z November 2001 85 GHz SSM/I image of TY 27W (Lingling) in the South China Sea about 330 nm east of Vietnam with an estimated intensity of 102 knots. While visible and IR imagery indicated a cloud-filled eye, this microwave image revealed a large irregular shaped eye feature.

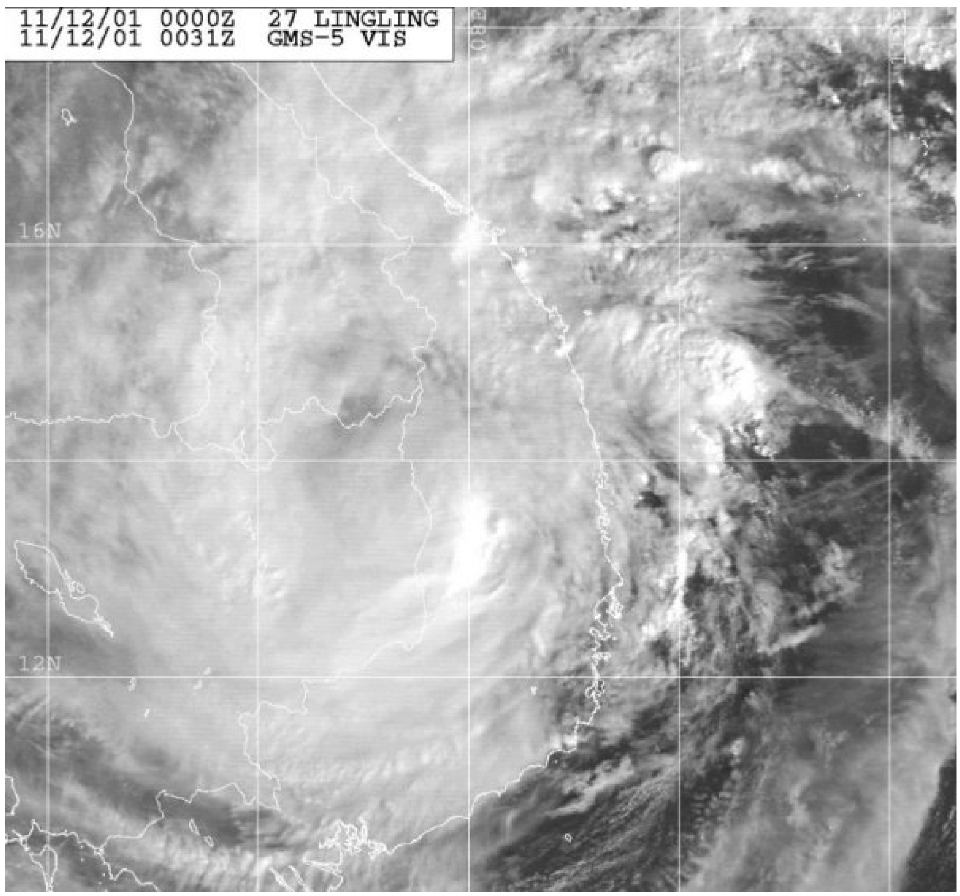
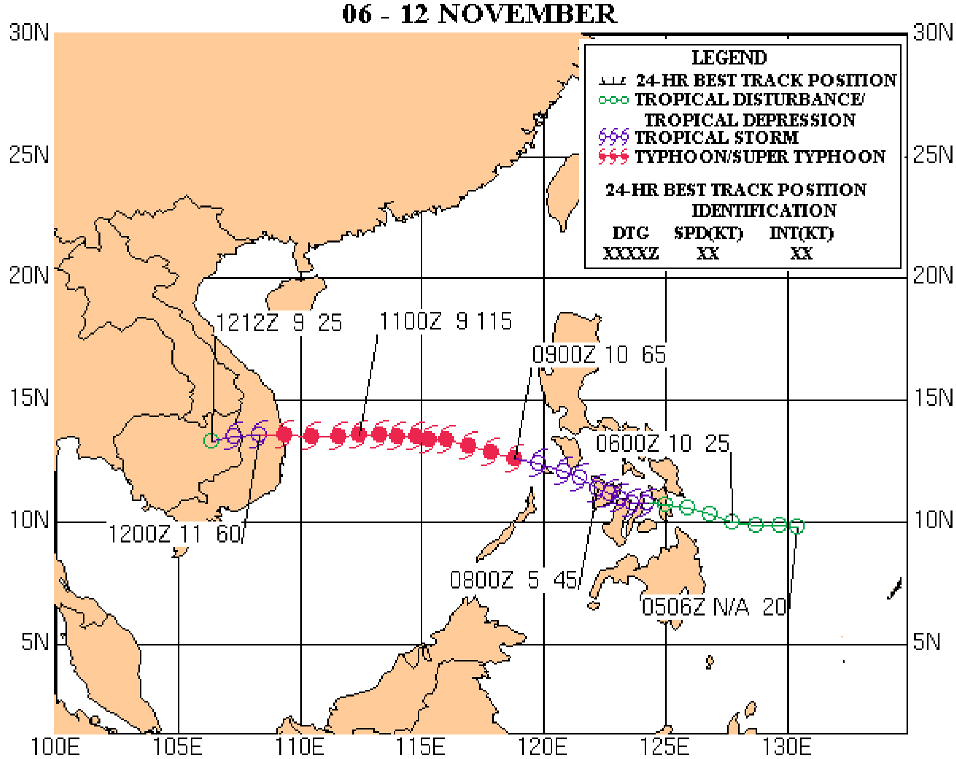


Figure 1-27W-3. 120031Z November 2001 visual image of TS 27W (Lingling) about 37 nm inland over Vietnam with an estimated intensity of 45 knots. Convection significantly decreased near the low level circulation due to interaction with land.

TYPHOON 27W (LINGLING)
06 - 12 NOVEMBER



Tropical Storm (TS) 28W

First Poor : 0600Z 14 Nov 01

First Fair : 0600Z 16 Nov 01

First TCFA : 1400Z 16 Nov 01

Second TCFA : 1400Z 17 Nov 01

First Warning : 1200Z 18 Nov 01

Last Warning : 1800Z 24 Nov 01

Max Intensity : 35 kts, gusts To 45 kts

Landfall : None

Total Warnings : 26

Remarks :

(1) Developed in the western Caroline Islands as a broad and weak circulation.

(2) Initially moved north then turned west and intensified into a minimal tropical storm for 24 hours before turning south-southwest.

(3) Moved slowly south-southwest for 24 hours and then turned north and began to slowly weaken eventually dissipating in the northern Philippine Sea 48 hours later.

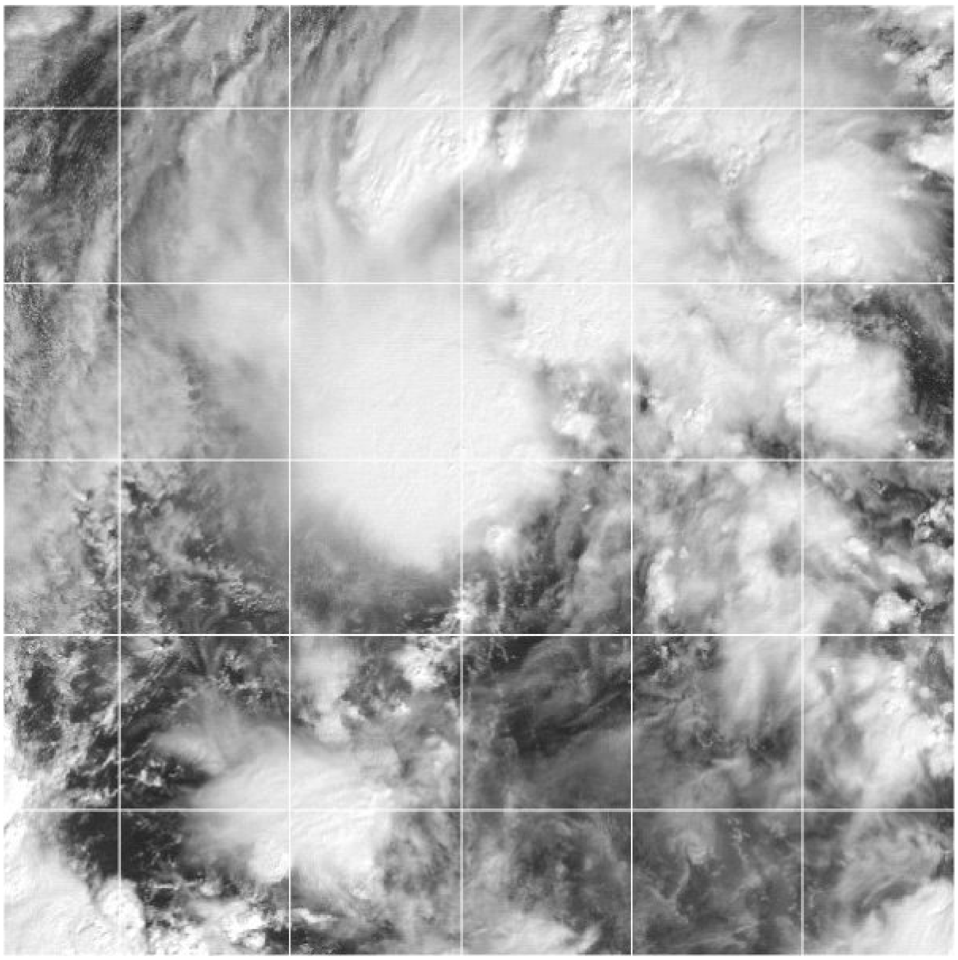


Figure 1-28W-1. 210031Z November 2001 visible image of TS 28W with a small CDO at peak intensity of 35 knots in the Philippine Sea.

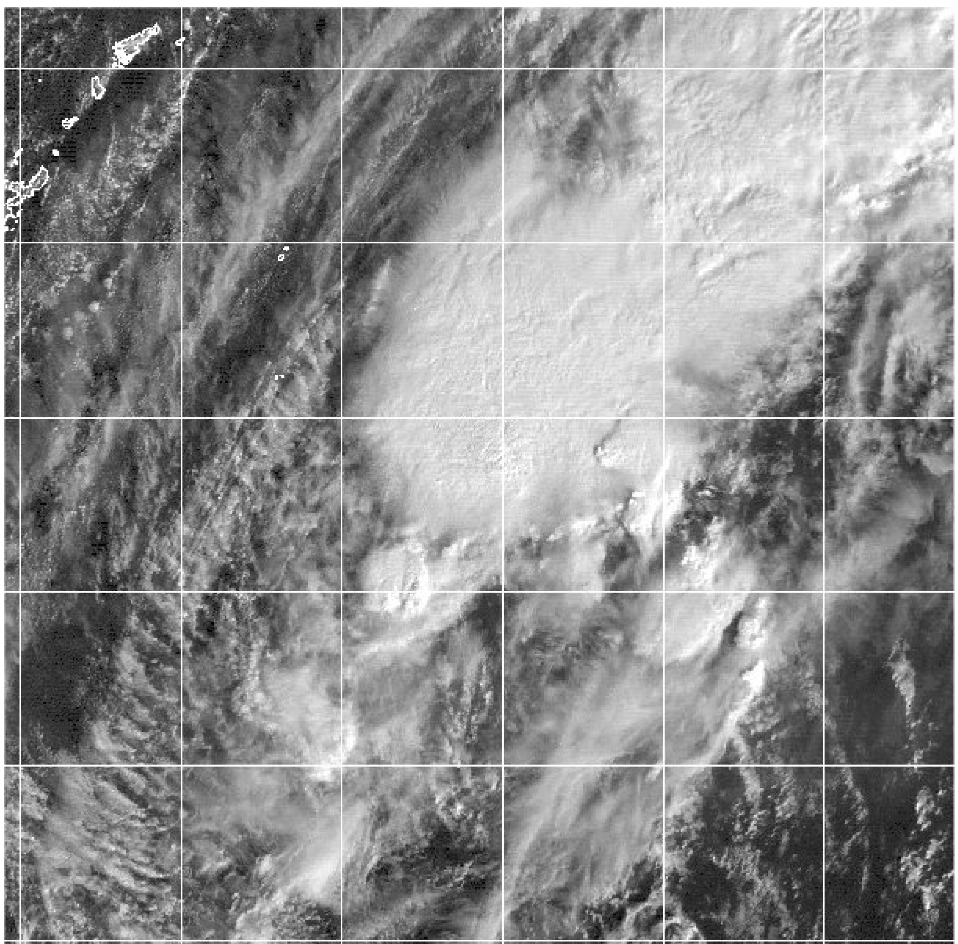
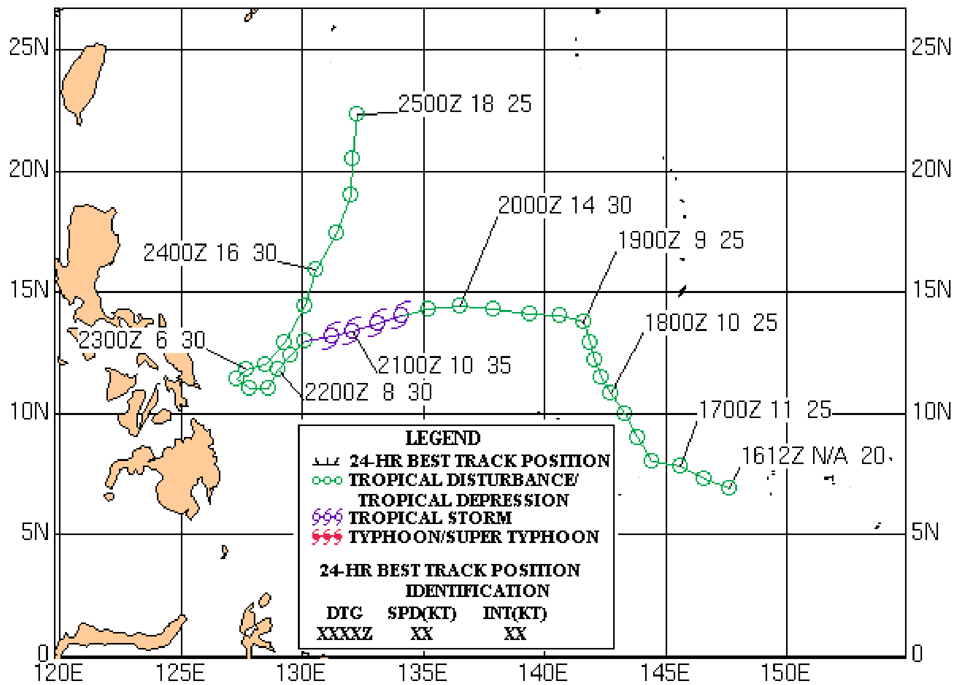


Figure 1-28W-2. 242301Z November 2001 visible image of TS 28W located southwest of Okinawa in northern Philippine Sea when the system was dissipating due to strong vertical shear.

TROPICAL STORM 28W
18 - 24 NOVEMBER



Tropical Storm (TS) 29W

First Poor : 0600Z 16 Nov 01

First Fair : NONE

First TCFA : 1700Z 18 Nov 01

Second TCFA : 1700Z 19 Nov 01

First Warning : 0600Z 20 Nov 01

Last Warning : 0600Z 23 Nov 01

Max Intensity : 35 kts, gusts To 45 kts

Landfall : None

Total Warnings : 13

Remarks : None

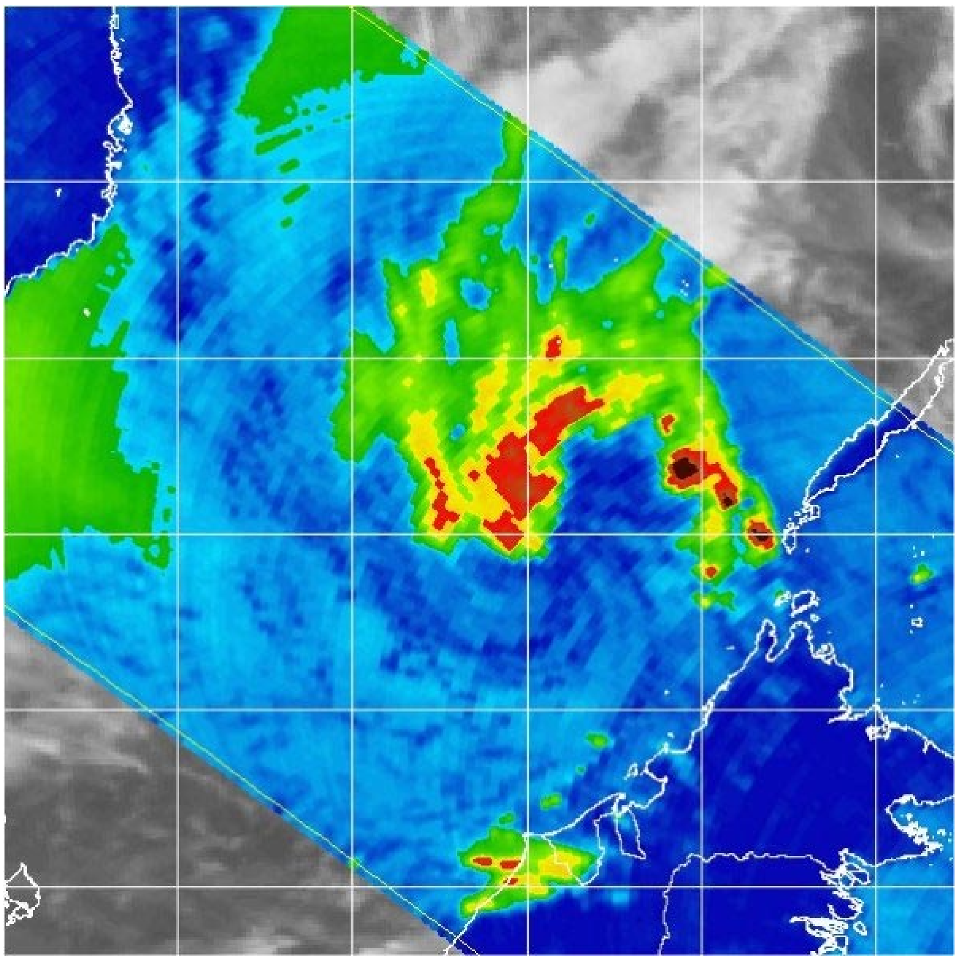
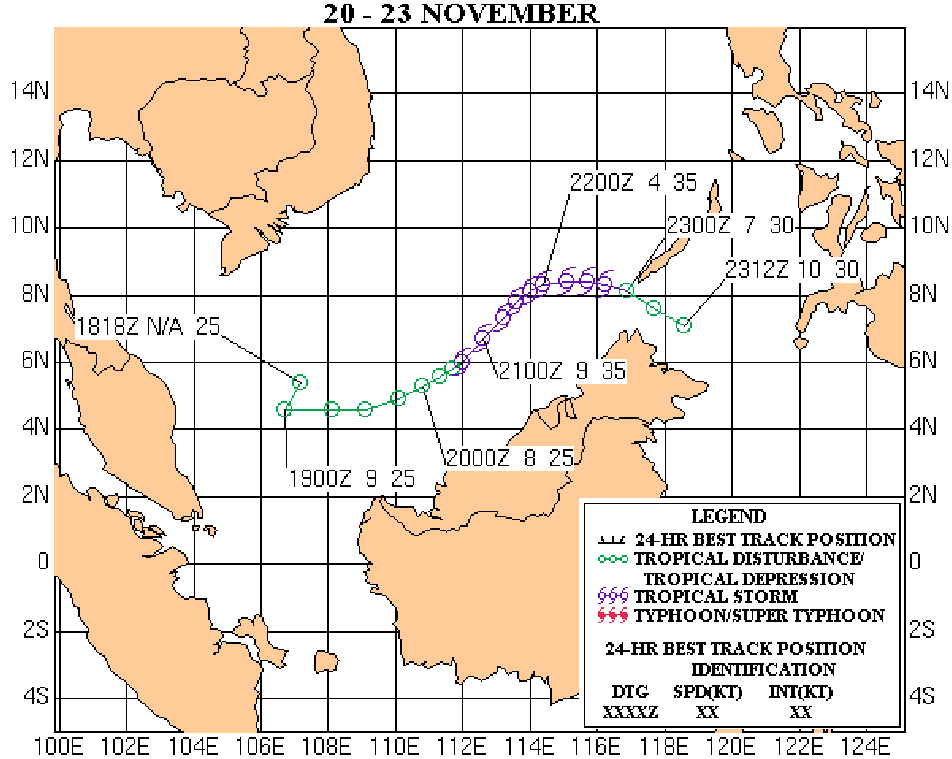


Figure 1-29W-1. 211709Z November 2001 85 GHz TRMM image of TS 29W in the South China Sea at peak intensity of 35kts.

TROPICAL STORM 29W
20 - 23 NOVEMBER



Tropical Storm (TS) 30W (Kajiki*)

First Poor : 0600Z 02 Dec 01

First Fair : 0130Z 04 Dec 01

First TCFA : 1100Z 04 Dec 01

First Warning : 0000Z 05 Dec 01

Last Warning : 0000Z 09 Dec 01

Max Intensity : 35 kts, gusts To 45 kts

Landfall : Central Philippines

Total Warnings : 17

Remarks :

(1) Philippine Civil Defense Office reports obtained from Agence France-Presse indicates that there were 2 fatalities and over 6,400 people displaced due to heavy rains and high winds associated with the TS 30W passage over central Philippines.

*Name assigned by RSMC Tokyo

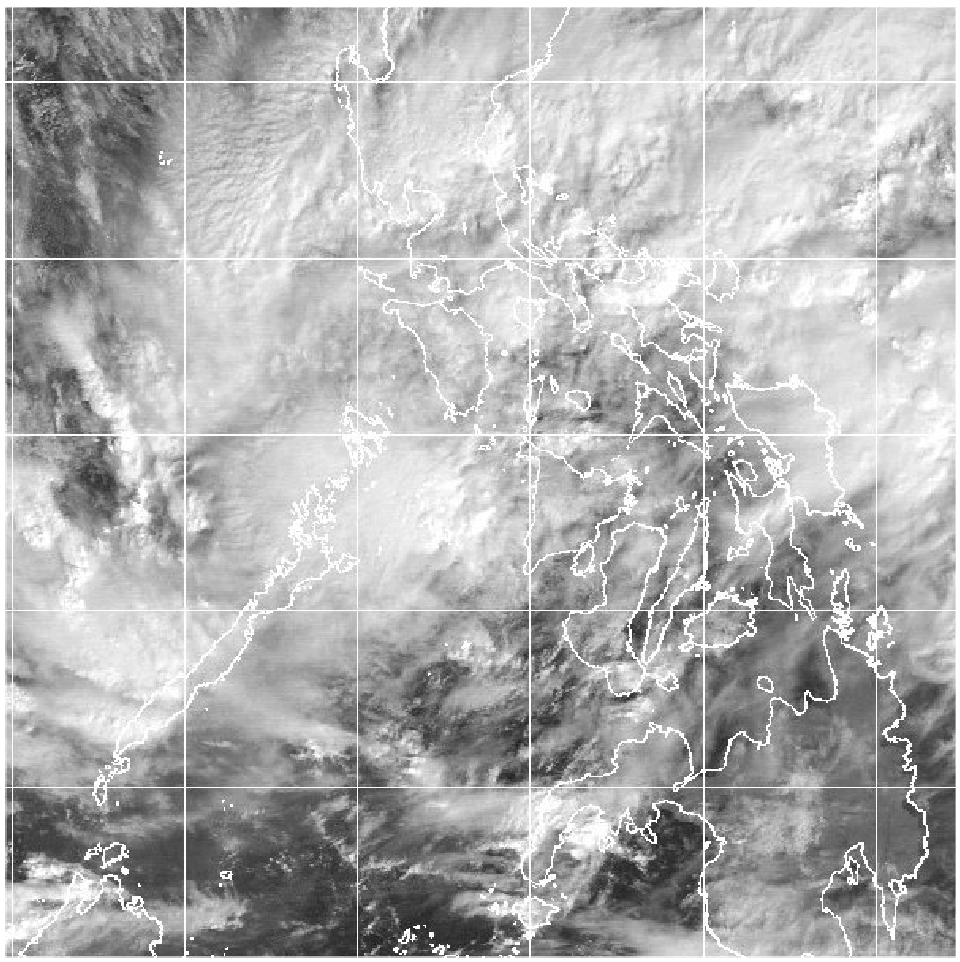
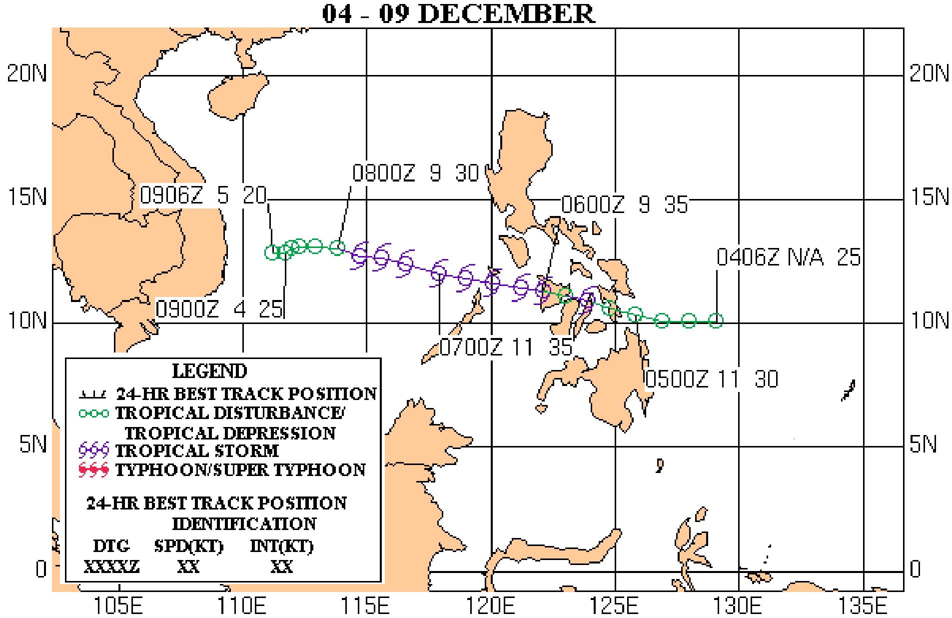


Figure 1-30W-1. 060031Z Dec 2001 GMS visible image of TS 30W (Kajiki) on the west coast Panay island in the central Philippines at peak intensity of 35 knots.

TROPICAL STORM 30W (KAJIKI)
04 - 09 DECEMBER



Tropical Storm (TS) 31W

First Poor : none

First Fair : 1730Z 10 Dec 01

First TCFA : 2000Z 10 Dec 01

First Warning : 1800Z 11 Dec 01

Last Warning : 0000Z 13 Dec 01

Max Intensity : 35 kts, gusts To 45 kts

Landfall : none

Total Warnings : 6

Remarks :

(1) TS 31W was originally warned on by JTWC as STY 31W (Faxai). JTWC post-analysis concluded that the original circulation, TS 31W, dissipated on 13 December after reaching tropical storm intensity. A new circulation, STY 33W (Faxai), then developed SE of the remnants of TS 31W.

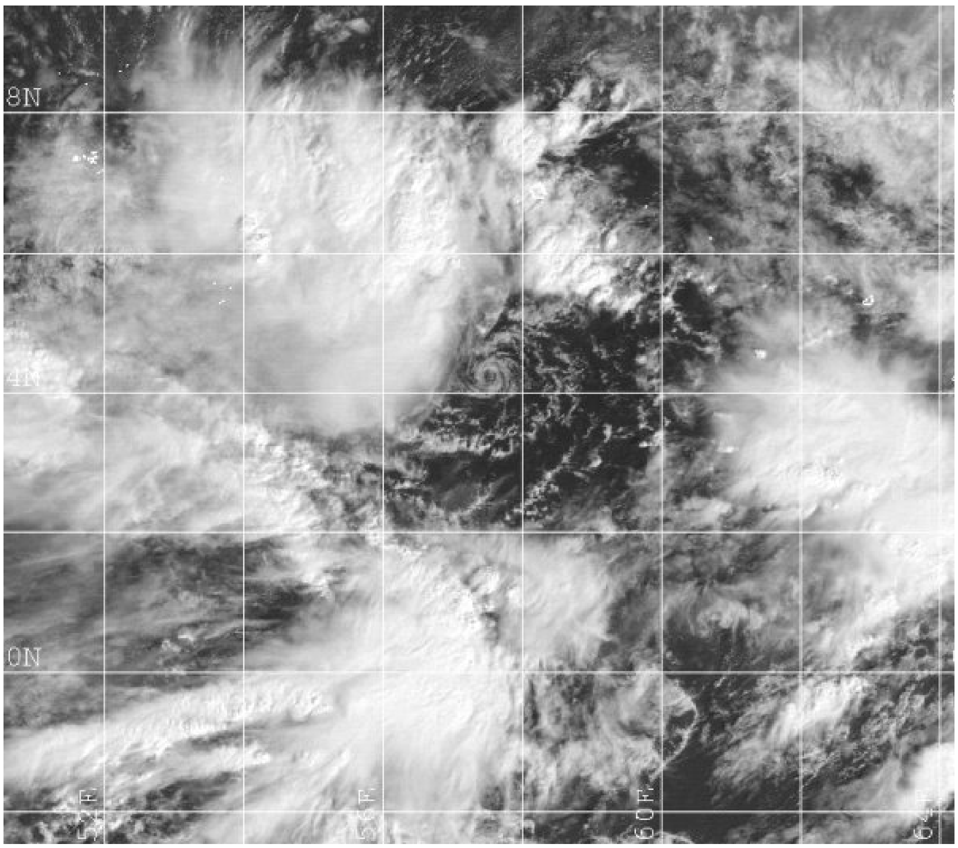
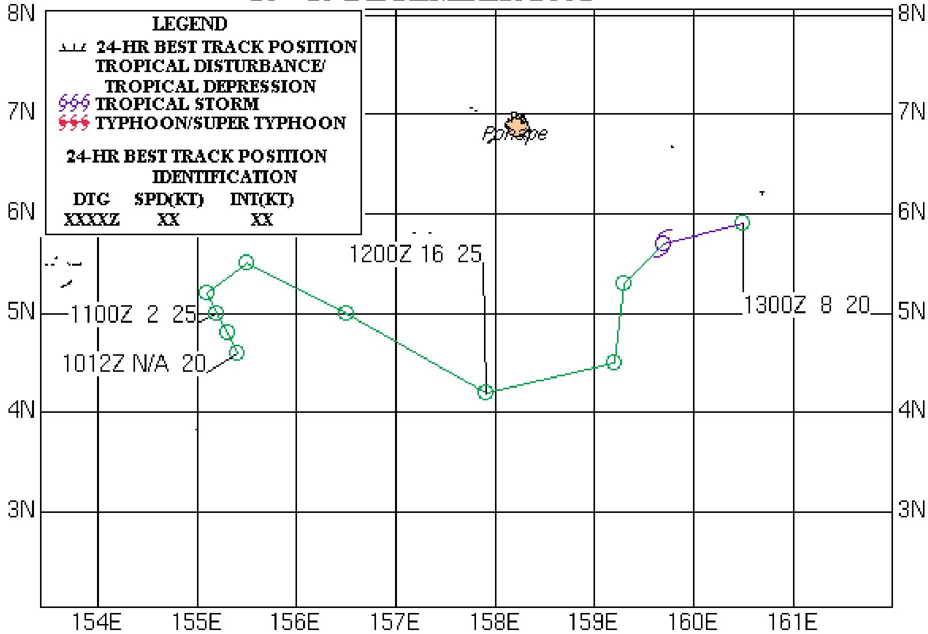


Figure 1-31W-1. 112234Z December 2001 visible imagery of TS 31W SE of Pohnpei with an exposed low-level circulation center. System intensity was estimated at 25 knots.

TROPICAL STORM 31W
10 - 13 DECEMBER 2001



Typhoon (TY) 32W (Vamei*)

First Poor : 0600Z 25 Dec 01

First Fair : 1330Z 26 Dec 01

First TCFA : none

First Warning : 0000Z 27 Dec 01

Last Warning : 1800Z 31 Dec 01

Max Intensity : 75 kts, gusts To 90 kts

Landfall : 0830Z 27 Dec

Total Warnings : 10

Remarks :

(1) TY 32W (Vamei) rapidly developed approximately 75 nm east-northeast of Singapore and reached a maximum intensity of 75 knots before making landfall about 30 nm NE of Singapore, Malaysia.

(2) AT 270000Z, JTWC classified the system as a typhoon based on naval ship observations indicating sustained winds within the small eyewall of 75 knots with gusts to 105 knots.

(3) This system was an anomaly in that it developed just 1.5 degrees north of the Equator. Synoptic data and 850mb vorticity post analysis revealed that the system spawned from a buffer zone over the equator. Due to its close proximity to the equator, the wind field close to the eye was nearly cyclostrophic in nature.

(4) JTWC originally dissipated TY 32W over land. JTWC then warned on what was thought to be another cyclone in the Bay of Bengal as TC 05B. Post analysis, however, concluded that TY 32W tracked into the Bay of Bengal and regenerated into a minimal tropical storm. Therefore, the cyclone designated as TC 05B was removed from JTWC records.

(5) No casualties or major damage were reported.

*Name assigned by RSMC Tokyo

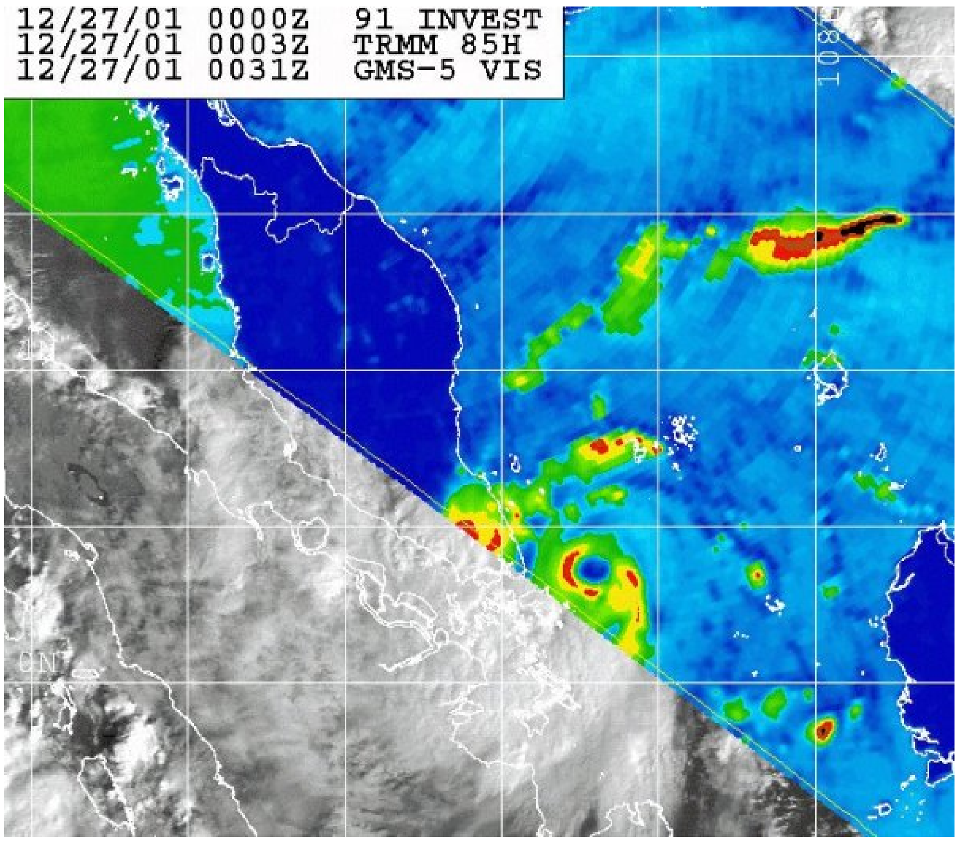


Figure 1-32W-1. 270003Z December 2001 85 GHz TRMM imagery revealed the well-defined eye feature of a midget system, TY 32W (Vamei). Visible and infrared imagery did not reveal the eye feature.

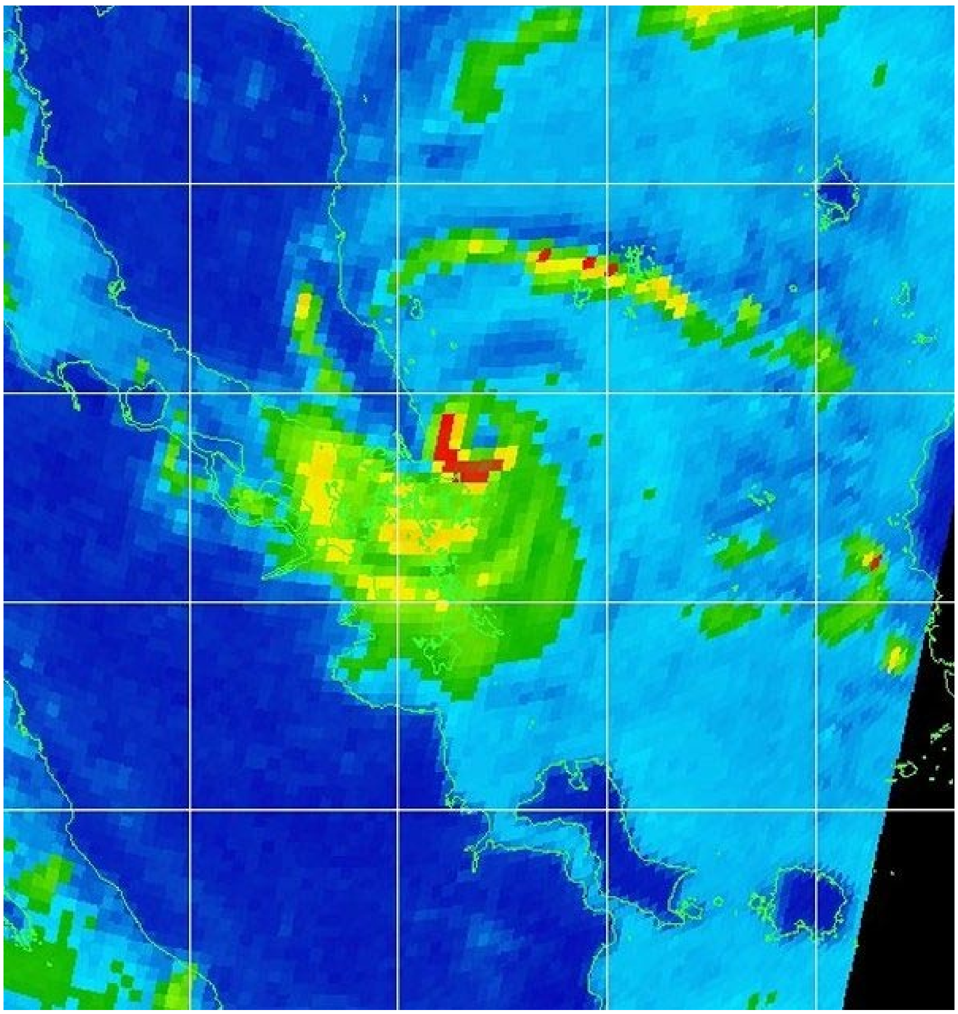


Figure 1-32W-2. 270220Z December 2001 SSM/I imagery of TY 32W (Vamei), just before landfall northeast of Singapore.

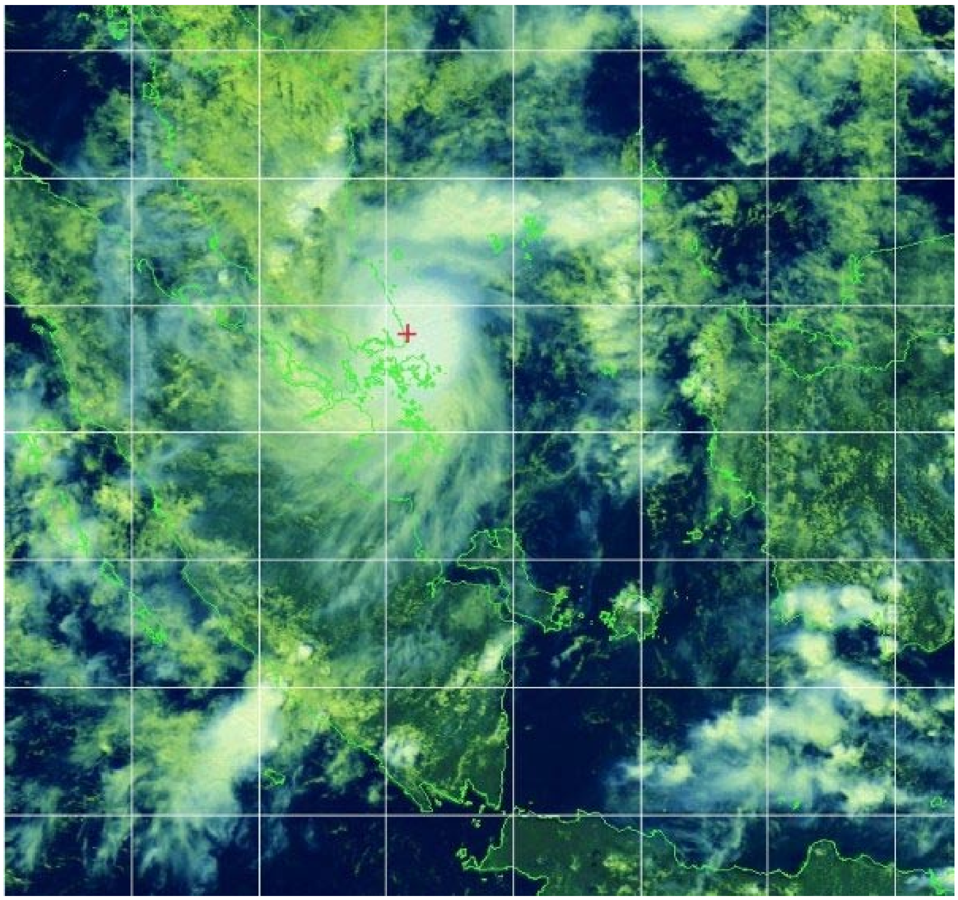


Figure 1-32W-3. 270530Z December 2001 Multispectral image of TY 32W (Vamei) located just east of the Malay Peninsula. Dvorak satellite intensity estimates were 55 knots, while naval ships recorded sustained surface winds of 70 knots with gusts to 105 knots near the center of the storm.

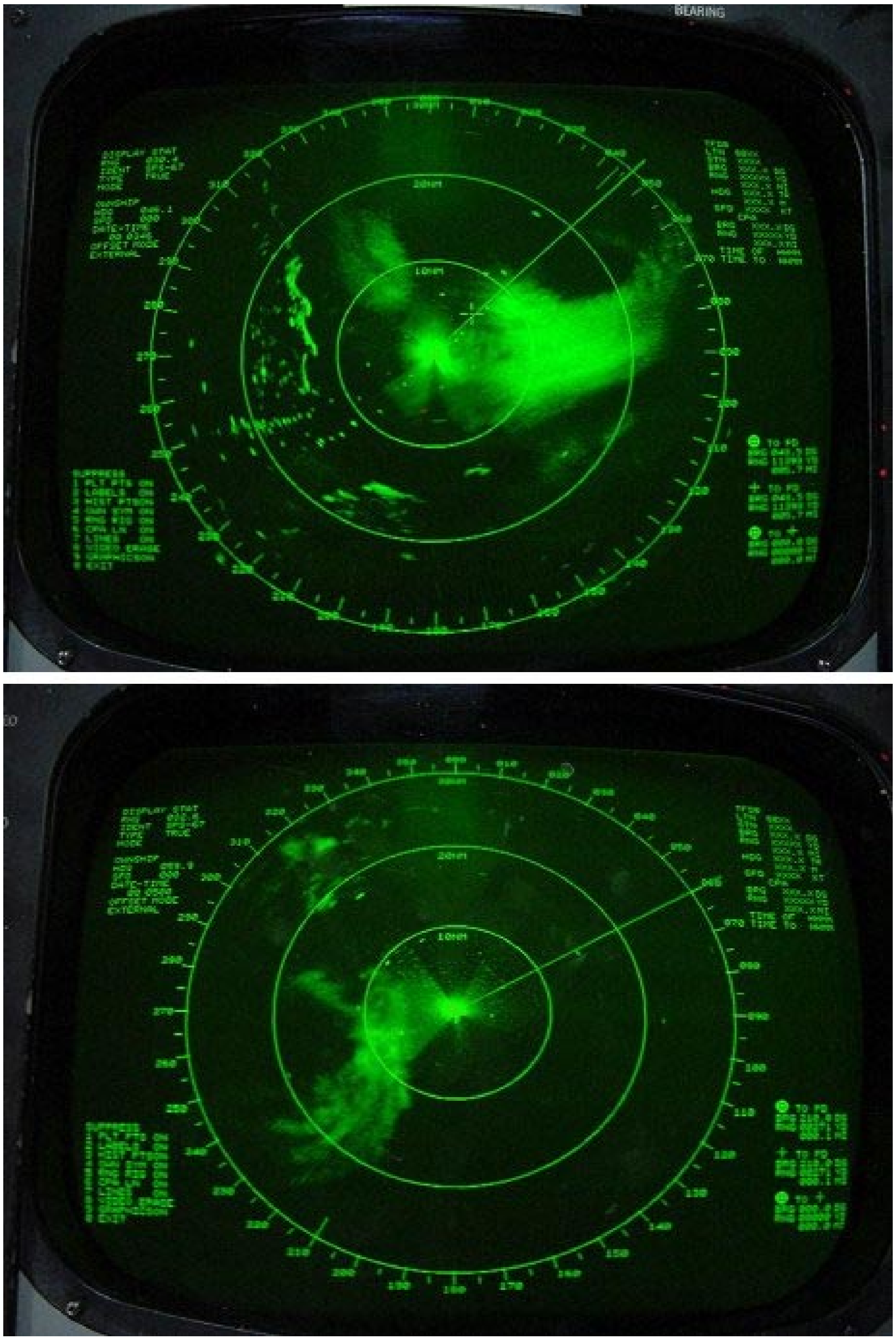


Fig1-32W-4. The top image is the radar depiction of the eye of TY 32W (Vamei) to the northeast of the USS Carl Vinson as the ship moved towards the storm center. The bottom image depicts the eye feature to the southwest of the USS Carl Vinson as the ship moved away from the tropical cyclone. The ships meteorologist indicated that the USS Carl Vinson passed south of the cyclone eyewall and had that feature (eyewall) continuously depicted on radar until the ship passed the center.

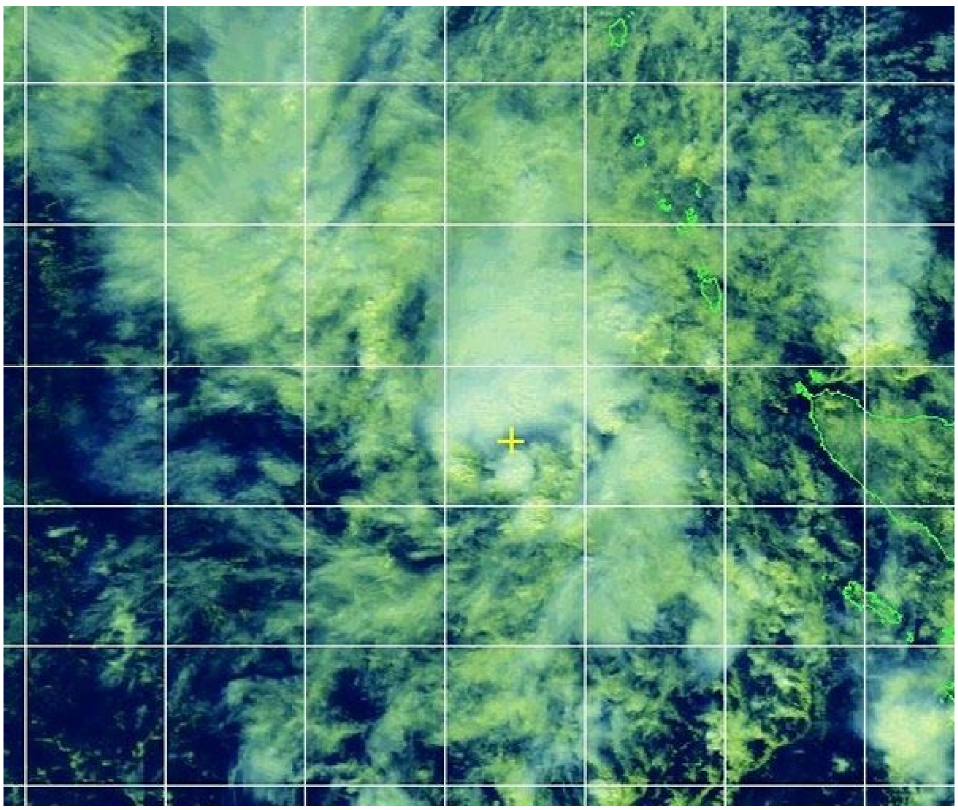
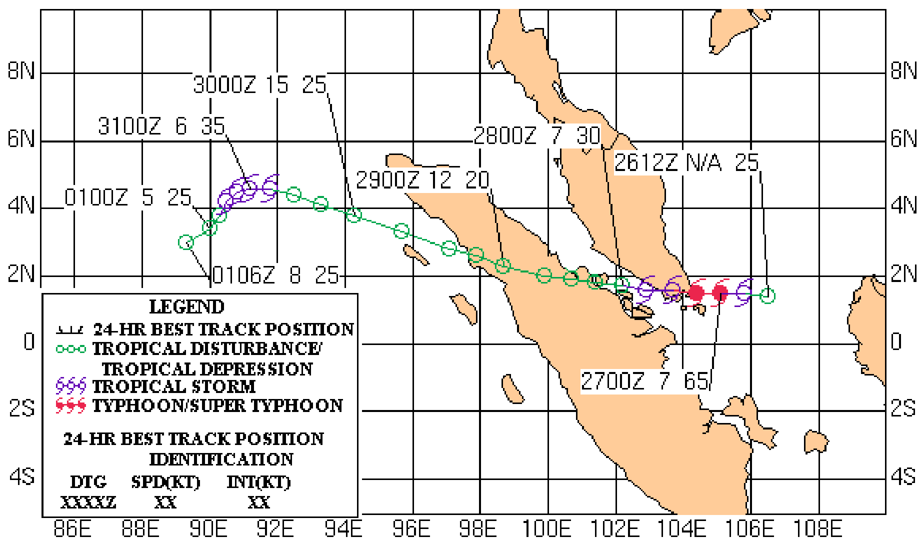


Figure 1-32W-5. 310530Z December 2001 multispectral image of TS 32W (Vamei) approximately 267 nm west of Sumatra with an estimated intensity of 35 knots. The system reintensified after transiting across Sumatra into the Bay of Bengal.

TYPHOON 32W (VAMEI)
27 - 31 DECEMBER 2001



Super Typhoon (STY) 33W (Faxai*)

First Poor : none

First Fair : none

First TCFA : none

First Warning : 0600Z 13 Dec 01

Last Warning : 1200Z 25 Dec 01

Max Intensity : 155 kts, gusts To 180 kts

Landfall : none

Total Warnings : 50

Remarks :

(1) Super Typhoon (STY) 33W (Faxai) was originally warned on as 31W, but after post-analysis, it was concluded that the circulation which developed into a super typhoon was separate from 31W. Therefore, STY Faxai, which originated southeast of TS 31W, was designated as 33W.

(2) STY 33W slowly developed just west of Kosrae on 13 December, and then remained quasi-stationary for nearly 5 days (13 to 18 December). This unusual event can be attributed to a series of factors including interaction with a shear line extending toward the system from the northeast, a relatively weak, thin low/mid level subtropical ridge line, and a series of westerly wind bursts.

(3) After 18 December, the system moved northwestward and intensified rapidly before recurving east of the Northern Mariana Islands chain.

*Name assigned by RSMC Tokyo

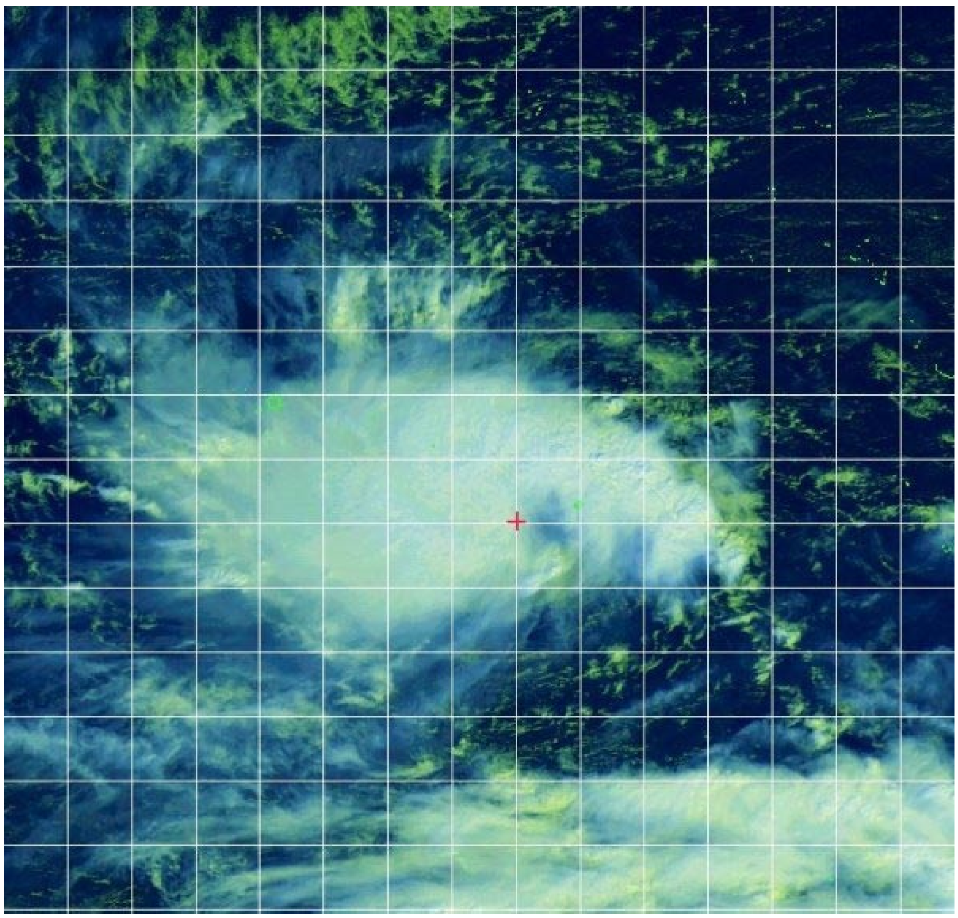


Figure 1-33W-1. 142330Z December 2001 multispectral image of STY (Faxai) 33W 51 nm southwest of Kosrae with an estimated intensity of 35 knots.

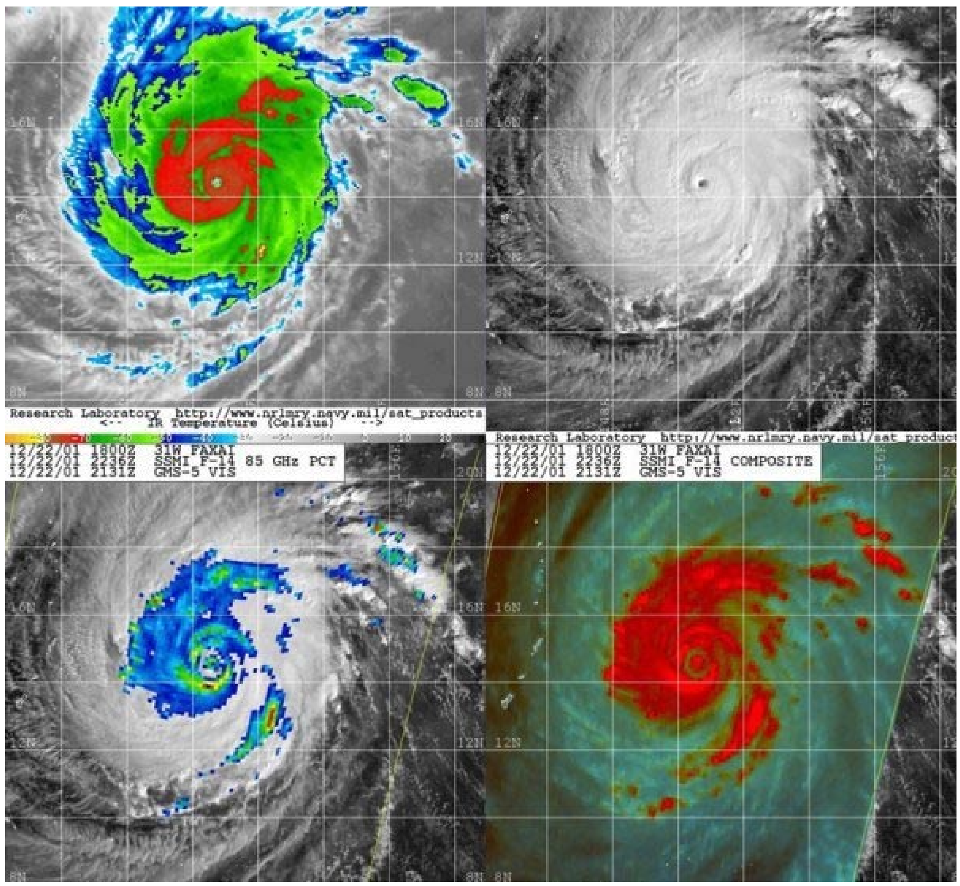


Figure 1-33W-2. 222236Z December 2001 composite imagery of STY 33W (Faxai) about 240 nm east of Saipan at its maximum intensity of 155 knots.

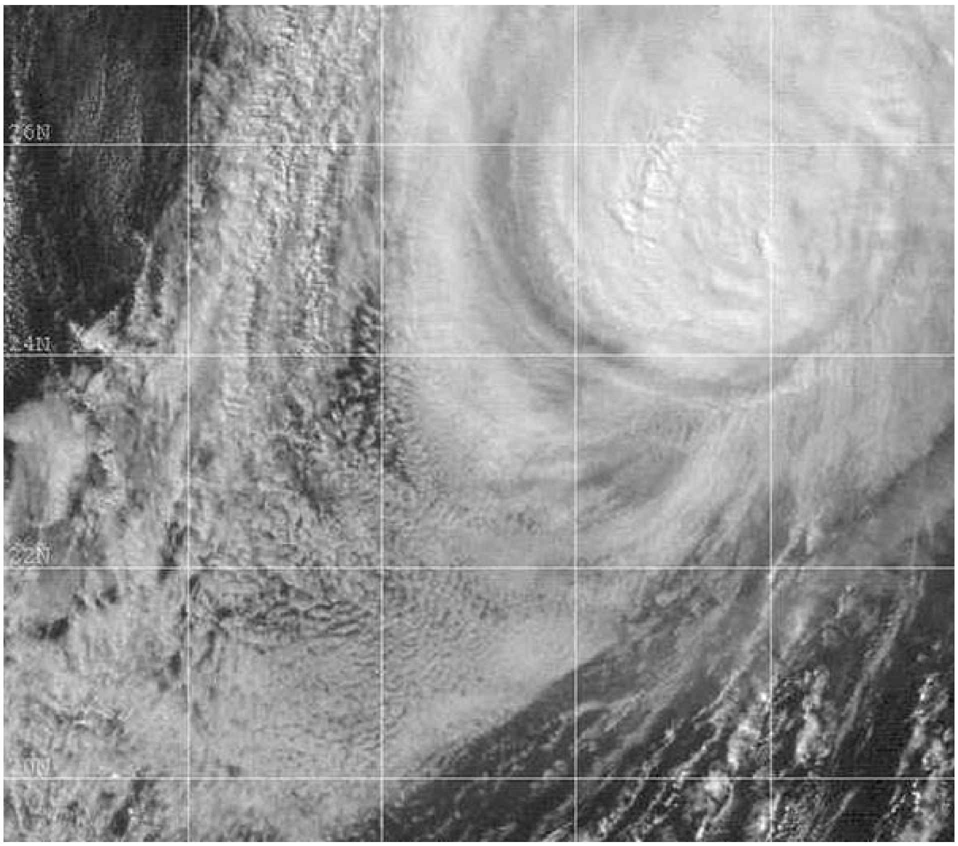
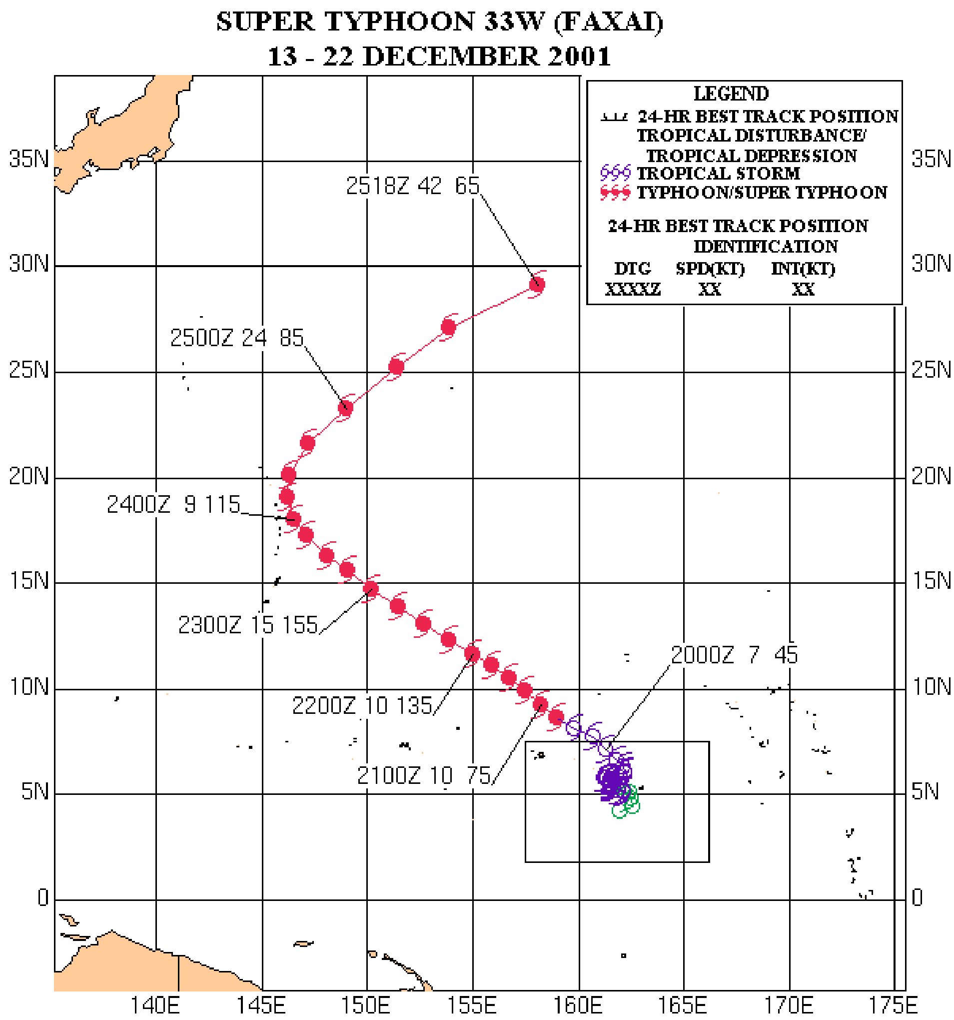
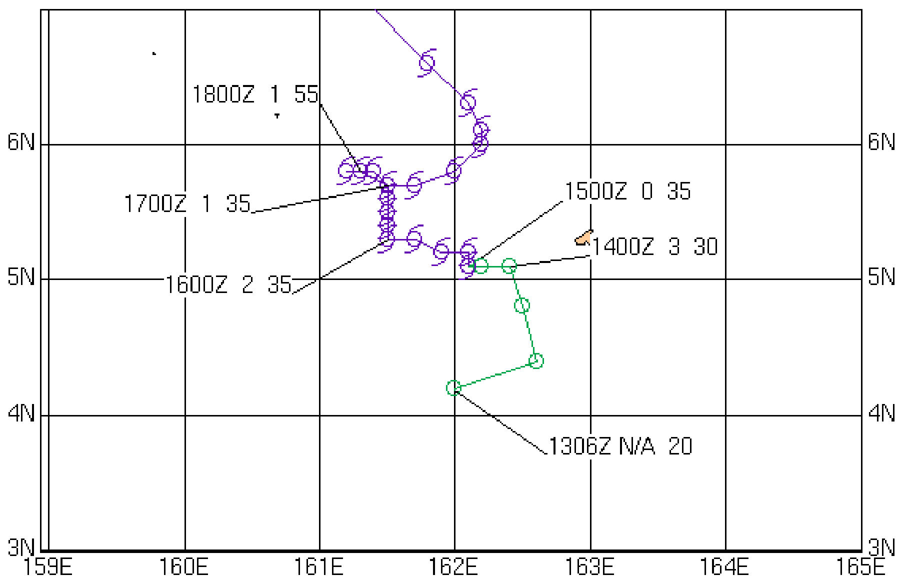


Figure 1-33W-3. 250531Z December 2001 visible image of STY 33W (Faxai) as it underwent extratropical transition. The low-level circulation center and associated convection remained well organized and intensity at this time was estimated at 75 knots.



See next page to view inset detail


1800Z 1 55
1700Z 1 35
1600Z 2 35
1500Z 0 35
1400Z 3 30
1306Z N/A 20
6N
5N
4N
3N
159E
160E
161E
162E
163E
164E
165E

Tropical Cyclone (TC) 01A

First Poor : 0130Z 18 May 01

First Fair : 1800Z 20 May 01

First TCFA : 0730Z 21 May 01

First Warning : 1800Z 21 May 01

Last Warning : 1800Z 28 May 01

Max Intensity : 110 kts, gusts to 135 kts

Landfall : Gujarat State, India

Total Warnings : 29

Remarks :

(1) Developed in eastern Arabian Sea, tracked east towards India before recurving northwest and attaining maximum intensity on 24 May. It did not affect India during this period.

(2) Proceeded to track north and weaken to tropical depression strength. Slightly reintensified while making landfall and quickly dissipated as it tracked inland.

(3) No casualties or damage were reported.

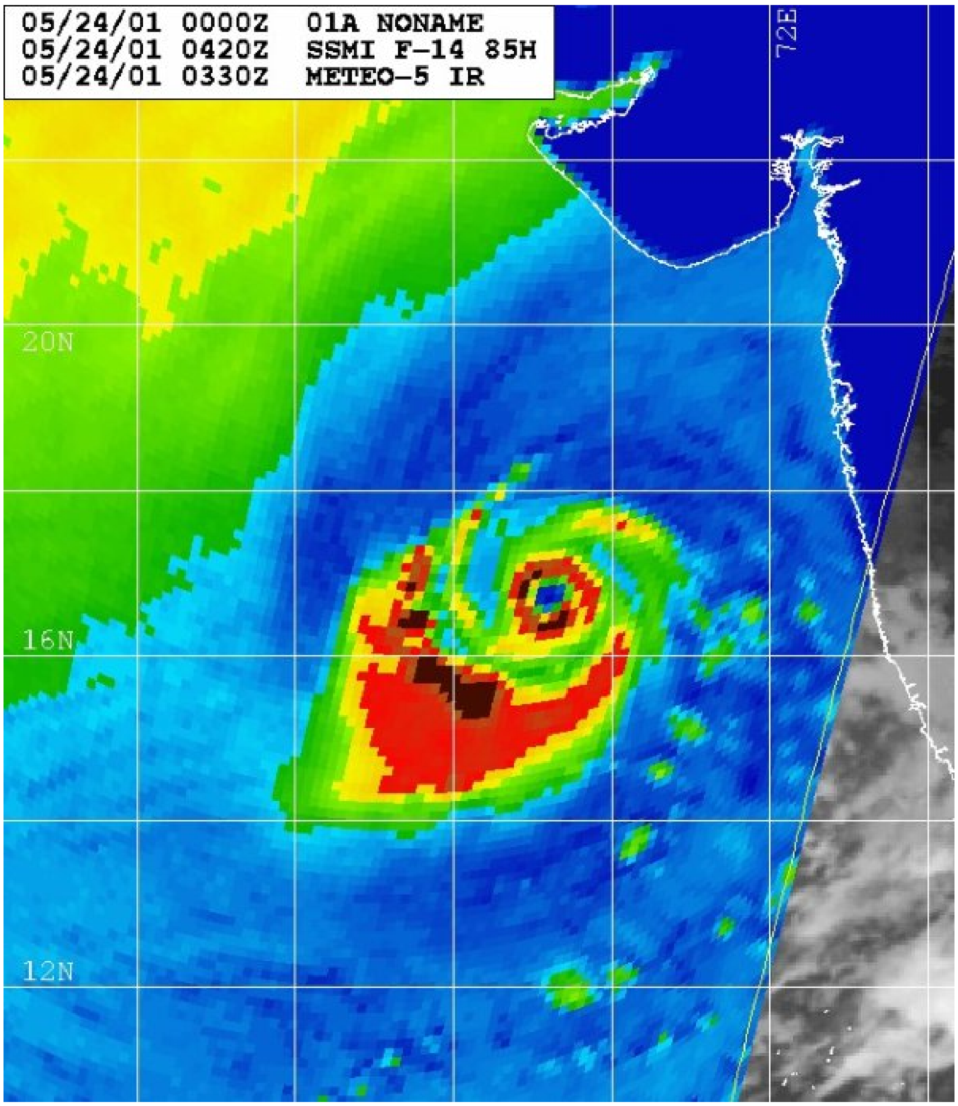


Figure 1-01A-1. 240420Z May 2001 85 GHz microwave satellite imagery of TC 01A 250 nm west-southwest of Bombay, India with an estimated intensity of 100 knots. Note the well-developed eyewall and banding feature in the southwest quadrant.

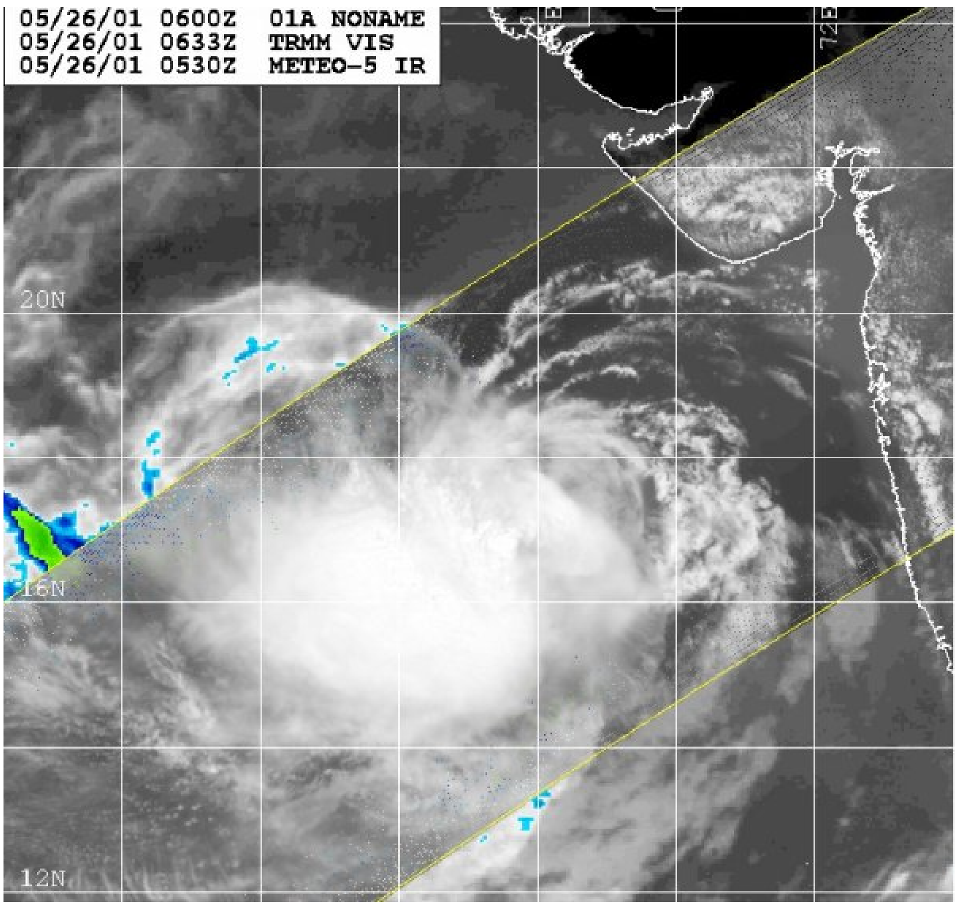
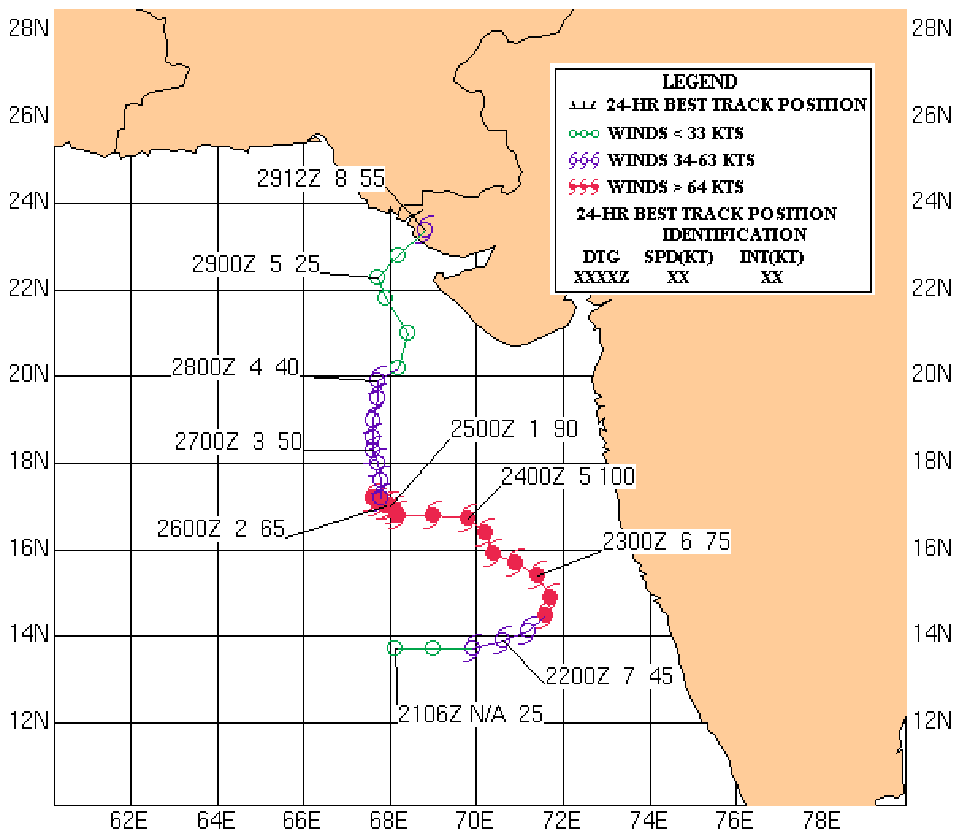


Figure 1-01A-2. 260633Z May 2001 TRMM visible satellite imagery of TC 01A about 300 nm west-southwest of Bombay, India with an estimated intensity of 60 knots. The low-level circulation was partially exposed with the deep convection displaced to the west.

TROPICAL CYCLONE 01A
21- 28 MAY 2001



Tropical Cyclone (TC) 02A

First Poor : None

First Fair : 0500Z 24 Sep 01

First TCFA : 1100Z 24 Sep 01

Second TCFA : 1100Z 25 Sep 01

First Warning : 0000Z 26 Sep 01

Last Warning : 1800Z 28 Sep 01

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 12

Remarks : None

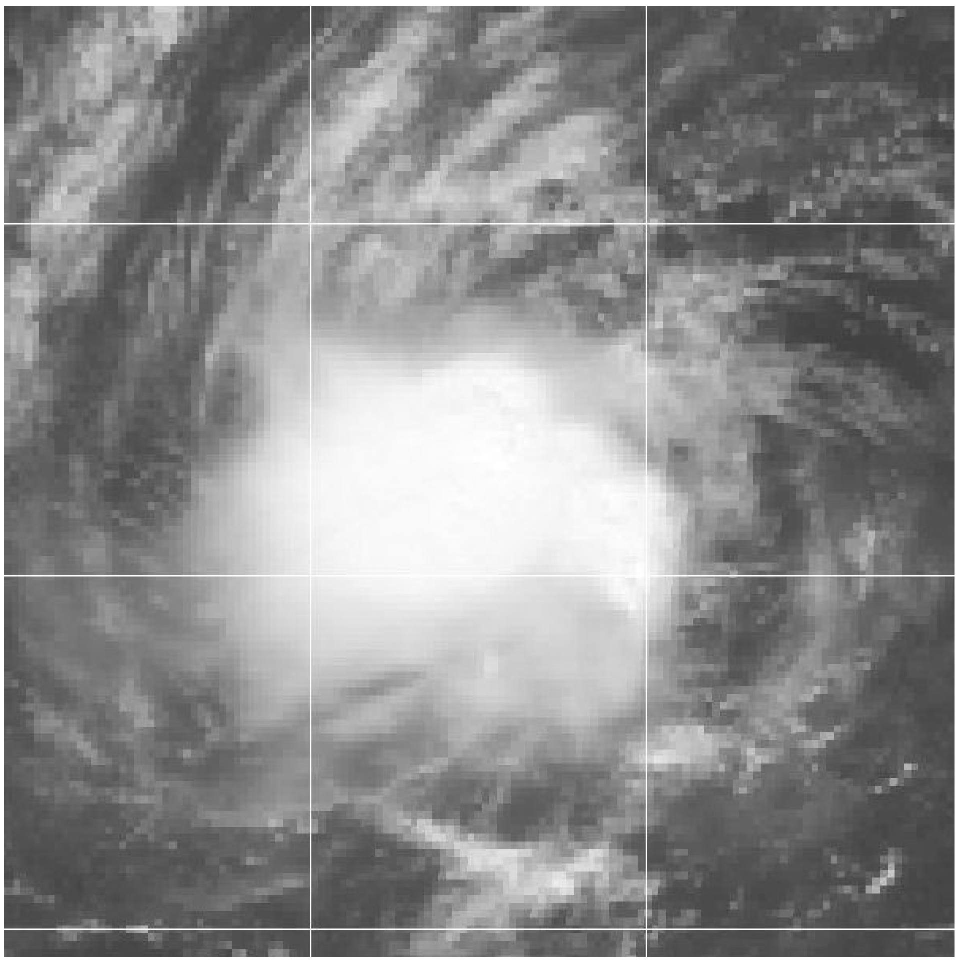
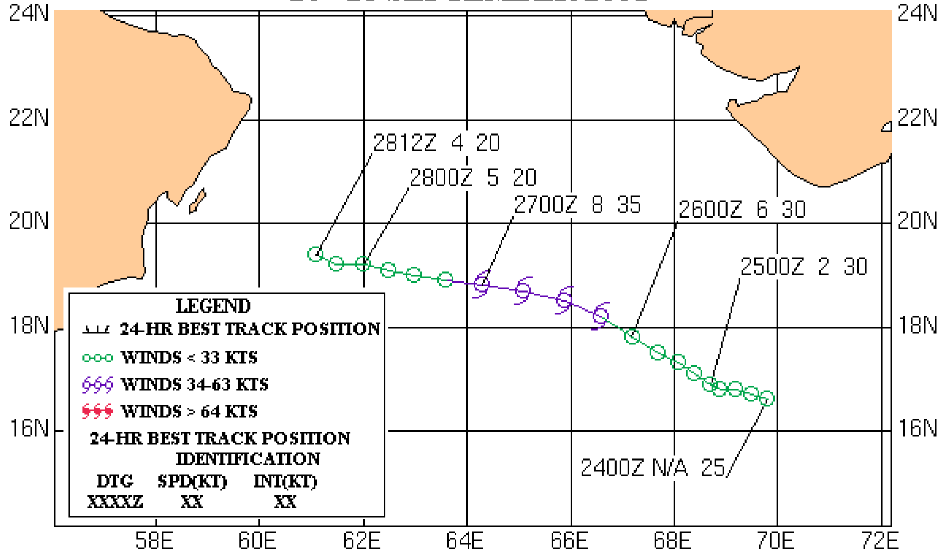


Figure 1-02A-1. 260830Z September 2001 Meteosat-5 visible imagery of TC 02A in the central Arabian Sea at its peak intensity of 35 knots.

TROPICAL CYCLONE 02A
26 - 28 SEPTEMBER 2001



Tropical Cyclone (TC) 03A

First Poor : 1130Z 07 Oct 01

First Fair : 0500Z 08 Oct 01

First TCFA : 0330Z 09 Oct 01

First Warning : 0600Z 09 Oct 01

Last Warning : 1200Z 10 Oct 01

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 6

Remarks : None

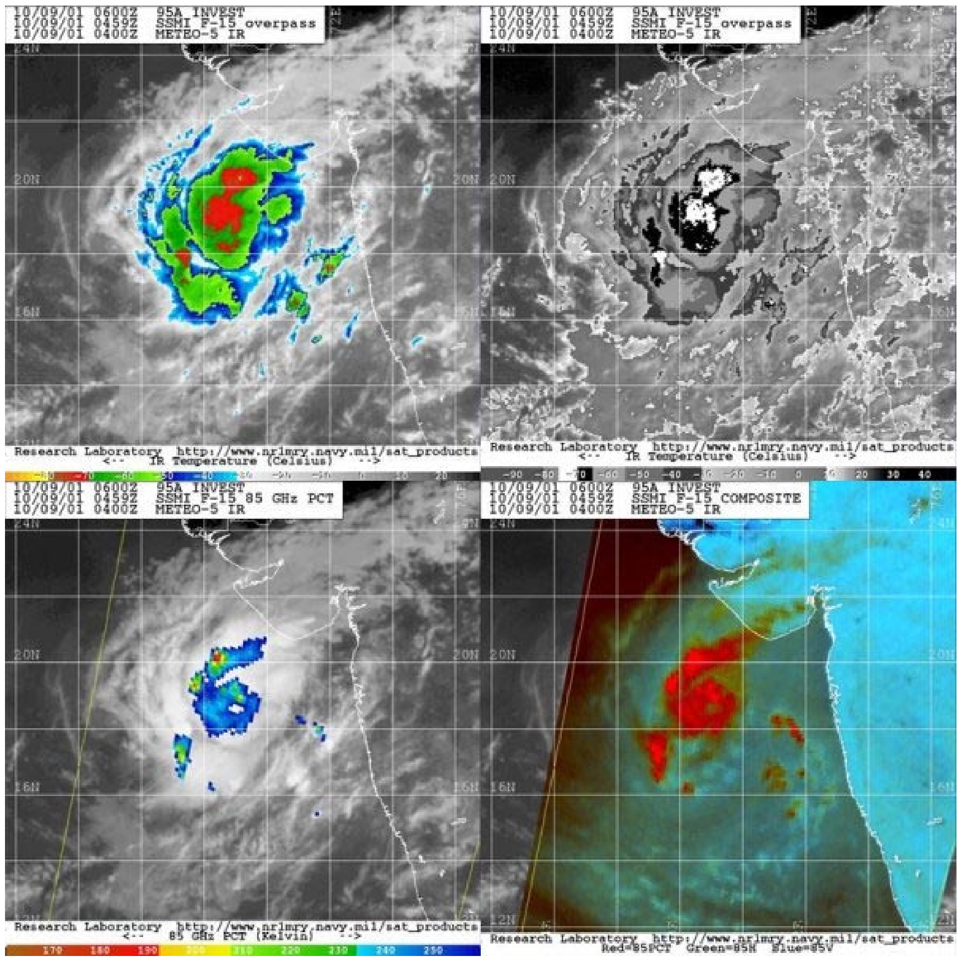
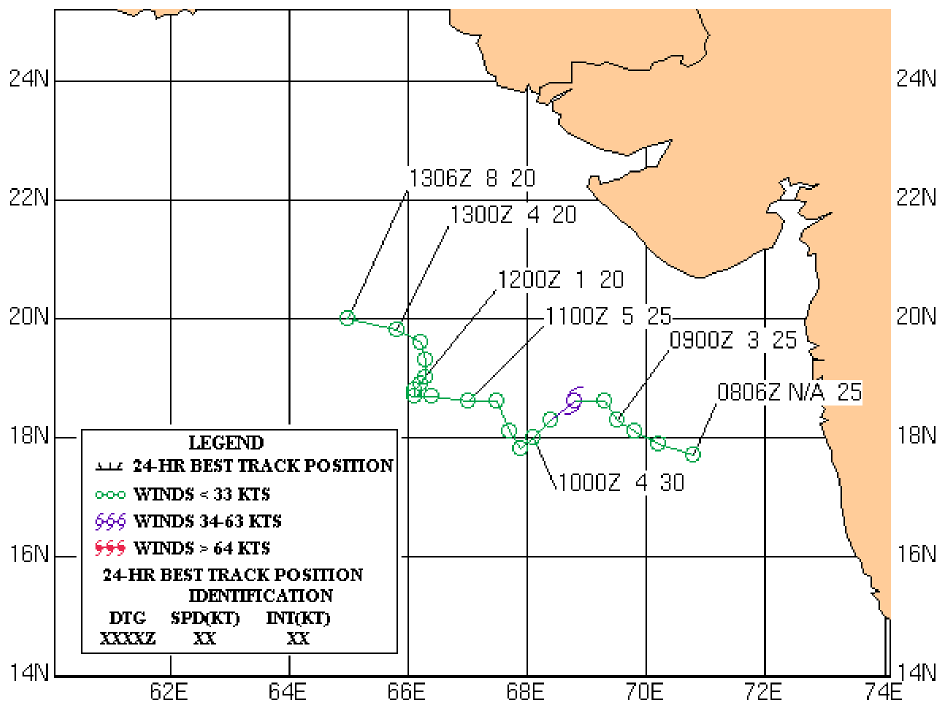


Figure 1-03A-1. 090459Z October 2001 enhanced infrared (top) and SSM/I 85 GHz (bottom) imagery of TC 03A approximately 200 nm west of India with an estimated intensity of 30 knots. Imagery shows the low-level circulation embedded in the deep convection.

TROPICAL CYCLONE 03A
09 - 10 OCTOBER 2001



Tropical Cyclone (TC) 04B

First Poor : 1800Z 06 Nov 01

First Fair : 0030Z 09 Nov 01

First TCFA : 1400Z 10 Nov 01

First Warning : 0000Z 11 Nov 01

Last Warning : 0000Z 12 Nov 01

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 3

Remarks : None

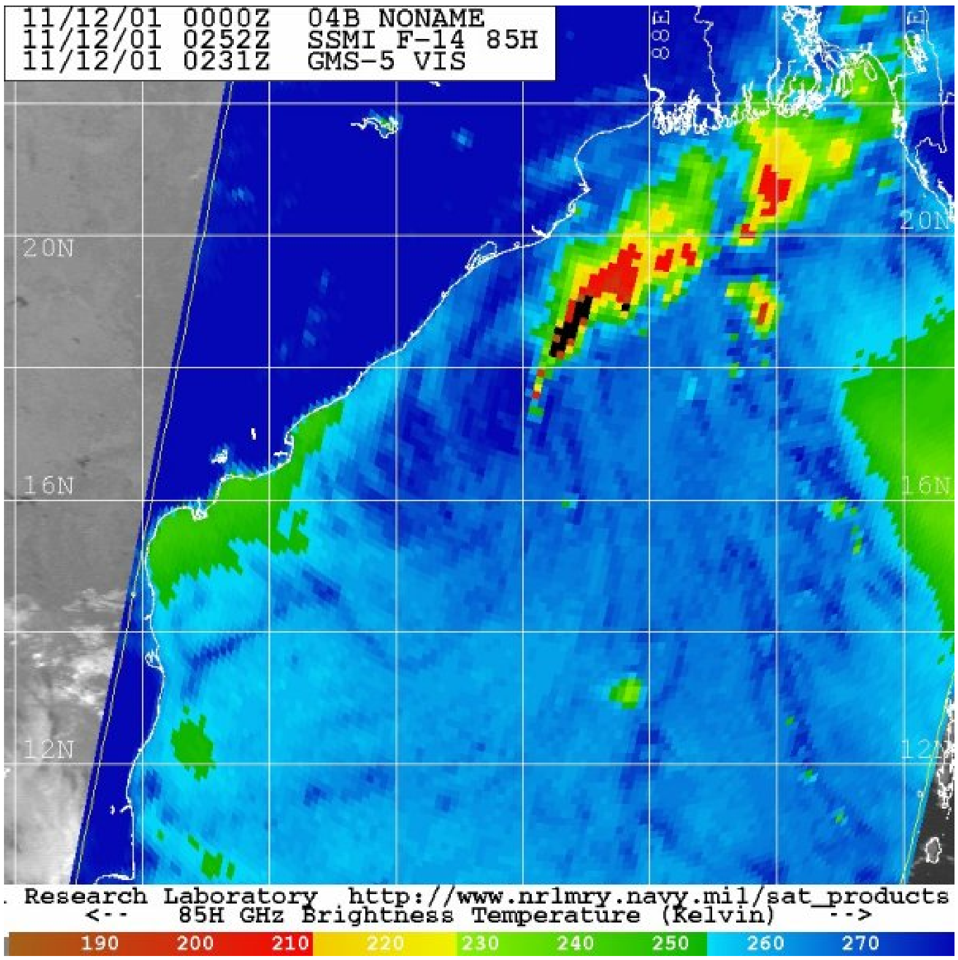
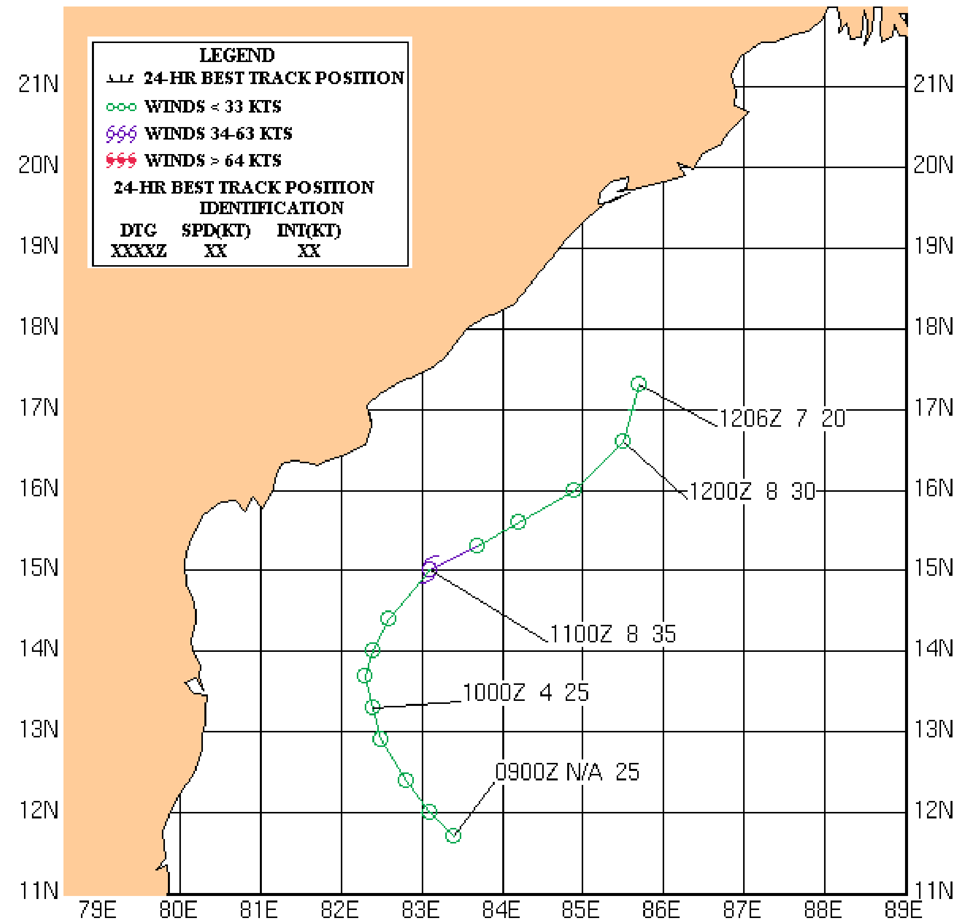


Figure 1-04B-1. 120252Z November 2001 SSM/I 85 GHz image of TC 04B about 125 nm east of India with an exposed low-level circulation center and an estimated intensity of 30 knots.

TROPICAL CYCLONE 04B
11 - 12 NOVEMBER 2001



2. SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

2.1 GENERAL

In accordance with CINCPACINST 3140.1 (series), Southern Hemisphere tropical cyclones are numbered sequentially from 01 July through 30 June to reflect the Southern Hemisphere tropical season.

For warning message delineation, the Southern Hemisphere Area of Responsibility (AOR) is divided into two basins: the South Indian (west of 135 East longitude) and the South Pacific Ocean (east of 135 East longitude). The suffixes "S" (South Indian Ocean) and "P" (South Pacific Ocean) are appended to the tropical cyclone number to differentiate warnings for these basins. For this report, the Southern Hemisphere AOR is broken down into three sub-basins, reflecting primary cyclogenesis areas: South Indian (west of 105 East longitude), Australia (105 East longitude to 165 East longitude), and South Pacific (east of 165 East longitude).

2.2 SUMMARY

Table 2-1 lists the significant tropical cyclones during the 2000 season and can be compared to the climatological mean presented in Table 2-2. Table 2-3 compares this year's tropical cyclone activity in the Southern Hemisphere sub-basins to previous years and climatology. Composites of the tropical cyclone best tracks for the Southern Hemisphere appear following Table 2-3.

Table 2-1 SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2001 (01 JULY 2000 - 30 JUNE 2001)

TC	NAME	PERIOD	NUMBER ISSUED	EST MAX SFC WINDS KTS (M/SEC)	MSLP (MB)**
01S	-	01 Aug 03 Aug	8	35 (18)	997
02S	-	12 Nov 13 Nov	3	35 (18)	997
03S	Sam	05 Dec 09 Dec	10	110 (57)	933
04S	Ando	02 Jan 11 Jan	16	120 (62)	922
05S	Bindu	07 Jan 16 Jan	19	100 (51)	944
06S	Charly	19 Jan 25 Jan	13	105 (54)	938
07S	Terri	29 Jan 31 Jan	6	45 (23)	991
08P	Winsome	10 Feb 11 Feb	4	40 (21)	994
09S	Vincent	12 Feb 15 Feb	8	35 (18)	997
10P	-	17 Feb 18 Feb	3	35 (18)	997
11P	Oma	20 Feb 22 Feb	4	45 (23)	991
12P	Abigail	25 Feb 27 Feb	4	60 (31)	980
13P	Paula	26 Feb 04 Mar	13	105 (54)	938

Table 2-1 SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2001 (01 JULY 2000 - 30 JUNE 2001)

14P	Rita	01 Mar	05 Mar	8	40 (21)	994
15S	Dera	09 Mar	13 Mar	9	90 (46)	954
16S	-	02 Apr	05 Apr	7	35 (18)	997
17S	Walter	03 Apr	07 Apr	10	85 (44)	958
18S	Evariste	03 Apr	08 Apr	11	75 (39)	967
19P	Sose	05 Apr	11 Apr	12	70 (35)	976
20S	Alistair	16 Apr	21 Apr	19	65 (33)	976
21S	-	21 Jun	23 Jun	4	65 (33)	991
		TOTAL		191		

**MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

Table 2-2 DISTRIBUTION OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES FOR 1958 - 2001

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTALS
1958-1977 AVE*	-	-	-	0.4	1.5	3.6	6.1	5.8	4.7	2.1	0.5	-	24.7
1981	0	0	0	1	3	2	6	5	3	3	1	0	24
1982	1	0	0	1	1	3	9	4	2	3	1	0	25
1983	1	0	0	1	1	3	5	6	3	5	0	0	25
1984	1	0	0	1	2	5	5	10	4	2	0	0	30
1985	0	0	0	0	1	7	9	9	6	3	0	0	35
1986	0	0	1	0	1	1	9	9	6	4	2	0	33
1987	0	1	0	0	1	3	6	8	3	4	1	1	28
1988	0	0	0	0	2	3	5	5	3	1	2	0	21
1989	0	0	0	0	2	1	5	8	6	4	2	0	28
1990	2	0	1	1	2	2	4	4	10	2	1	0	29
1991	0	0	1	1	1	3	2	5	5	2	1	1	22
1992	0	0	1	1	2	5	4	11	3	2	1	0	30
1993	0	0	1	1	0	5	7	7	2	2	2	0	27
1994	0	0	0	0	2	4	8	4	9	3	0	0	30
1995	0	0	0	0	2	2	5	4	5	4	0	0	22
1996	0	0	0	0	1	3	7	6	6	4	1	0	28
1997	1	1	1	2	2	6	9	8	3	1	3	1	38
1998	1	0	0	3	2	3	7	9	6	6	0	0	37
1999	1	0	1	1	1	6	6	8	7	2	0	0	33
2000	0	0	0	0	0	3	6	5	7	6	0	0	27
2001	0	1	0	0	1	1	4	6	2	5	0	1	21
(1981-2001)													
MEAN	0.4	0.1	0.3	0.7	1.4	3.4	6.1	6.7	4.8	3.2	0.9	0.2	28.2
CASES	8	3	7	14	30	71	128	141	101	68	18	4	593

* (GRAY, 1978)

The criteria used in TABLE 2-2 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.

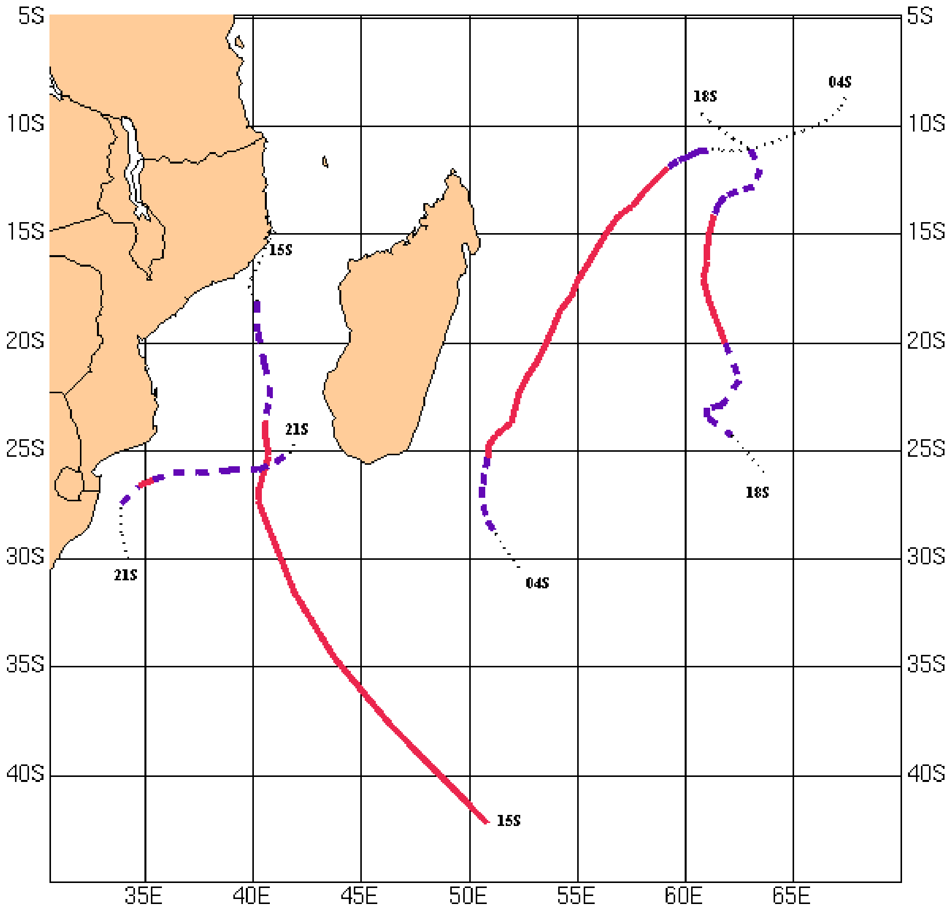
Table 2-2 DISTRIBUTION OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES FOR 1958 - 2001

2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.

3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

Table 2-3 ANNUAL VARIATION OF SOUTHERN HEMISPHERE TROPICAL CYCLONE BY OCEAN BASIN

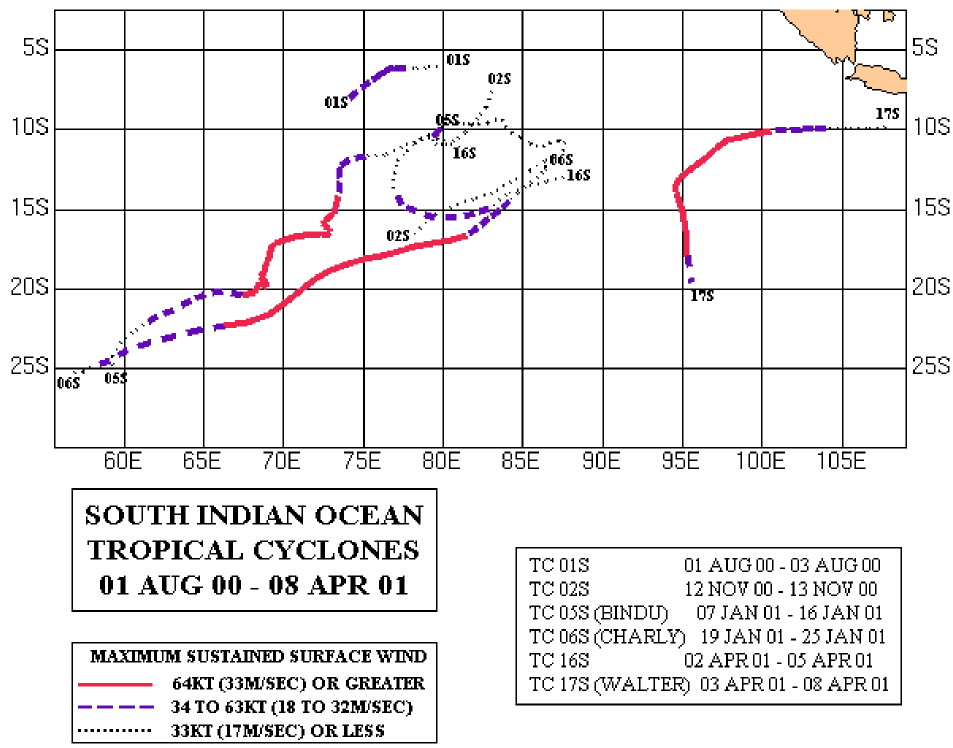
YEAR	SOUTH INDIAN	AUSTRALIAN	SOUTH PACIFIC	
	(WEST OF 105E)	(105E - 165E)	(EAST OF 165E)	TOTAL
1958-1977 AVERAGE*	8.4	10.3	5.9	24.6
1981	13	8	3	24
1982	12	11	2	25
1983	7	6	12	25
1984	14	14	2	30
1985	14	15	6	35
1986	14	16	3	33
1987	9	8	11	28
1988	14	2	5	21
1989	12	9	7	28
1990	18	8	3	29
1991	11	10	1	22
1992	11	6	13	30
1993	10	16	1	27
1994	16	10	4	30
1995	11	7	4	22
1996	13	11	4	28
1997	17	5	16	38
1998	12	10	15	37
1999	13	16	4	33
2000	10	12	5	27
2001	10	8	3	21
(1981-2001)				
TOTAL	261	208	124	594
AVERAGE	12.4	9.9	5.9	28.3
* (Gray,1978)				

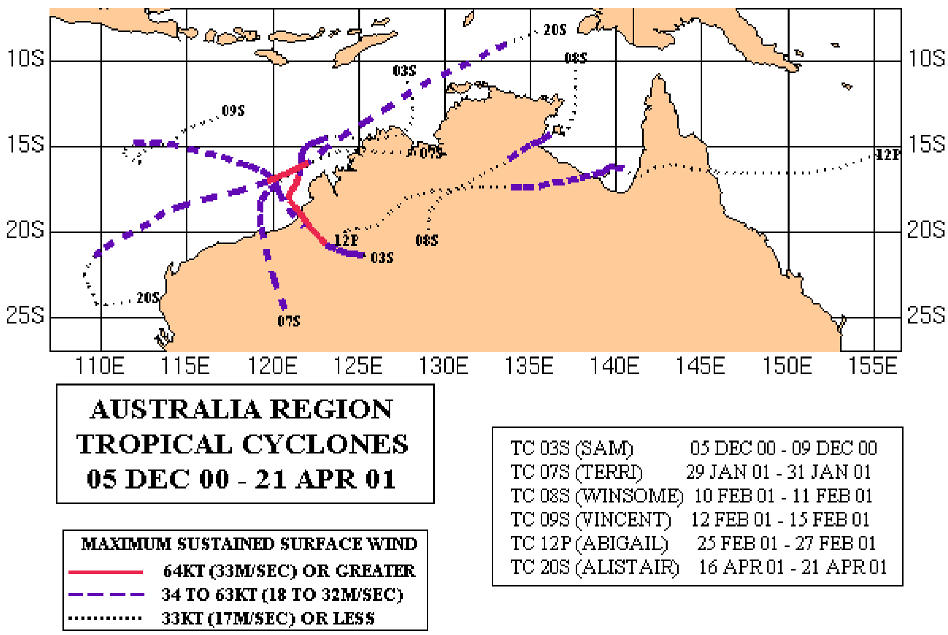


SOUTH INDIAN OCEAN TROPICAL CYCLONES 02 JAN 01 - 23 JUN 01

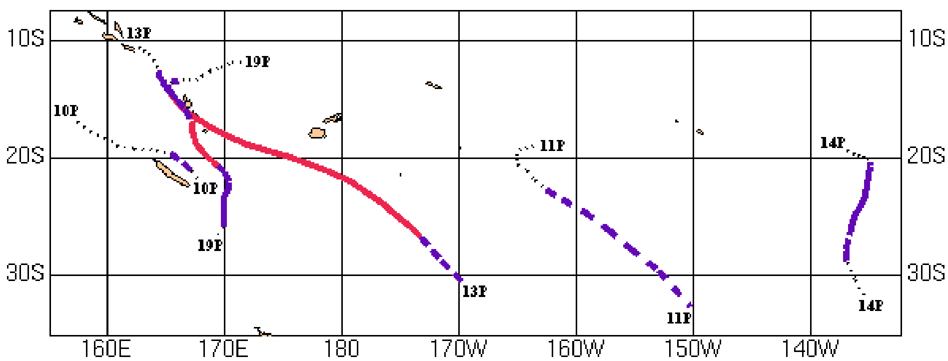
MAXIMUM SUSTAINED SURFACE WIND
- **64KT (33M/SEC) OR GREATER**
- **34 TO 63KT (18 TO 32M/SEC)**
- **33KT (17M/SEC) OR LESS**

TC 04S (ANDO)	02 JAN 01 - 10 JAN 01
TC 15S (DERA)	09 MAR 01 - 13 MAR 01
TC 18S (EVARISTE)	03 APR 01 - 08 APR 01
TC 21S	21 JUN 01 - 23 JUN 01


SOUTH INDIAN OCEAN
TROPICAL CYCLONES
01 AUG 00 - 08 APR 01
MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS
TC 01S 01 AUG 00 - 03 AUG 00
TC 02S 12 NOV 00 - 13 NOV 00
TC 05S (BINDU) 07 JAN 01 - 16 JAN 01
TC 06S (CHARLY) 19 JAN 01 - 25 JAN 01
TC 16S 02 APR 01 - 05 APR 01
TC 17S (WALTER) 03 APR 01 - 08 APR 01
5S
10S
15S
20S
25S
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
01S
02S
05S
06S
16S
17S



AUSTRALIA REGION
TROPICAL CYCLONES
05 DEC 00 - 21 APR 01
MAXIMUM SUSTAINED SURFACE WIND
64KT (33M/SEC) OR GREATER
34 TO 63KT (18 TO 32M/SEC)
33KT (17M/SEC) OR LESS
TC 03S (SAM) 05 DEC 00 - 09 DEC 00
TC 07S (TERRI) 29 JAN 01 - 31 JAN 01
TC 08S (WINSOME) 10 FEB 01 - 11 FEB 01
TC 09S (VINCENT) 12 FEB 01 - 15 FEB 01
TC 12P (ABIGAIL) 25 FEB 01 - 27 FEB 01
TC 20S (ALISTAIR) 16 APR 01 - 21 APR 01
10S
15S
20S
25S
110E
115E
120E
125E
130E
135E
140E
145E
150E
155E
03S
07S
08S
09S
12P
20S



SOUTH PACIFIC OCEAN TROPICAL CYCLONES 17 FEB 01 - 11 APR 01

TC 10P	17 FEB 01 - 18 FEB 01
TC 11P (OMA)	20 FEB 01 - 27 FEB 01
TC 13P (PAULA)	26 FEB 01 - 04 MAR 01
TC 14P (RITA)	01 MAR 01 - 03 MAR 01
TC 19P (SOSE)	05 APR 01 - 11 APR 01

MAXIMUM SUSTAINED SURFACE WIND

- 64KT (33M/SEC) OR GREATER
- 34 TO 63KT (18 TO 32M/SEC)
- 33KT (17M/SEC) OR LESS

2.3 SUMMARY OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

Tropical Cyclone (TC) 01S

First Poor : None

First Fair : 0400Z 01 Aug 00

First TCFA : None

First Warning : 1800Z 01 Aug 00

Last Warning : 1200Z 03 Aug 00

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 8

Remarks : None

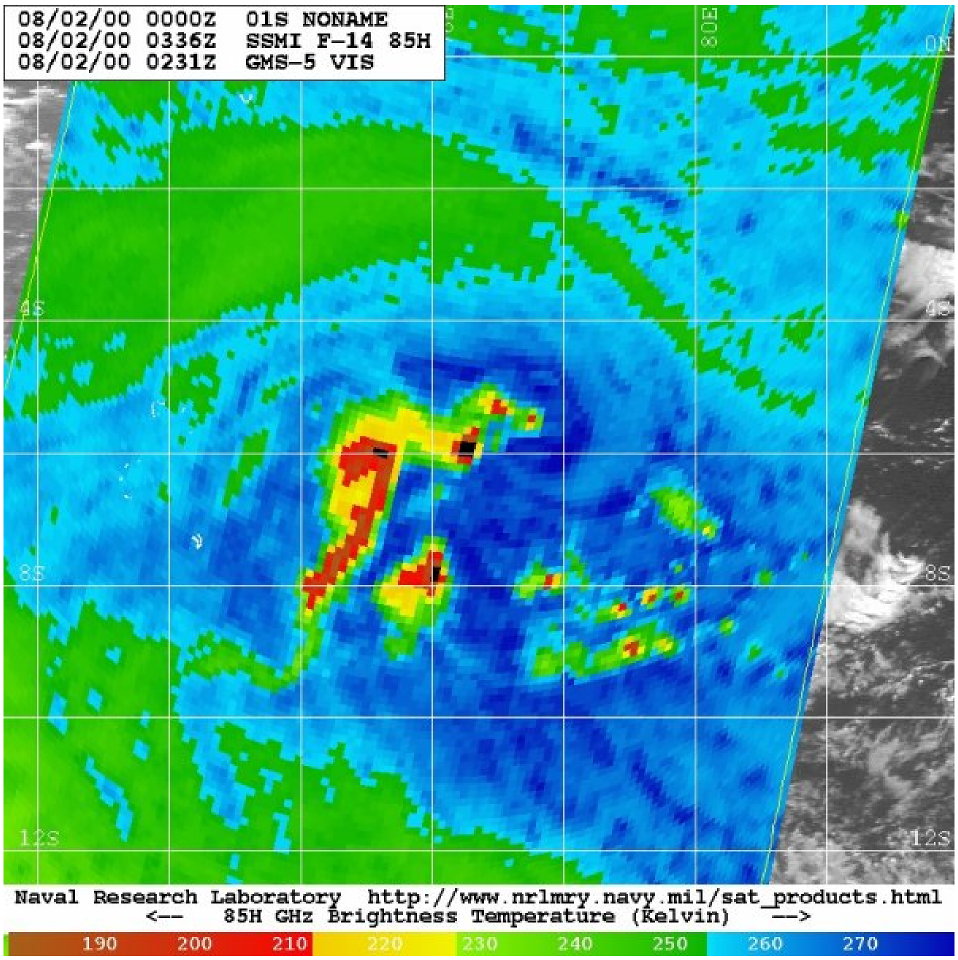
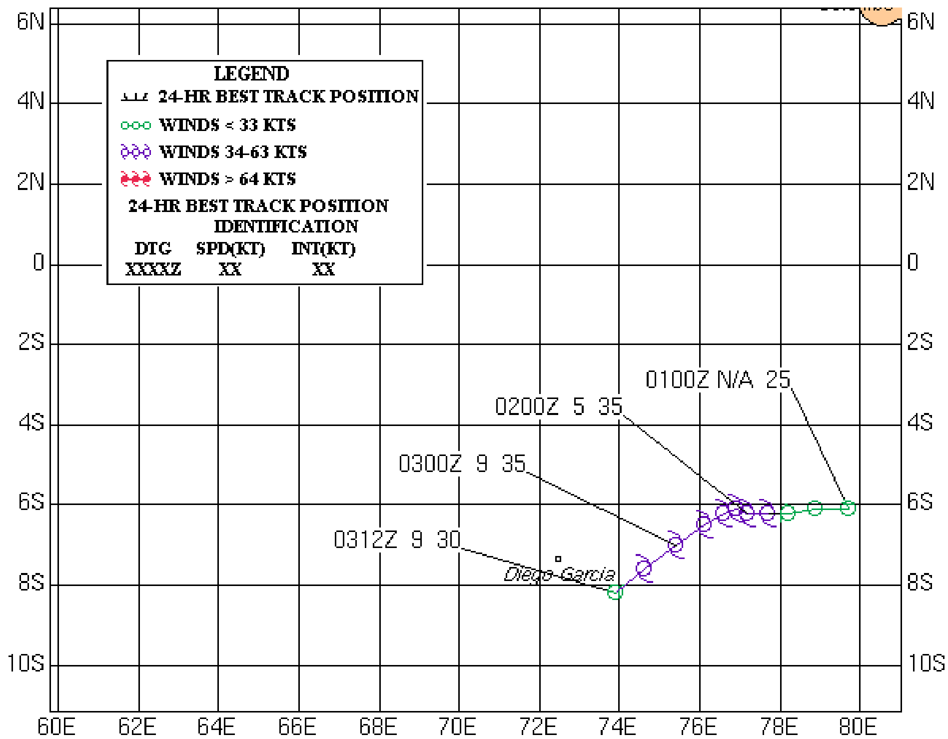


Figure 2-01S-1. 020336Z August 2000 85 GHz microwave satellite imagery of TC 01S, located east of Diego Garcia. At this time, the system is at peak intensity of 35 knots.

TROPICAL CYCLONE 01S
01-03 AUGUST 2000



Tropical Cyclone (TC) 02S

First Poor : 0500Z 09 Nov 00

First Fair : 0900Z 10 Nov 00

First TCFA : 0800Z 11 Nov 00

First Warning : 0000Z 12 Nov 00

Last Warning : 0000Z 13 Nov 00

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 3

Remarks : None

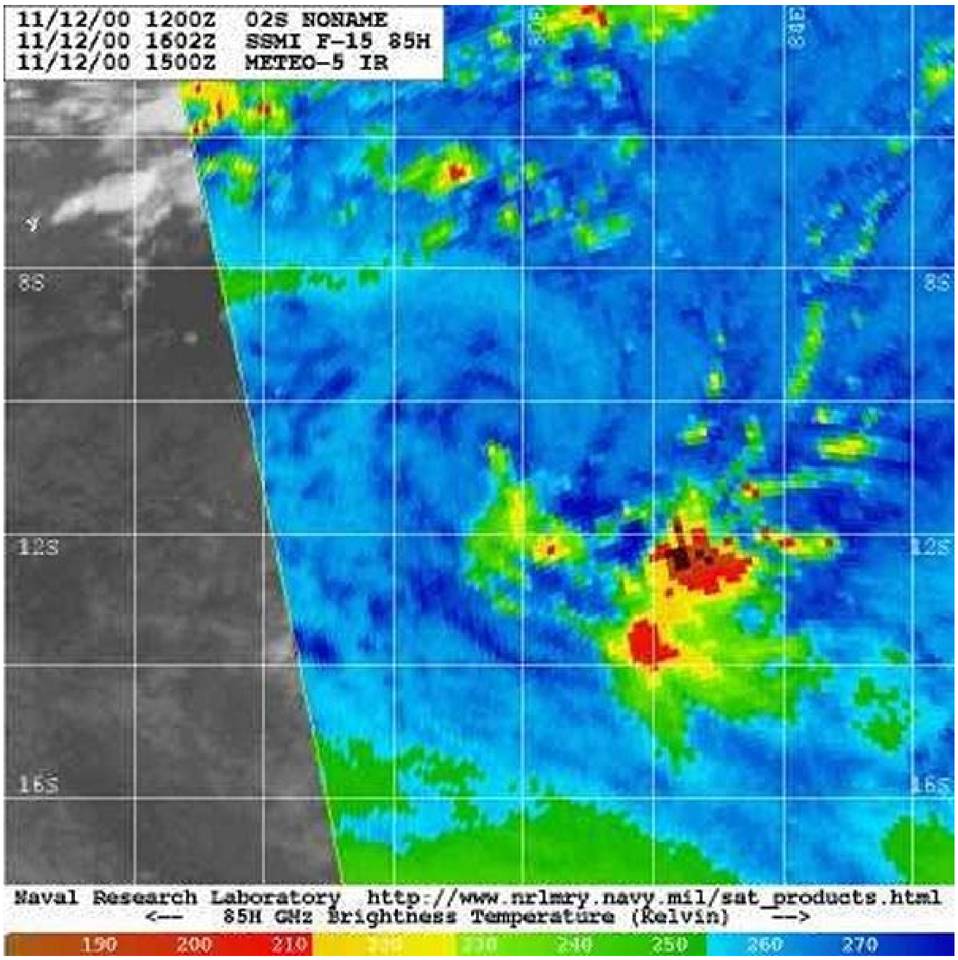
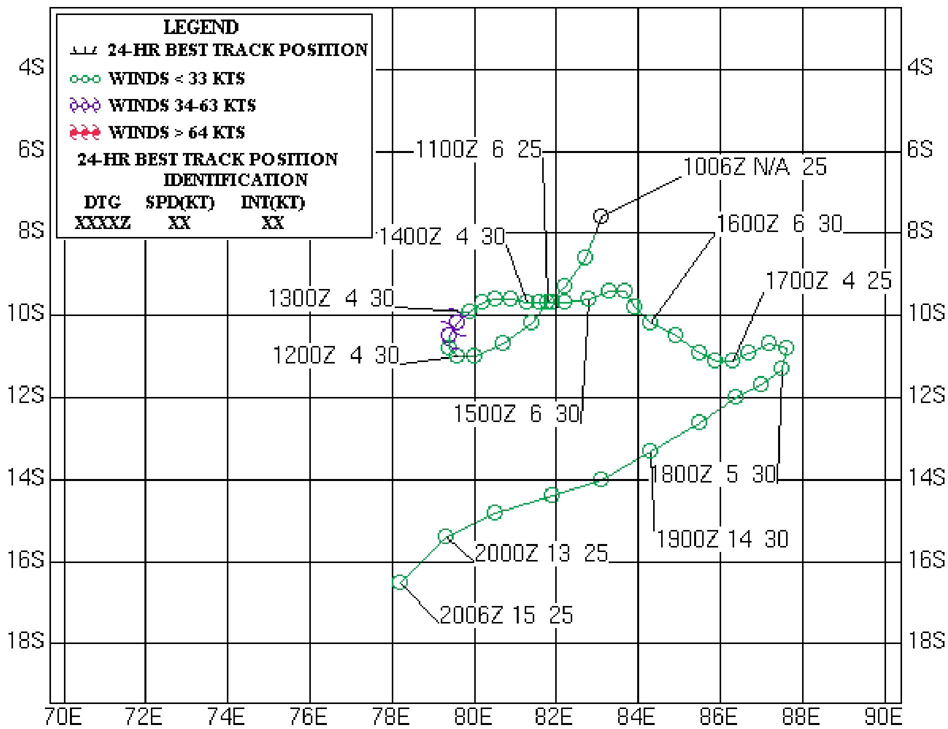


Figure 2-02S-1. 121600Z November 2000 microwave image of TC 02S, located east of Diego Garcia. At this time, the system has a peak intensity of 35 knots. The effects of vertical wind shear are evident in this image, showing the convection sheared to the southeast of the circulation center.

TROPICAL CYCLONE 02S
12-13 NOVEMBER 2000



Tropical Cyclone (TC) 03S (Sam*)

First Poor : 0300Z 01 Dec 00

First Fair : 1800Z 03 Dec 00

First TCFA : 1700Z 04 Dec 00

First Warning : 0000Z 05 Dec 00

Last Warning : 0600Z 09 Dec 00

Max Intensity : 110 kts, gusts to 135 kts

Landfall : 2300Z 03 Dec 00 near Cape Talbot; 1300Z 08 Dec 00 near Lagrange

Total Warnings : 10

Remarks : None

* Name assigned by Perth TCWC

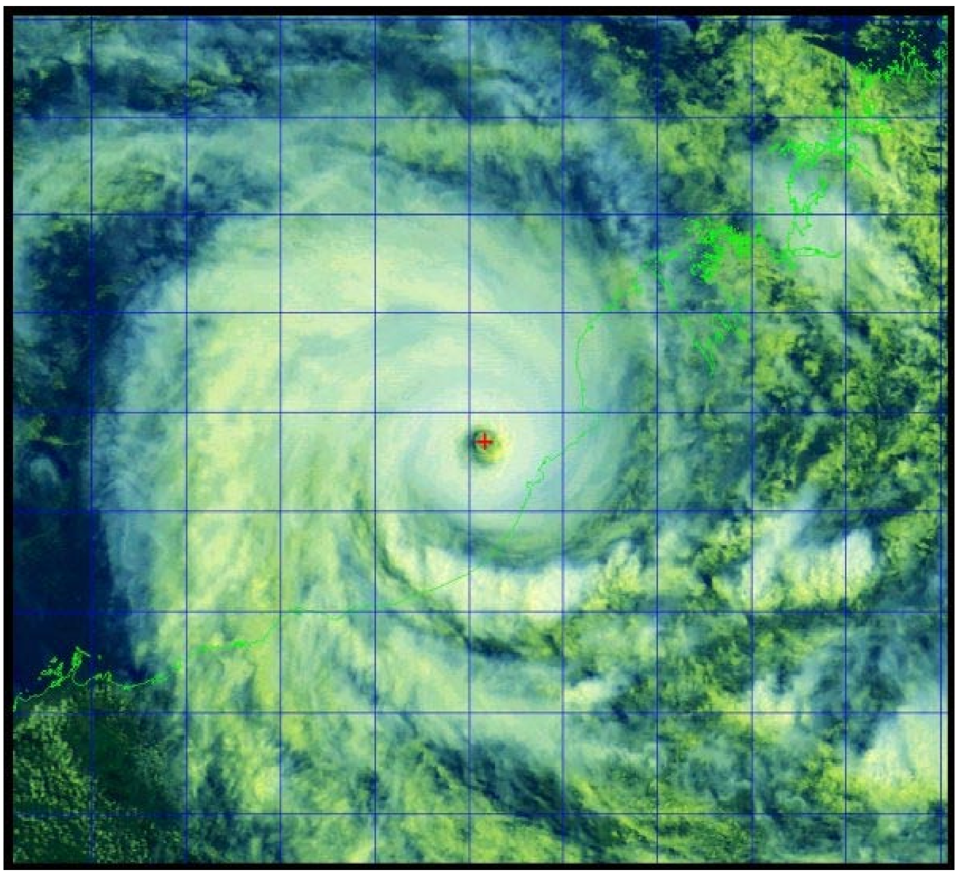
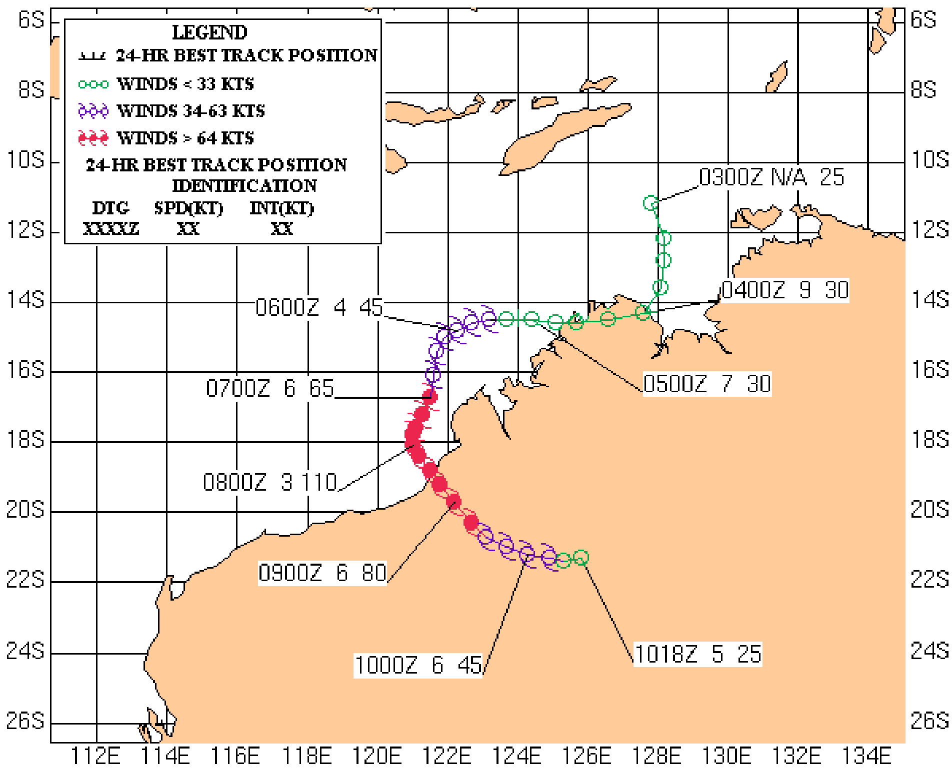


Figure 2-03S-1. 080530Z December 2000 multi-spectral satellite imagery of TC 03S (Sam), located near the Kimberly Coast of Western Australia. At this time, the system has a maximum intensity of 110 knots.

TROPICAL CYCLONE 03S (SAM)
05-09 DECEMBER 2000



Tropical Cyclone (TC) 04S (Ando*)

First Poor : 0100Z 31 Dec 00

First Fair : 1800Z 31 Dec 00

First TCFA : 0930Z 02 Jan 01

First Warning : 1800Z 02 Jan 01

Last Warning : 0600Z 10 Jan 01

Max Intensity : 120 kts, gusts to 145 kts

Landfall : None

Total Warnings : 16

Remarks : None

* Name assigned by RSMC La Reunion

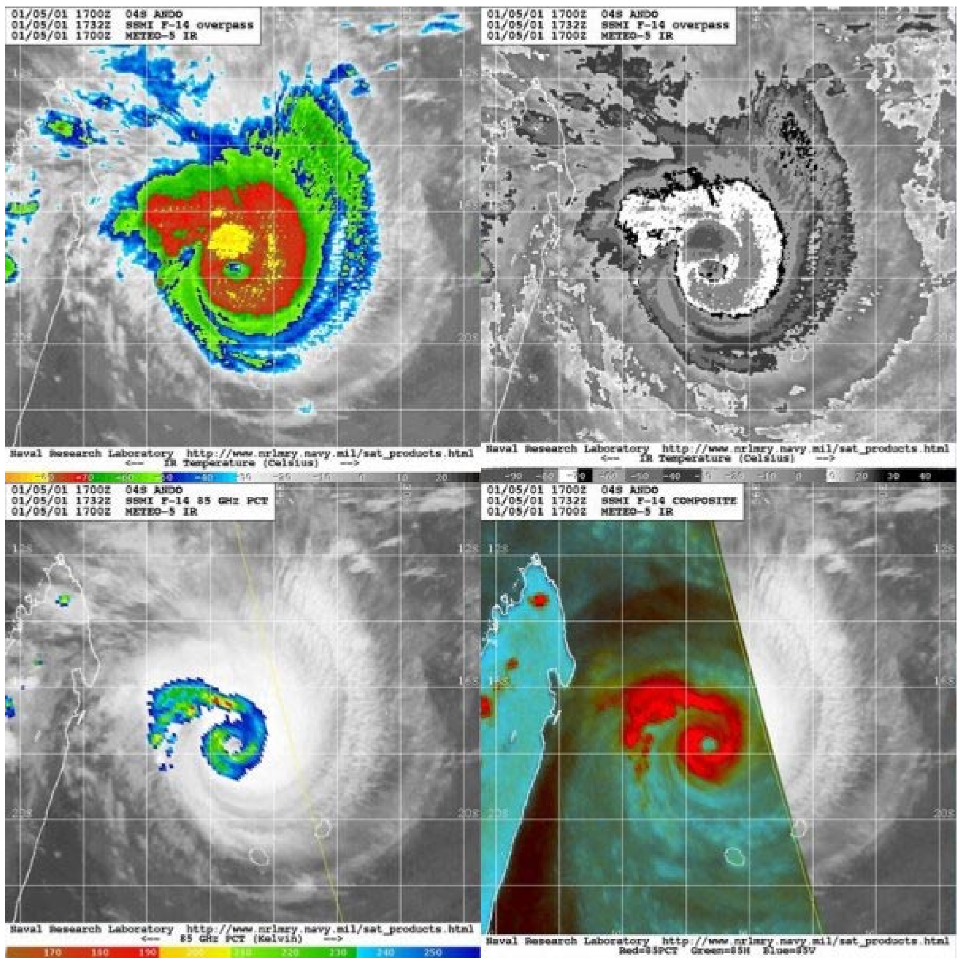
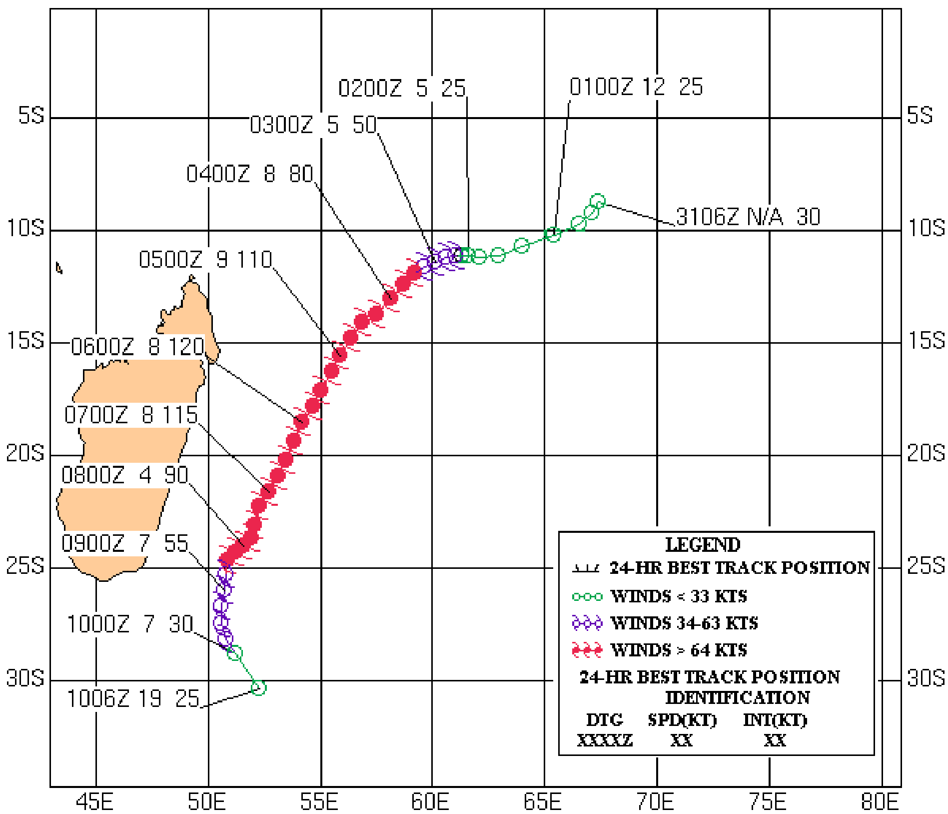


Figure 2-04S-1. 051732Z January 2001 multi-sensor satellite images of TC 04S (Ando), located off the east coast of Madagascar, at its maximum intensity of 120 knots.

TROPICAL CYCLONE 04S (ANDO)
02 - 10 JANUARY 2001



Tropical Cyclone (TC) 05S (Bindu*)

First Poor : 1100Z 02 Jan 01

First Fair : 1800Z 05 Jan 01

First TCFA : 0000Z 06 Jan 01

First Warning : 1800Z 07 Jan 01

Last Warning : 1800Z 16 Jan 01

Max Intensity : 100 kts, gusts to 125 kts

Landfall : None

Total Warnings : 19

Remarks : None

* Name assigned by RSMC La Reunion

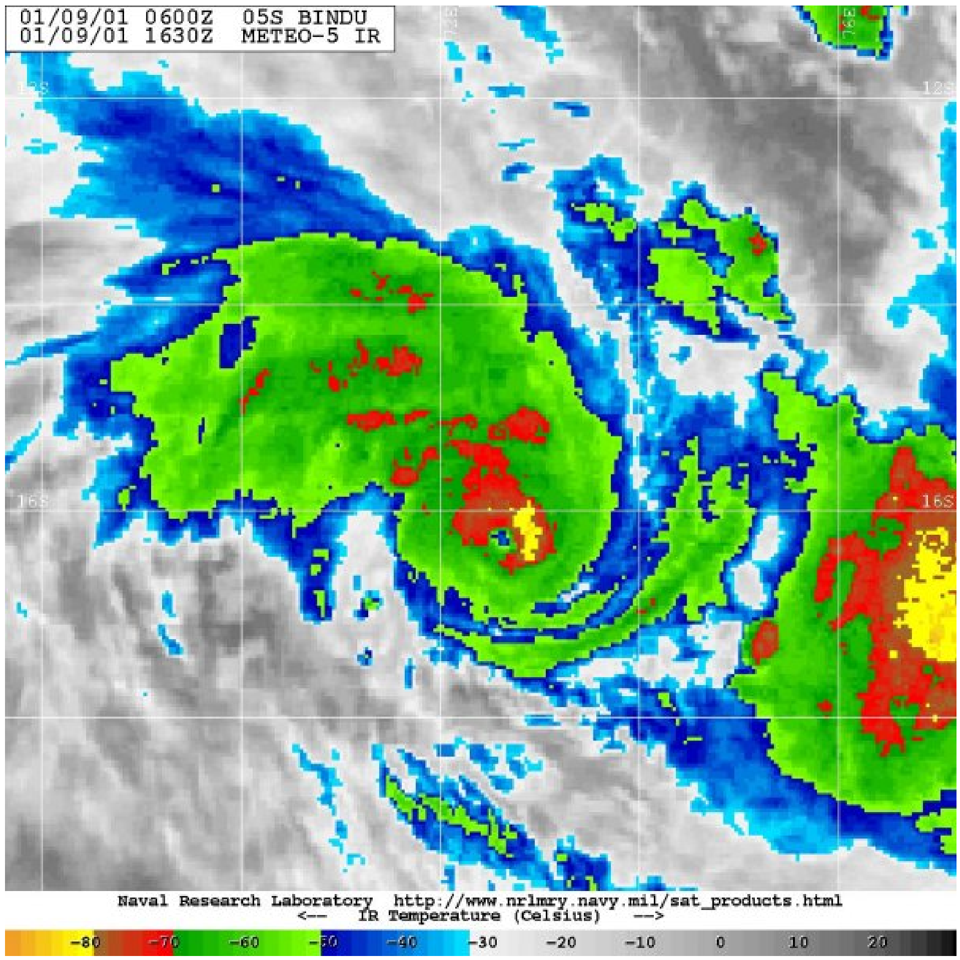
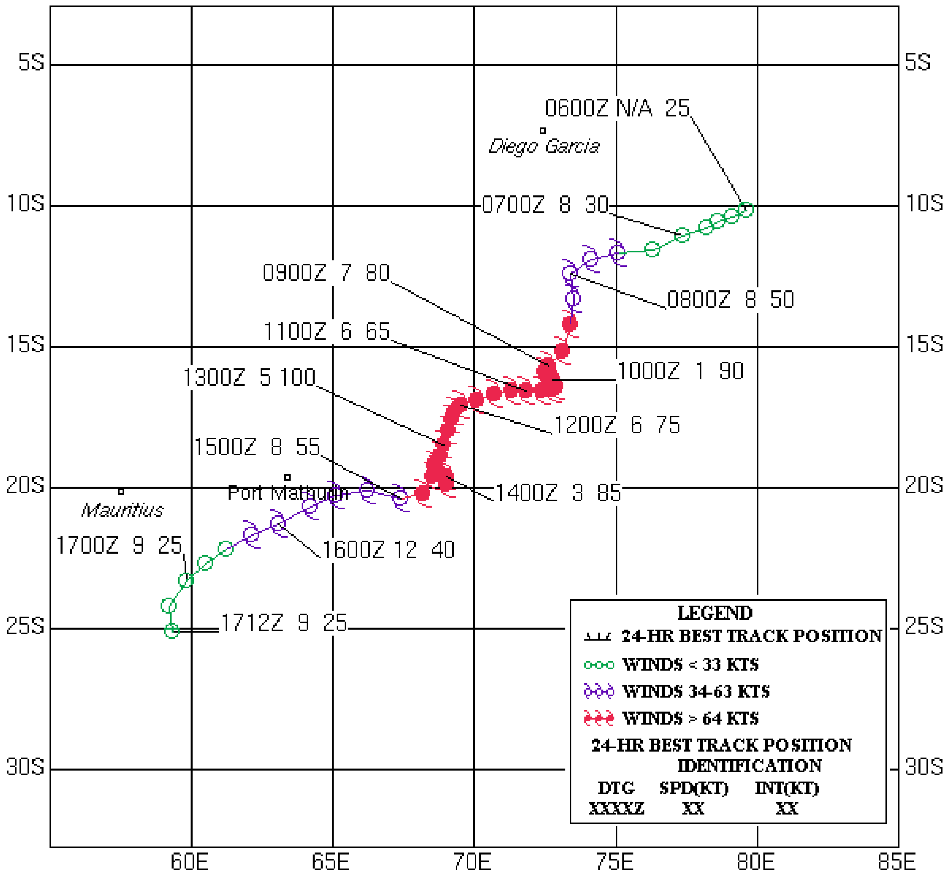


Figure 2-05S-1. 091630Z January 2001 enhanced infrared image of TC 05S (Bindu) with an estimated intensity of 90 knots. The system held this intensity briefly before weakening to 65 knots, and then reintensifyed to its peak intensity of 120 knots on 12 January.

TROPICAL CYCLONE 05S (BINDU)
07-16 JANUARY



Tropical Cyclone (TC) 06S (Charly*)

First Poor : 1800Z 11 Jan 01

First Fair : 1800Z 15 Jan 01

First TCFA : 1200Z 18 Jan 01

First Warning : 1800Z 19 Jan 01

Last Warning : 1800Z 25 Jan 01

Max Intensity : 105 kts, gusts to 125 kts

Landfall : None

Total Warnings : 13

Remarks : None

* Name assigned by RSMC La Reunion

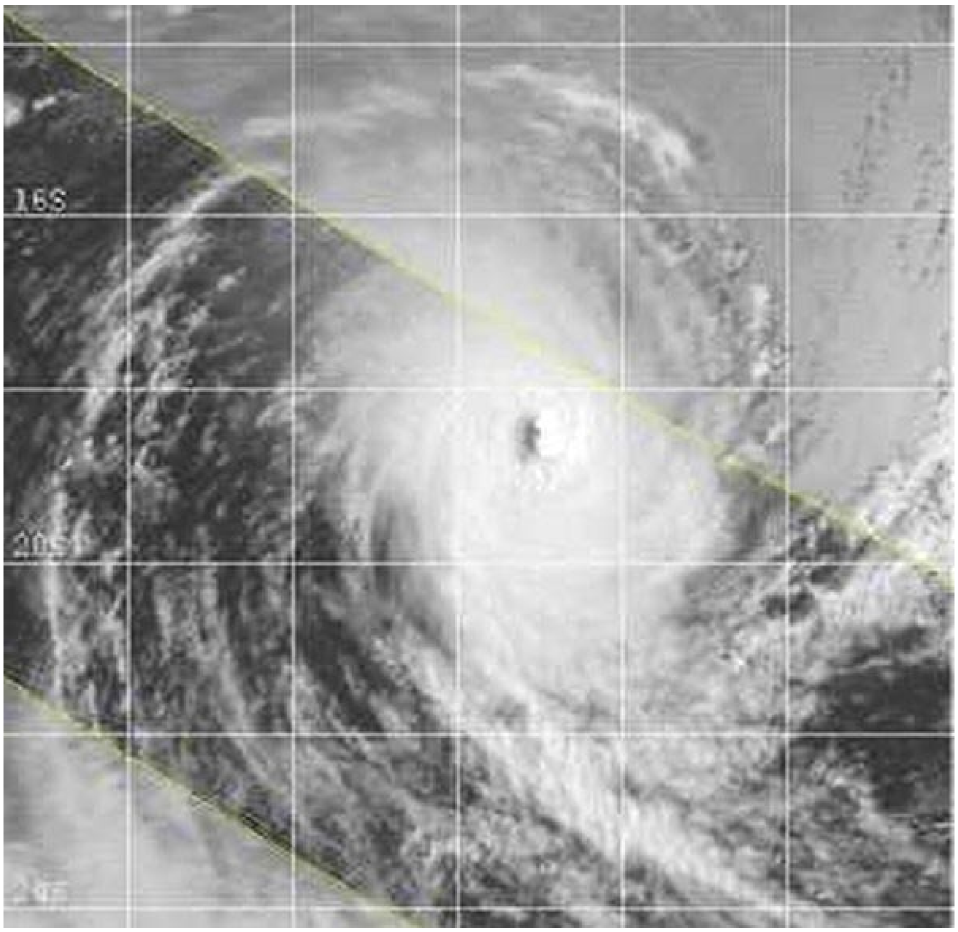
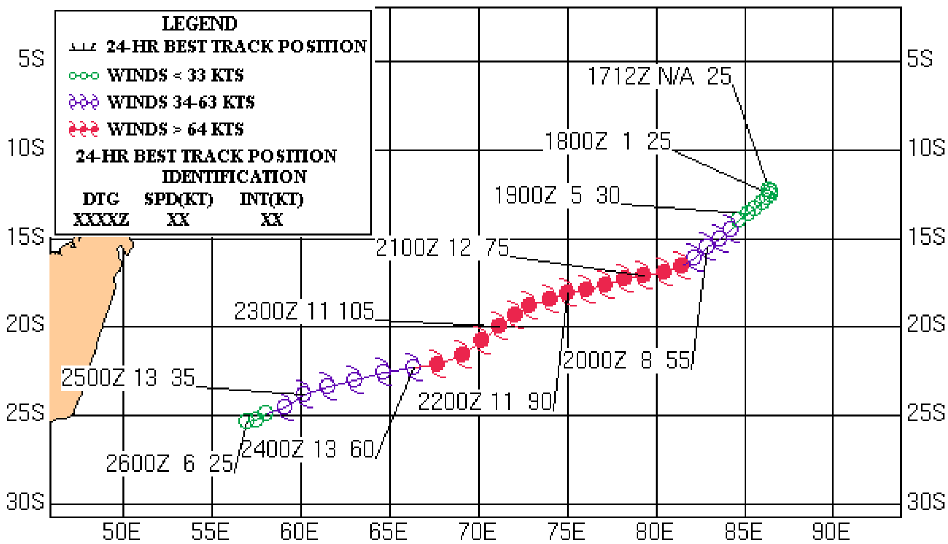


Figure 2-06S-1. 221057Z January 2001 TRMM visible image of TC 06S (Charly), located about 550 nm east of Port Mathurin. At this time, the cyclone has an estimated intensity of 100 knots, with a cloud-filled eye.

TROPICAL CYCLONE 06S (CHARLY)
19-25 JANUARY



Tropical Cyclone (TC) 07S (Terri*)

First Poor : None

First Fair : 1800Z 27 Jan 01

First TCFA : 0130Z 28 Jan 01

First Warning : 0600Z 29 Jan 01

Last Warning : 1800Z 31 Jan 01

Max Intensity : 45 kts, gusts to 65 kts

Landfall : 0230Z 31 Jan 01, over Point Poissonnier near Pardoo

Total Warnings : 6

Remarks : None

* Name assigned by Perth TCWC

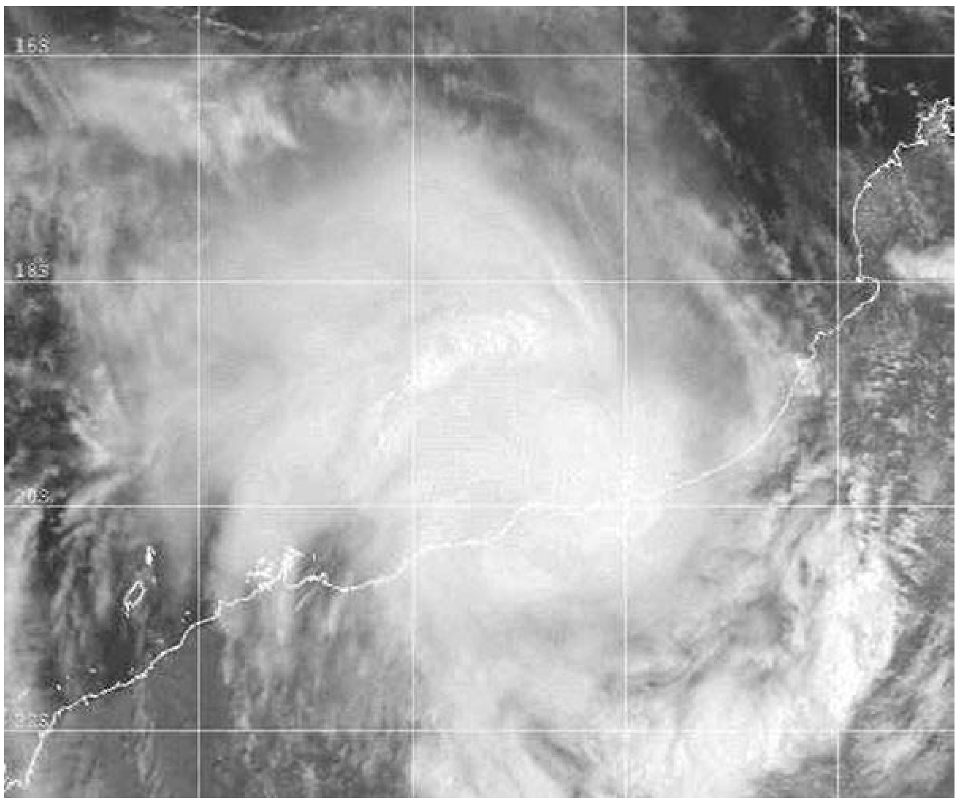
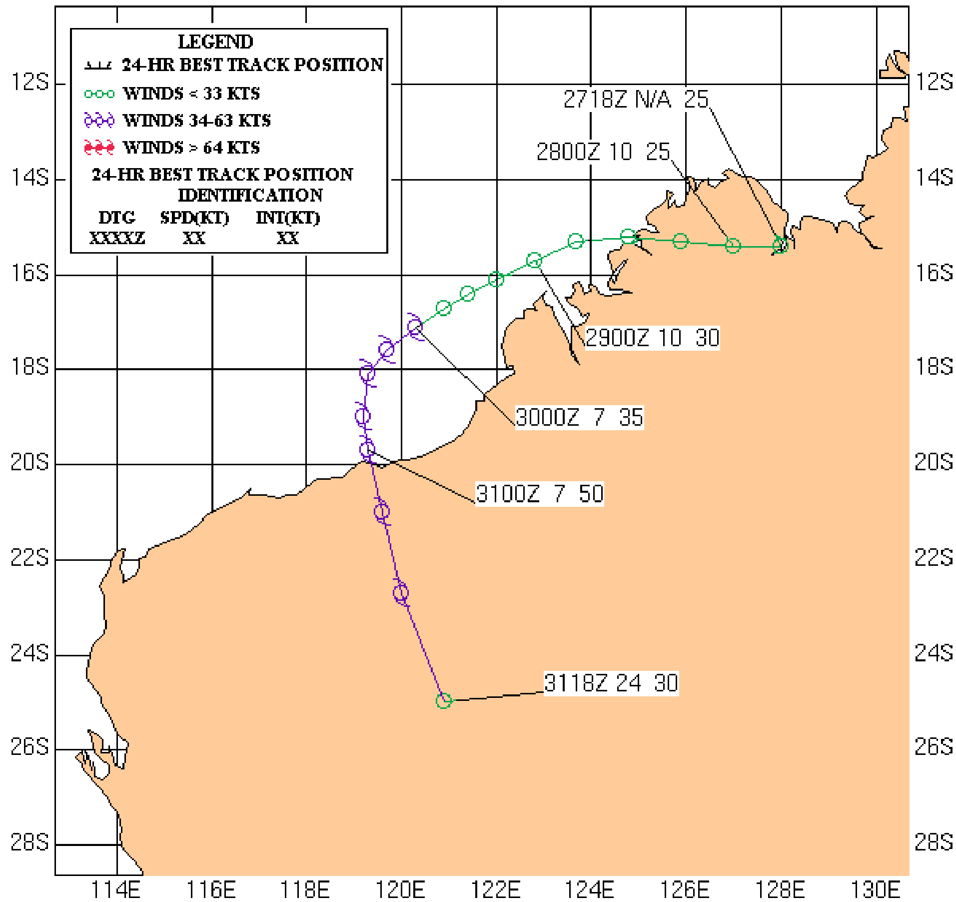


Figure 2-07S-1. 310131Z January 2001 GMS-5 visible image of TC 07S (Terri), located about 45 nm east of Port Hedland, Australia. At this time, the cyclone has estimated intensity of 50 knots, with two notable rainbands north and south of the low-level circulation center.

TROPICAL CYCLONE 07S (TERRI)
29 - 31 JANUARY 2001



Tropical Cyclone (TC) 08P (Winsome*)

First Poor : None

First Fair : 0600Z 09 Feb 01

First TCFA : 1600Z 09 Feb 01

First Warning : 0600Z 10 Feb 01

Last Warning : 1800Z 11 Feb 01

Max Intensity : 40 kts, gusts to 55 kts

Landfall : 0100Z 11 Feb 01, over the Limmen Bight in the Northern Territory, Australia

Total Warnings : 04

Remarks : None

* Name assigned by Darwin TCWC

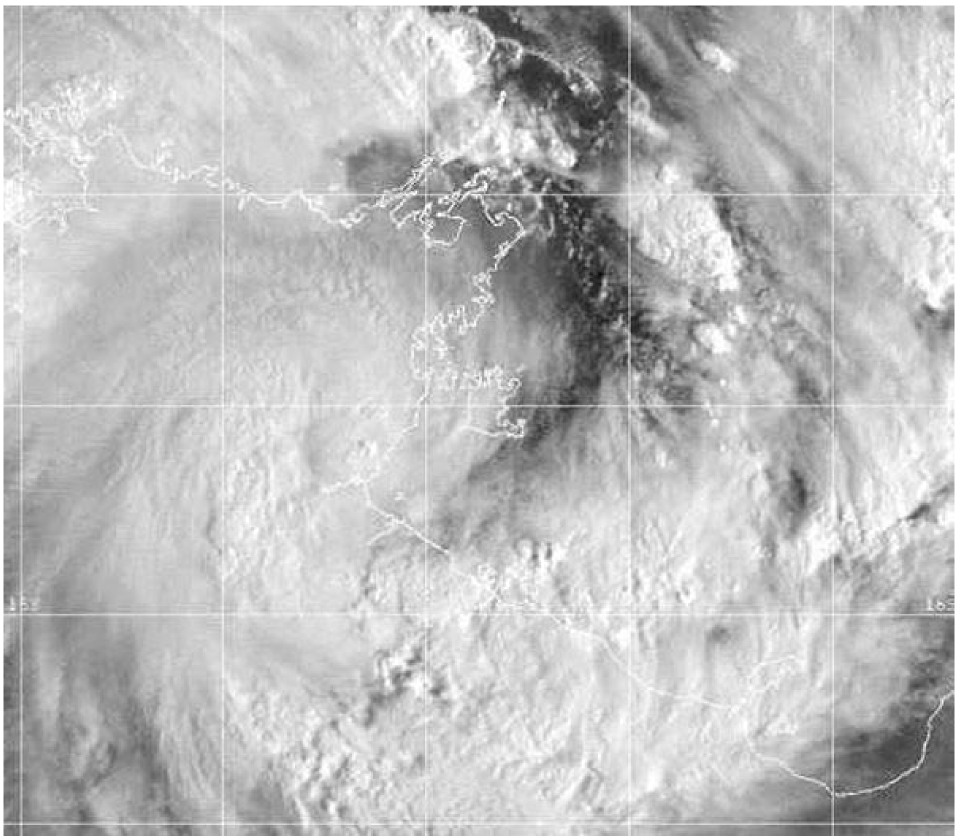
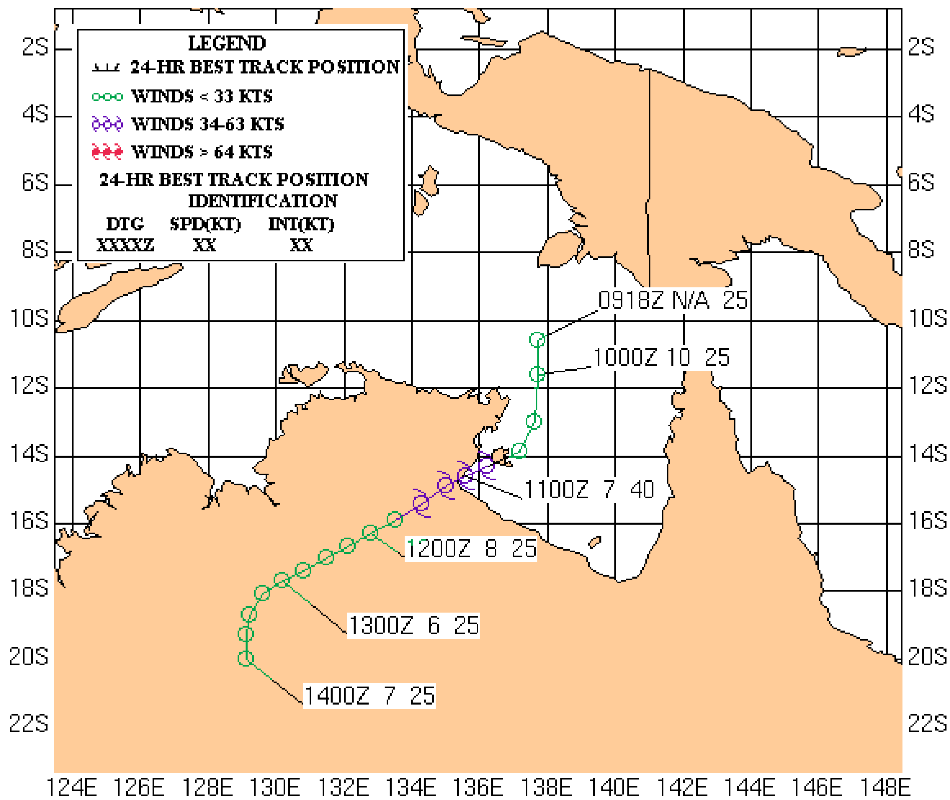


Figure 2-08P-1. 102224Z February 2001 GMS-5 visible image of TC 08P (Winsome), as the cyclone made landfall about 300 nm east-southeast of Darwin, Australia. At this time, the cyclone has an estimated intensity of 40 knots, with a large rainband extending from the low-level circulation center.

TROPICAL CYCLONE 08P (WINSOME)
10 - 11 FEBRUARY 2001



Tropical Cyclone (TC) 09S (Vincent*)

First Poor : 0200Z 07 Feb 01

First Fair : 1800Z 07 Feb 01

First TCFA : 2030Z 09 Feb 01

First Warning : 0600Z 12 Feb 01

Last Warning : 1800Z 15 Feb 01

Max Intensity : 35 kts, gusts to 45 kts

Landfall : 2100Z 15 Feb 01, 200 nm east of Port Hedland, Australia

Total Warnings : 08

Remarks : None

* Name assigned by Perth TCWC

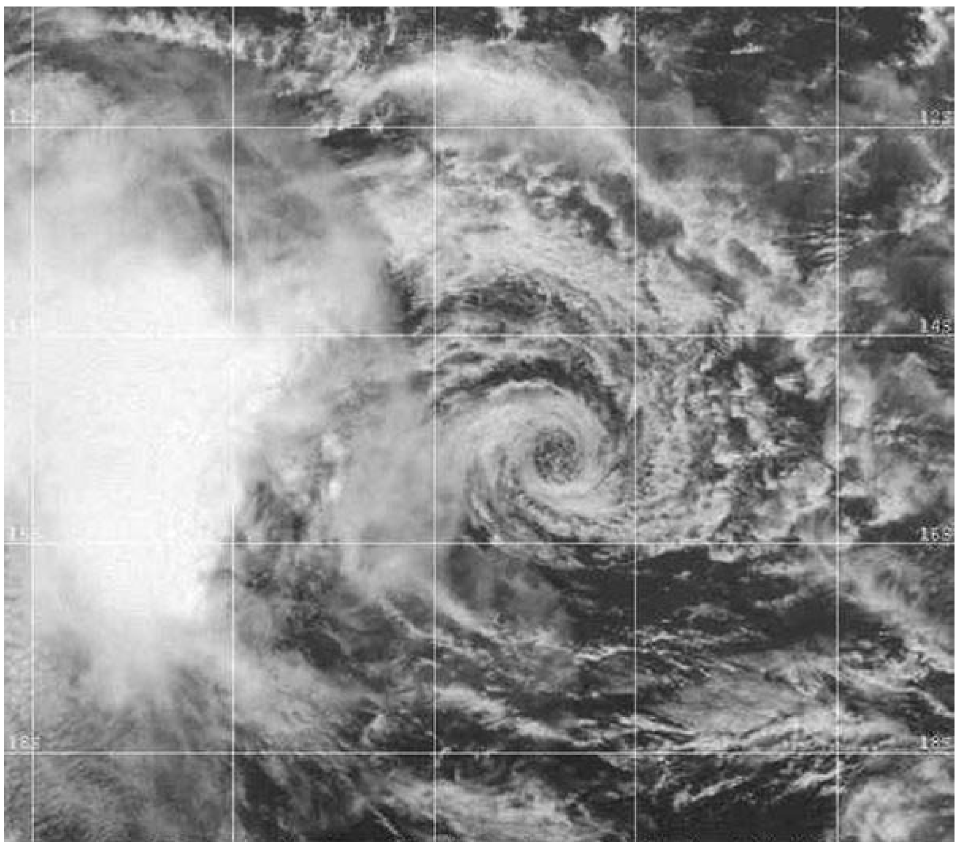
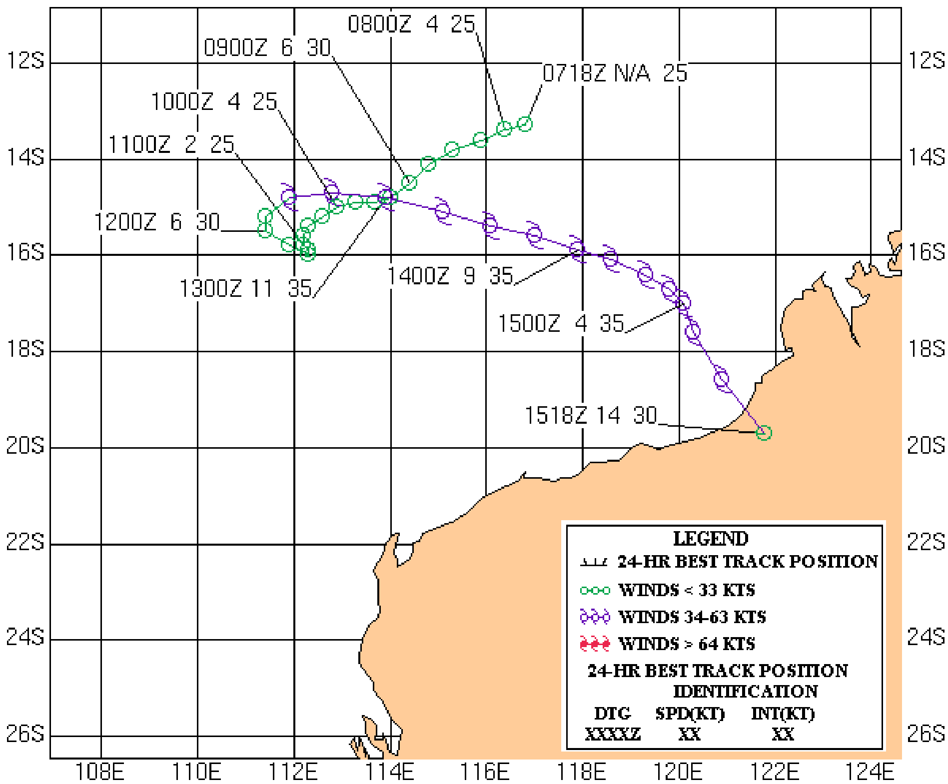


Figure 2-09S-1. 130501Z February 2001 GMS-5 visible image of TC 09S (Vincent), located about 380 nm northwest of Port Hedland, Australia. At this time, the cyclone has an estimated intensity of 35 knots, with a completely exposed low-level circulation center.

TROPICAL CYCLONE 09S (VINCENT)
12 - 15 FEBRUARY 2001



Tropical Cyclone (TC) 10P

First Poor : 2130Z 10 Feb 01

First Fair : 1030Z 11 Feb 01

First TCFA : 0200Z 12 Feb 01

First Warning : 0000Z 17 Feb 01

Last Warning : 0000Z 18 Feb 01

Max Intensity : 35 kts, gusts to 45 kts

Landfall : None

Total Warnings : 3

Remarks : None

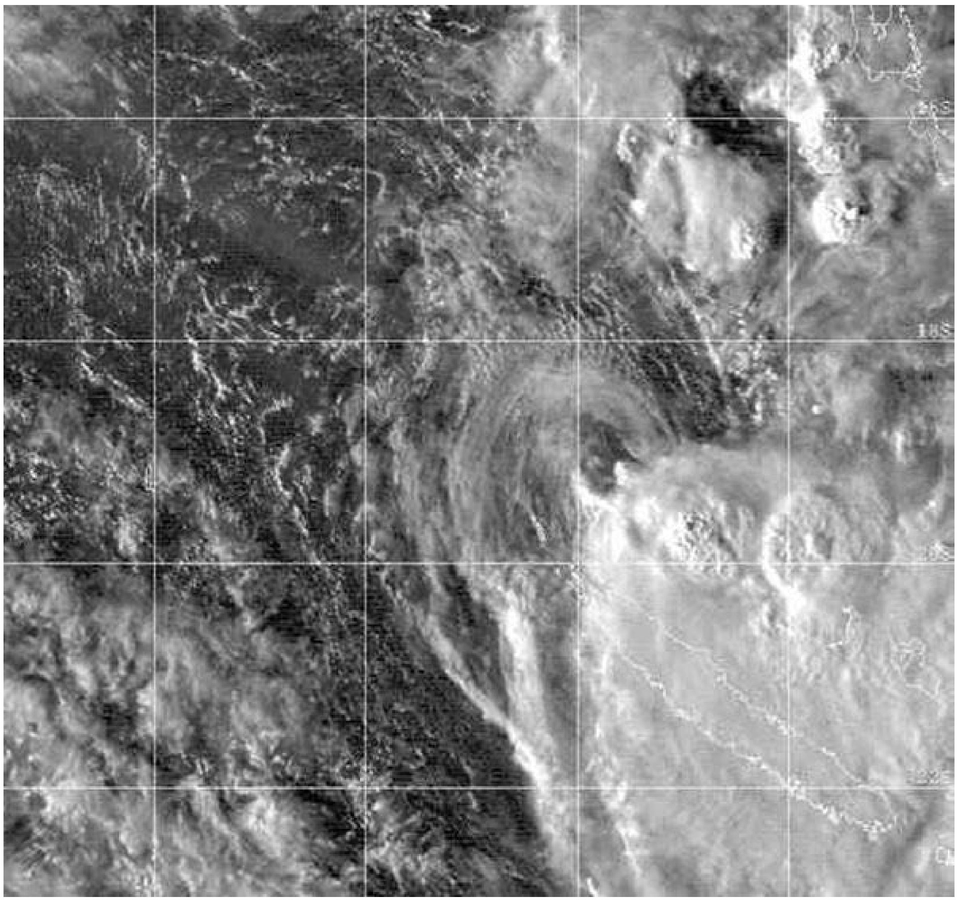
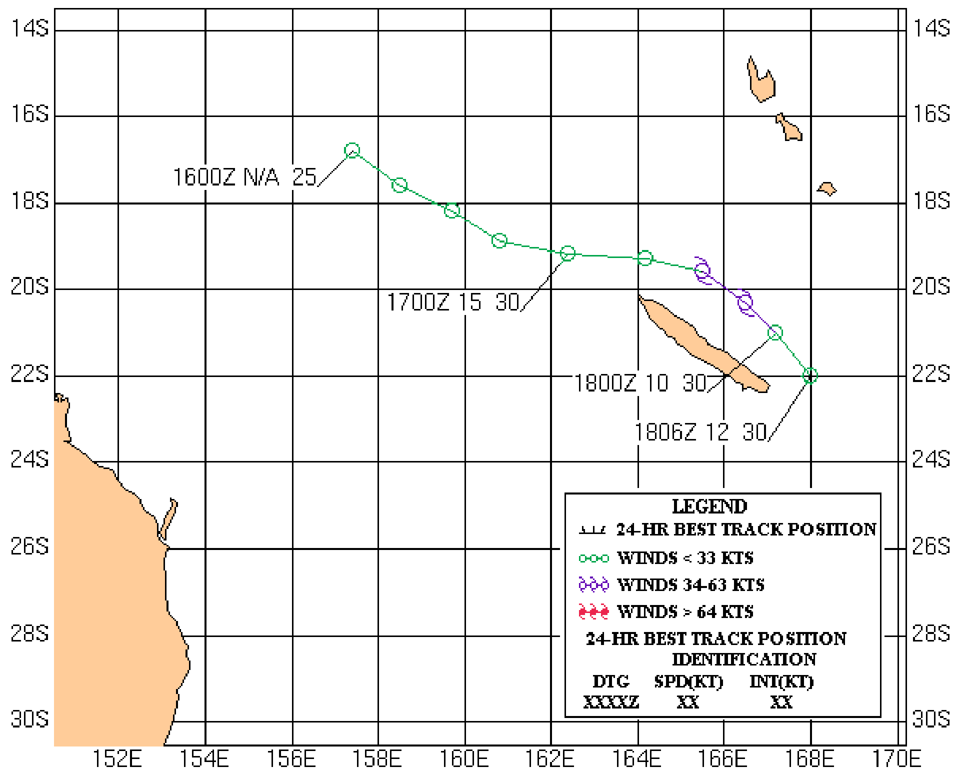


Figure 2-10P-1. 170631Z February 2001 GMS-5 visible image of TC 10P, located 60 nm north of New Caledonia. Note the deep convection displaced to the southeast of the low-level circulation center, indicative of strong vertical shear.

TROPICAL CYCLONE 10P
17 - 18 FEBRUARY 2001



Tropical Cyclone (TC) 11P (Oma*)

First Poor : None

First Fair : None

First TCFA : 0300Z 19 Feb 01

First Warning : 1800Z 20 Feb 01

Last Warning : 0600Z 22 Feb 01

Max Intensity : 45 kts, gusts to 55 kts

Landfall : None

Total Warnings : 4

Remarks : None

* Name assigned by RSMC Nadi

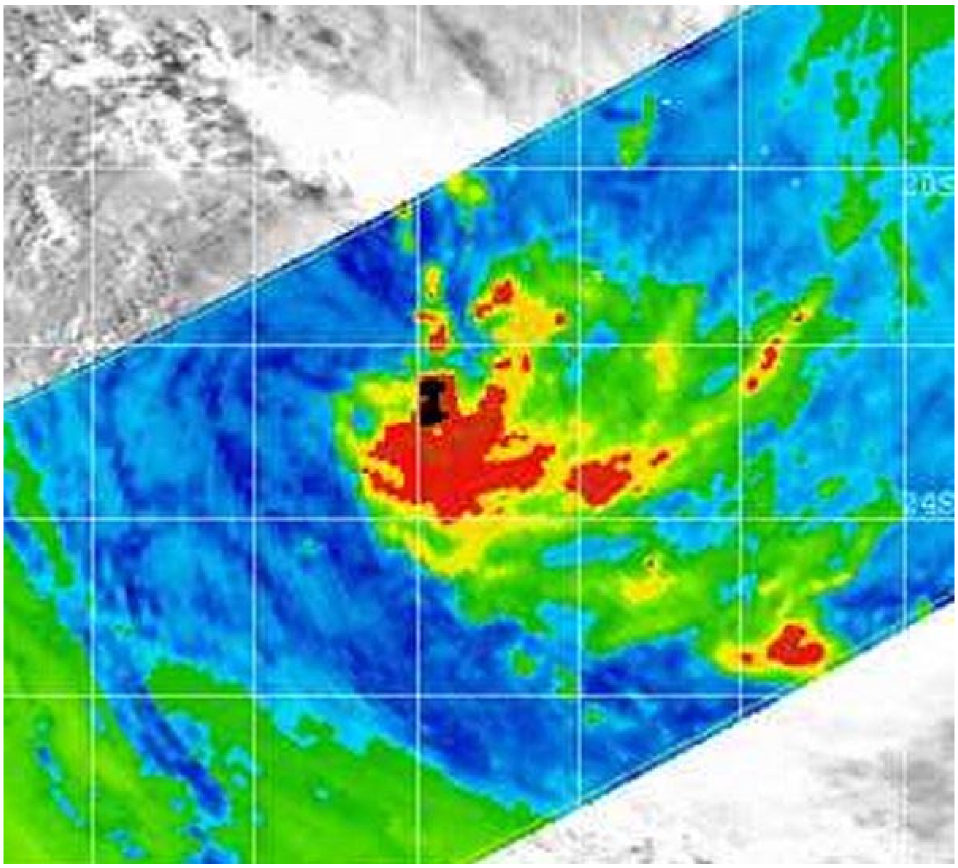
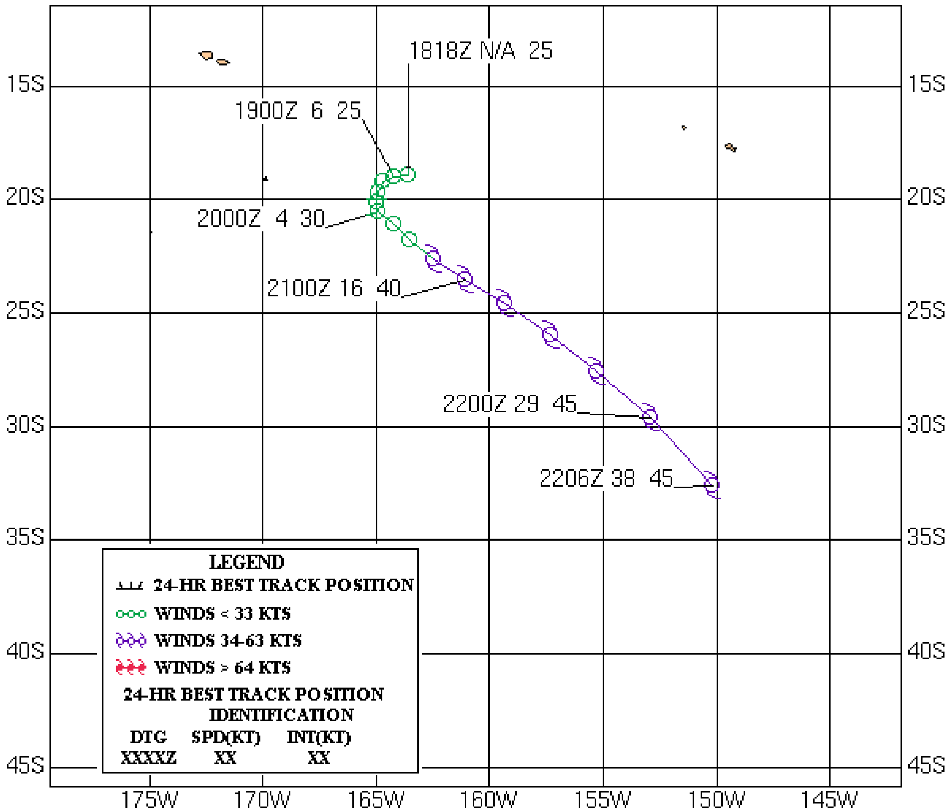


Figure 2-11P-1. 201831Z February 2001 TRMM 85 GHz image of TC 11P (Oma), located 180 nm west-southwest of Rarotonga Island, with an estimated intensity of 35 knots. Note the deep convection displaced southeast of the partially exposed low-level circulation center, indicative of strong vertical shear.

TROPICAL CYCLONE 11P (OMA)
01 - 05 MARCH 2001



Tropical Cyclone (TC) 12P (Abigail*)

First Poor : 0300Z 22 Feb 01

First Fair : 2130Z 22 Feb 01

First TCFA : 0500Z 23 Feb 01

First Warning : 1800Z 25 Feb 01

Last Warning : 0600Z 27 Feb 01

Max Intensity : 60 kts, gusts to 80 kts

Landfall : 1400Z 26 Feb 01, 35 nm west-northwest of Bayley Point, Australia

Total Warnings : 4

Remarks : None

* Name assigned by Brisbane TCWC

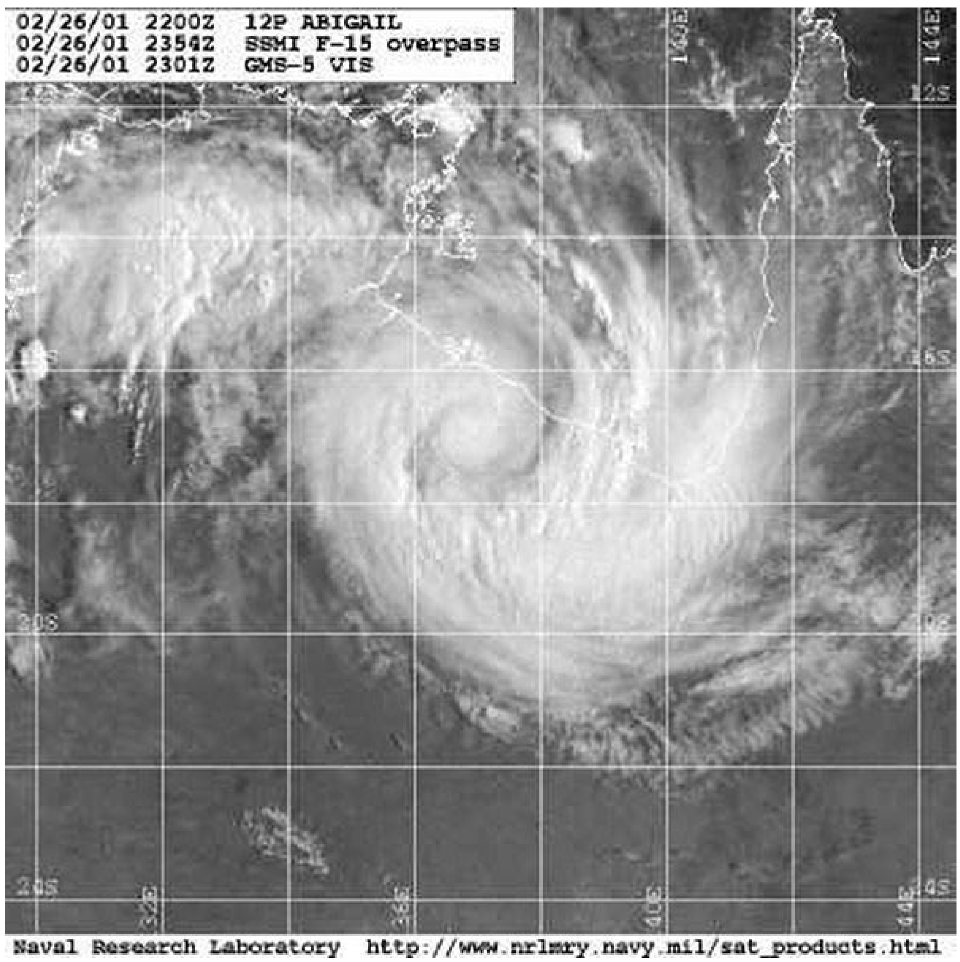
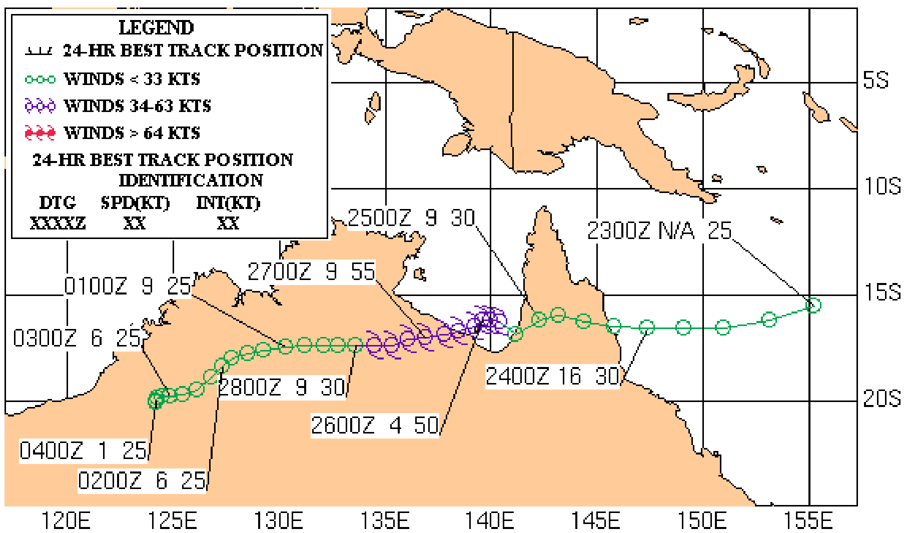


Figure 2-12P-1. 262301Z February 2001 visible image of TC 12S (Abigail) just after landfall along the border of Queensland and Northern Territory, Australia.

TROPICAL CYCLONE 12P (ABIGAIL)
25-27 FEBRUARY



Tropical Cyclone (TC) 13P (Paula*)

First Poor : None

First Fair : None

First TCFA : 1200Z 26 Feb 01

First Warning : 1200Z 26 Feb 01

Last Warning : 1200Z 04 Mar 01

Max Intensity : 105 kts, gusts to 125 kts

Landfall : None

Total Warnings : 13

Remarks : None

* Name assigned by RSMC Nadi

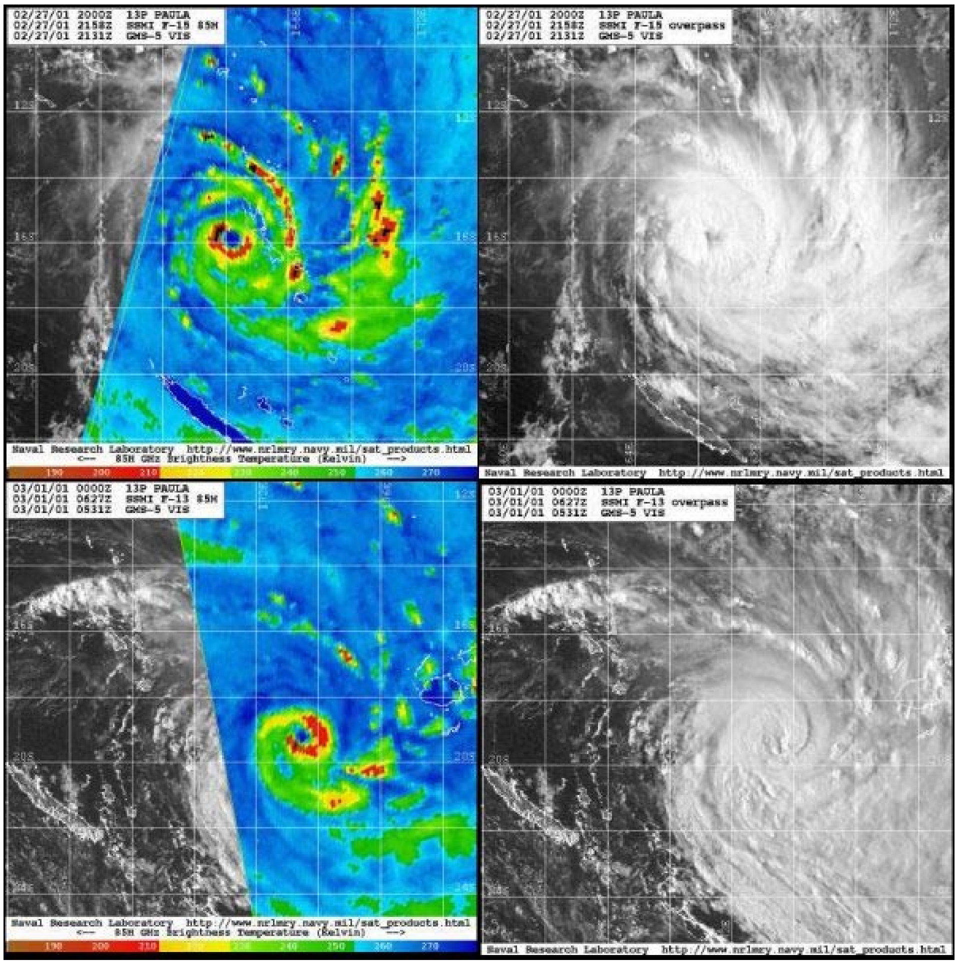


Figure 2-13P-1. 272130Z February 2001 and 010627Z March 2001 microwave and visible imagery of TC 13P (Paula). Imagery shows a developing dry slot expanding around the eastern side of the system, indicative of initial stages of extratropical transition. At this time, the system has reached peak intensity, begun to weaken due to increased vertical wind shear and interact with the baroclinic region to the south.

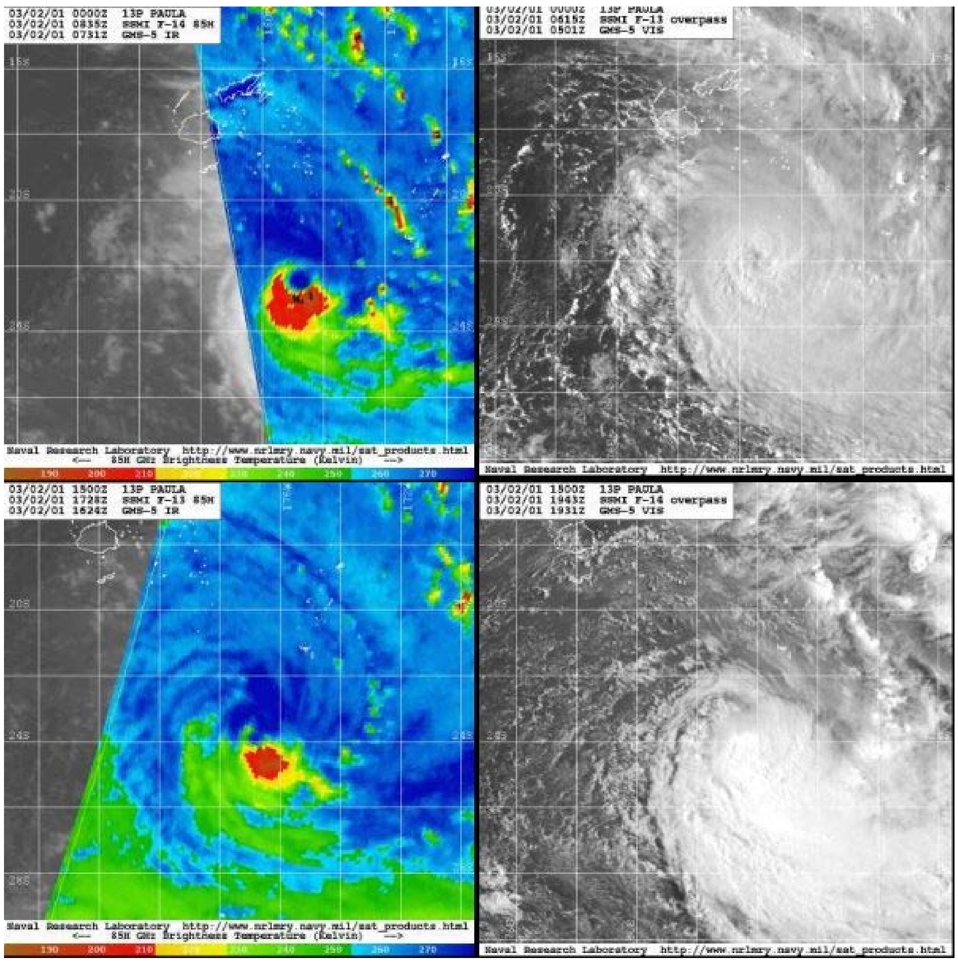
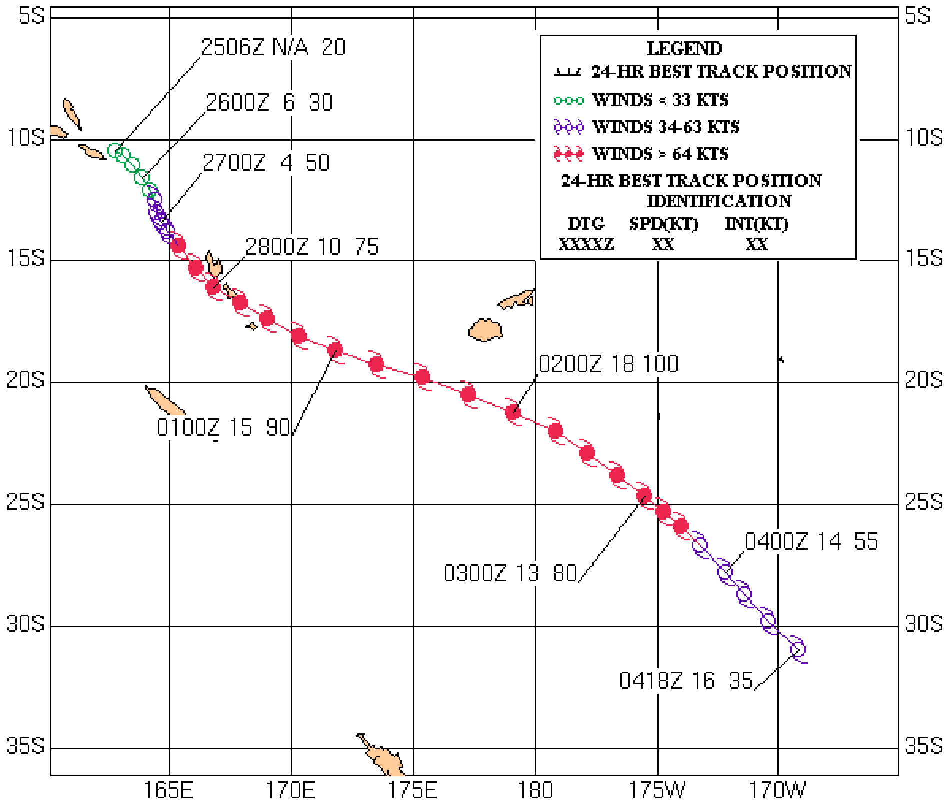


Figure 2-13P-2. Microwave and visible satellite imagery for 020700Z and 021800Z March 2001 of TC 13P (Paula). Imagery shows eye wall erosion, indicative of mid-stage extratropical transition.

TROPICAL CYCLONE 13P (PAULA)
26 FEBRUARY-04 MARCH



Tropical Cyclone (TC) 14P (Rita*)

First Poor : None

First Fair : None

First TCFA : 1200Z 28 Feb 01

First Warning : 1800Z 01 Mar 01

Last Warning : 0600Z 05 Mar 01

Max Intensity : 40 kts, gusts to 50 kts

Landfall : None

Total Warnings : 8

Remarks : None

* Name assigned by RSMC Nadi

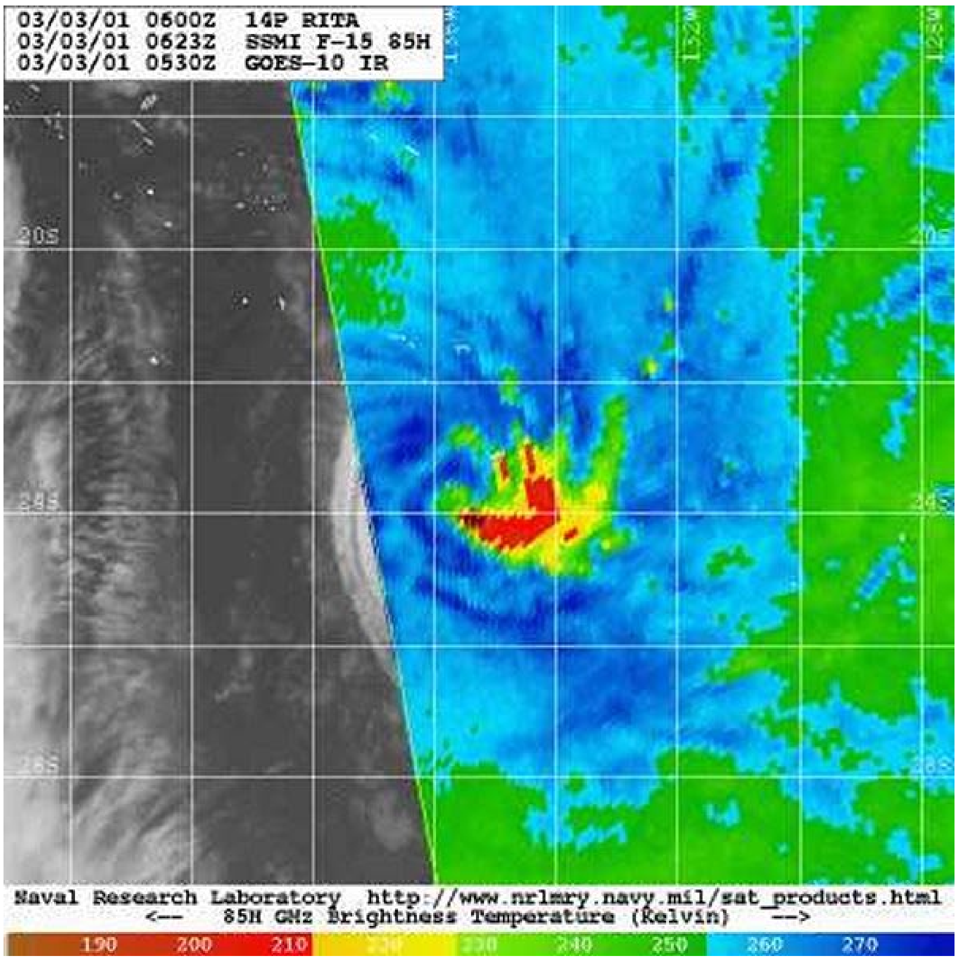
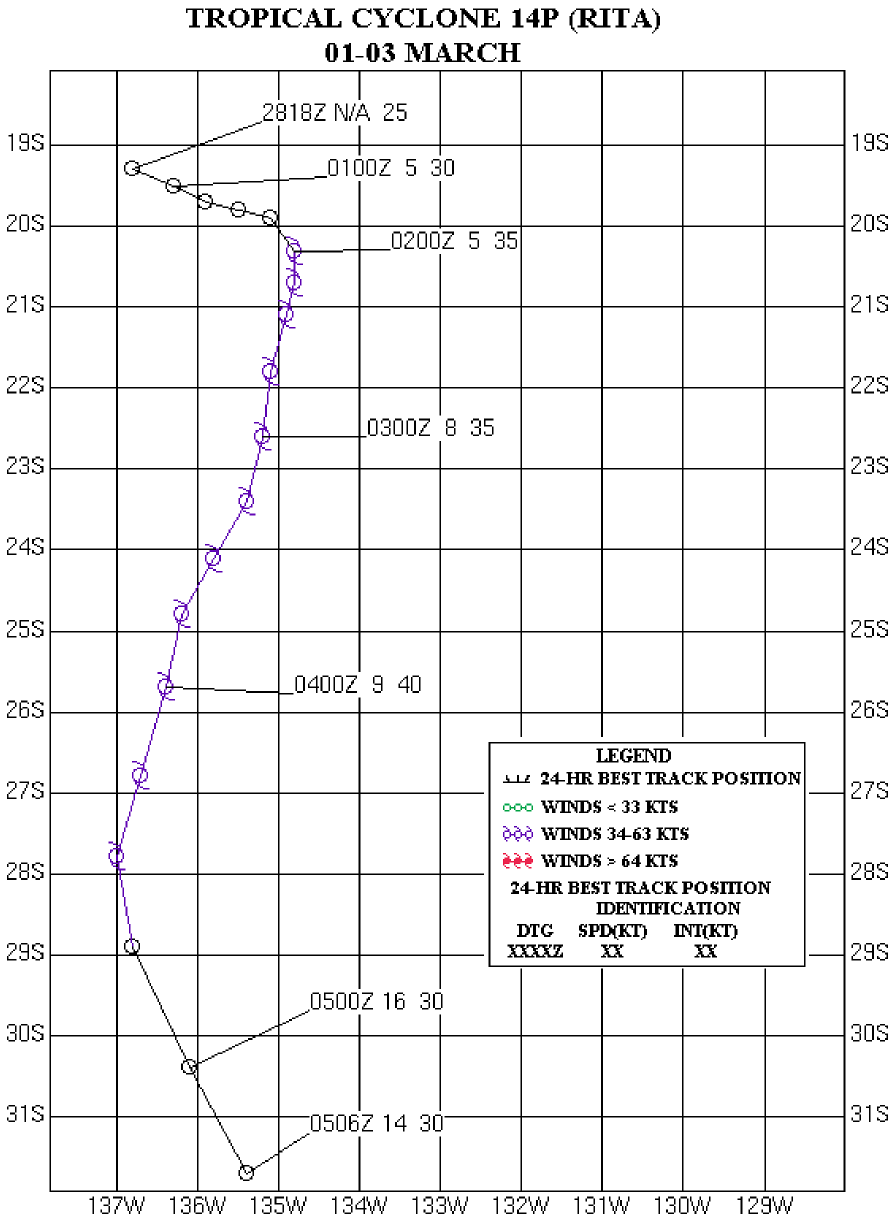


Figure 2-14P-1. 030600Z March 2001 microwave image of TC 14P (Rita) as the system moved by the Gambier Islands.


TROPICAL CYCLONE 14P (RITA)
01-03 MARCH
2818Z N/A 25
0100Z 5 30
0200Z 5 35
0300Z 8 35
0400Z 9 40
0500Z 16 30
0506Z 14 30
19S
20S
21S
22S
23S
24S
25S
26S
27S
28S
29S
30S
31S
137W
136W
135W
134W
133W
132W
131W
130W
129W
LEGEND
24-HR BEST TRACK POSITION
WINDS < 33 KTS
WINDS 34-63 KTS
WINDS > 64 KTS
24-HR BEST TRACK POSITION IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX

Tropical Cyclone (TC) 15S (Dera*)

First Poor : 1800Z 04 Mar 01

First Fair : 0830Z 05 Mar 01

First TCFA : 1000Z 08 Mar 01

First Warning : 0000Z 09 Mar 01

Last Warning : 0000Z 13 Mar 01

Max Intensity : 90 kts, gusts to 110 kts

Landfall : None

Total Warnings : 9

Remarks : None

* Name assigned by RSMC La Reunion

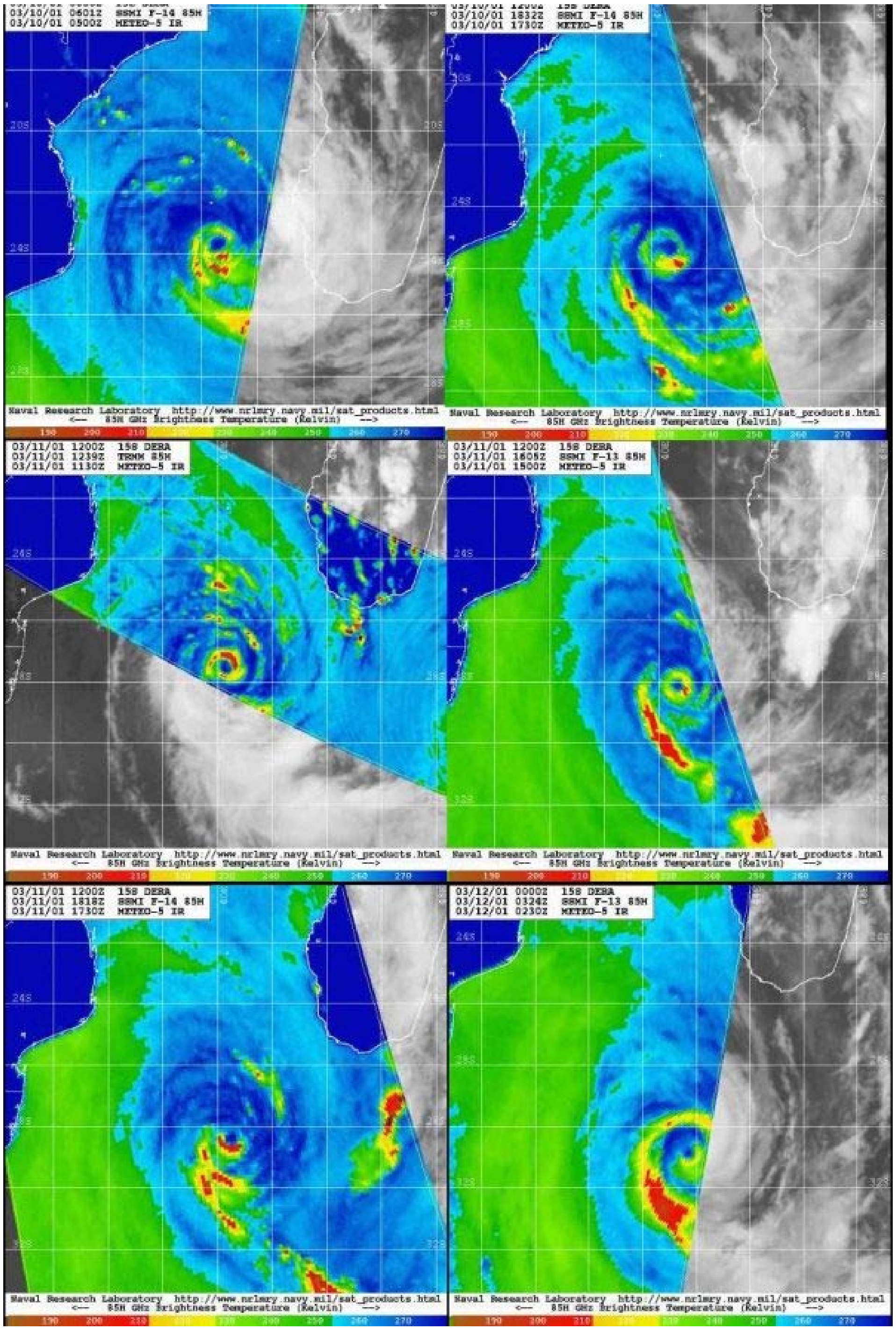
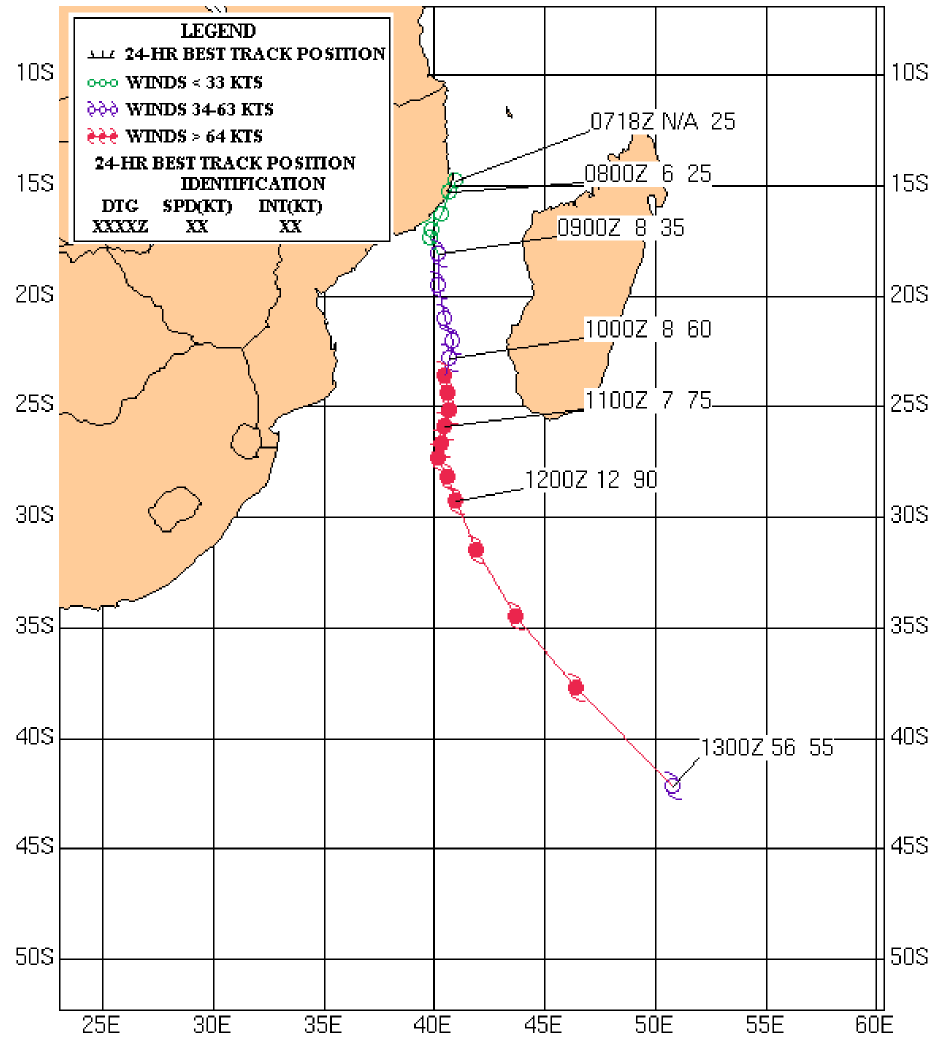


Figure 2-15S-1. A six panel image of TC 15S (Dera) as it undergoes extratropical transition while moving through the southern Mozambique Channel between 100601Z and 120324Z March 2001. The microwave imagery reveals the system beginning to weaken at the onset of extratropical transition, but then later reintensifying, with a band of convection wrapping north of the center.

TROPICAL CYCLONE 15S (DERA)
09-13 MARCH



Tropical Cyclone (TC) 16S

First Poor : 0800Z 01 Apr 01

First Fair : 1800Z 02 Apr 01

First TCFA : None

First Warning : 1800Z 02 Apr 01

Last Warning : 1800Z 05 Apr 01

Max Intensity : 35 kts gusts to 45 kts

Landfall : None

Total Warnings : 7

Remarks:

(1) Experienced a binary (Fujiwara) interaction, then merged with a nearby disturbance.

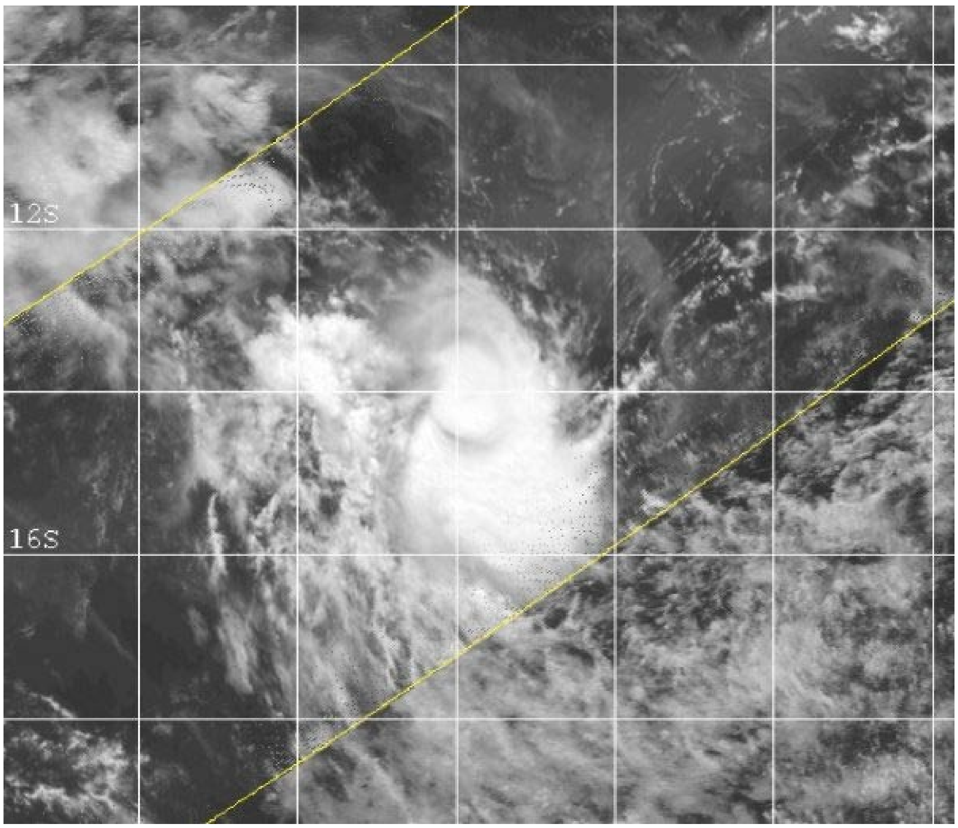
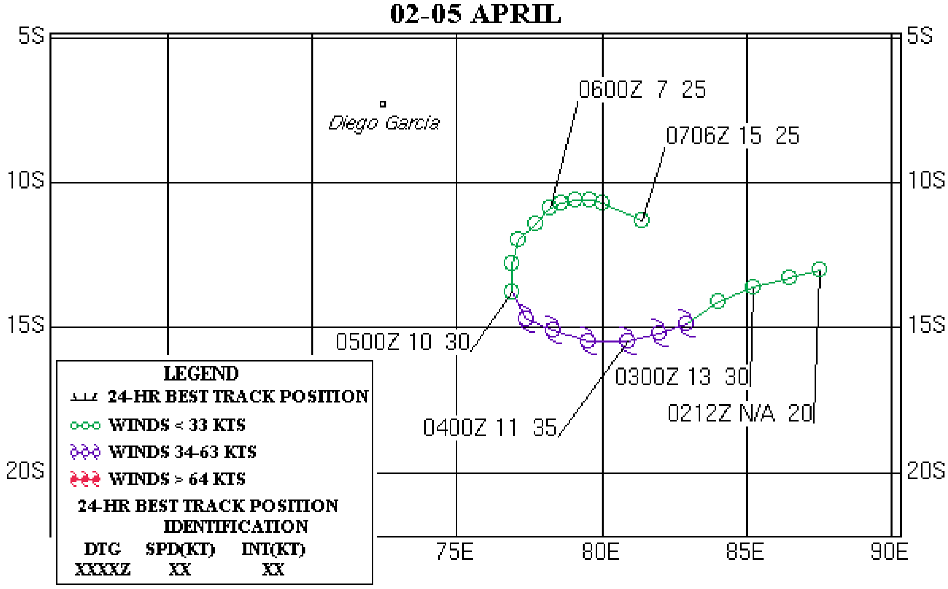


Figure 2-16S-1. 030557Z April 2001 TRMM visible image of TC 16S. At this time, the deepest convection is located south and east of the low-level circulation center.

TROPICAL CYCLONE 16S
02-05 APRIL



Tropical Cyclone (TC) 17S (Walter*)

First Poor : 0030Z 02 Apr 01

First Fair : 0200Z 02 Apr 01

First TCFA : 0600Z 02 Apr 01

First Warning : 0000Z 03 Apr 01

Last Warning : 1200Z 05 Apr 01

Max Intensity : 85 kts gusts to 105 kts

Landfall : None

Total Warnings : 10

Remarks : None

* Name assigned by Perth TCWC

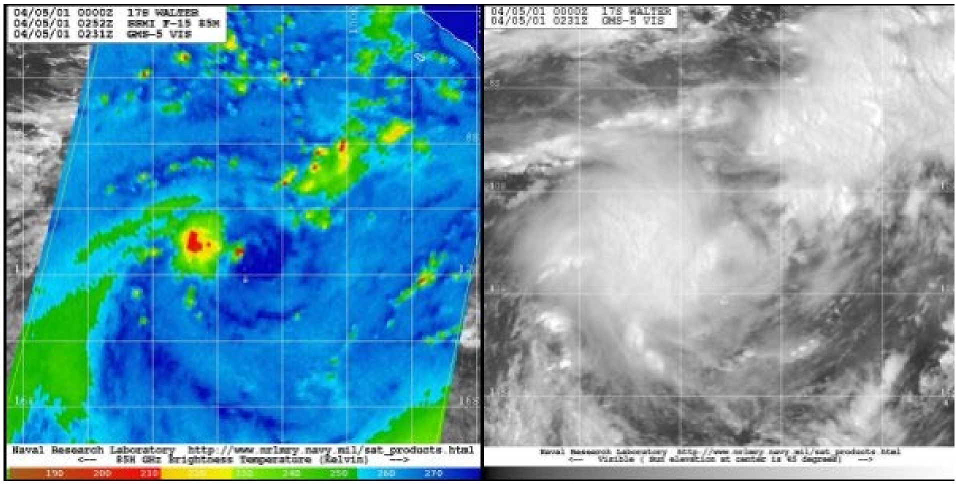
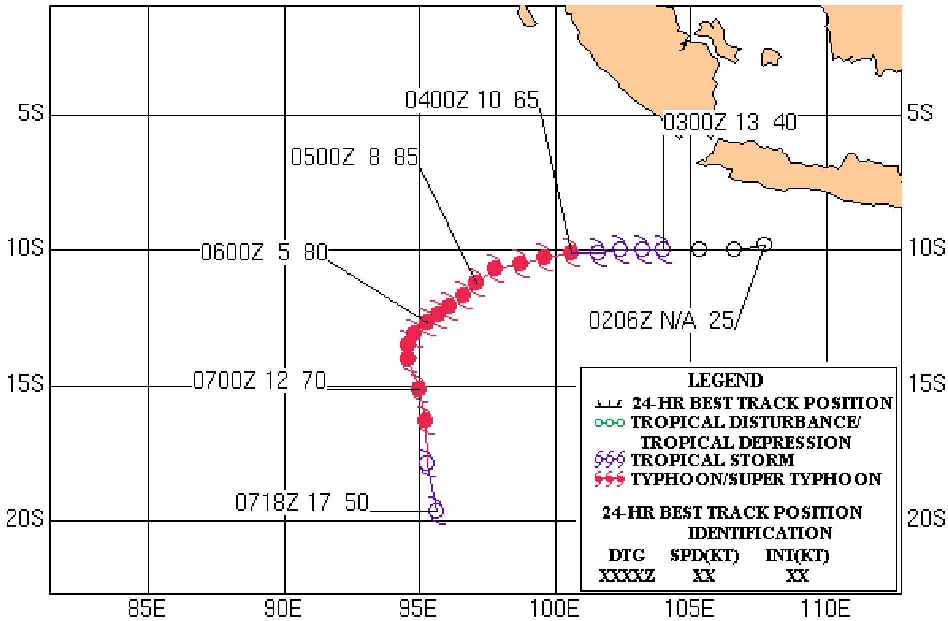


Figure 2-17S-1. 050252Z April 2001 SSMI 85 GHz and 050231Z April 2001 visible image of TC 17S (Walter). At this time, the deepest convection is located south and east of the low-level circulation center.

TROPICAL CYCLONE 17S (WALTER)
03-08 APRIL 2001



Tropical Cyclone (TC) 18S (Evariste*)

First Poor : 1800Z 01 Apr 01

First Fair : None

First TCFA : 2130Z 02 Apr 01

First Warning : 1800Z 03 Apr 01

Last Warning : 0600Z 08 Apr 01

Max Intensity : 75 kts gusts to 90 kts

Landfall : None

Total Warnings : 12*

Remarks:

(1) Post-analysis could not verify or substantiate the 12th (final) JTWC warning position for this cyclone. Thus, the final warning position was not used in error computation and that position was removed from the best track.

* Name assigned by RSMC La Reunion

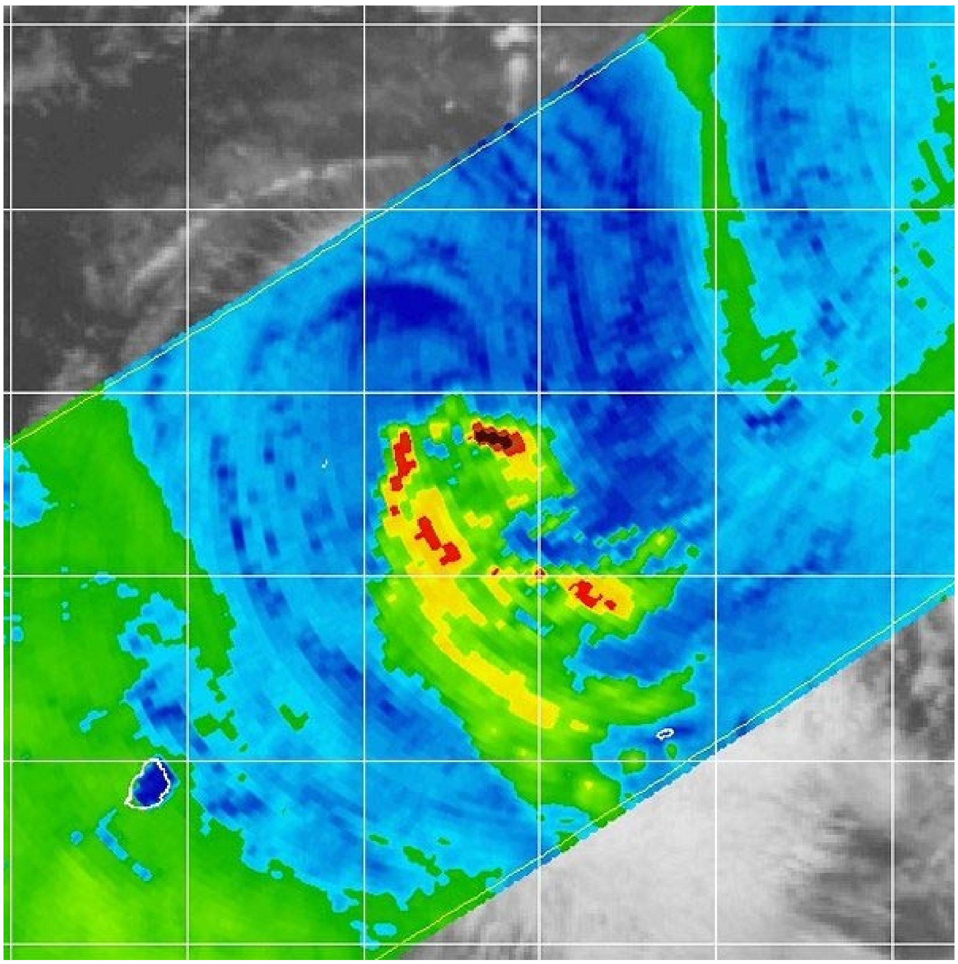
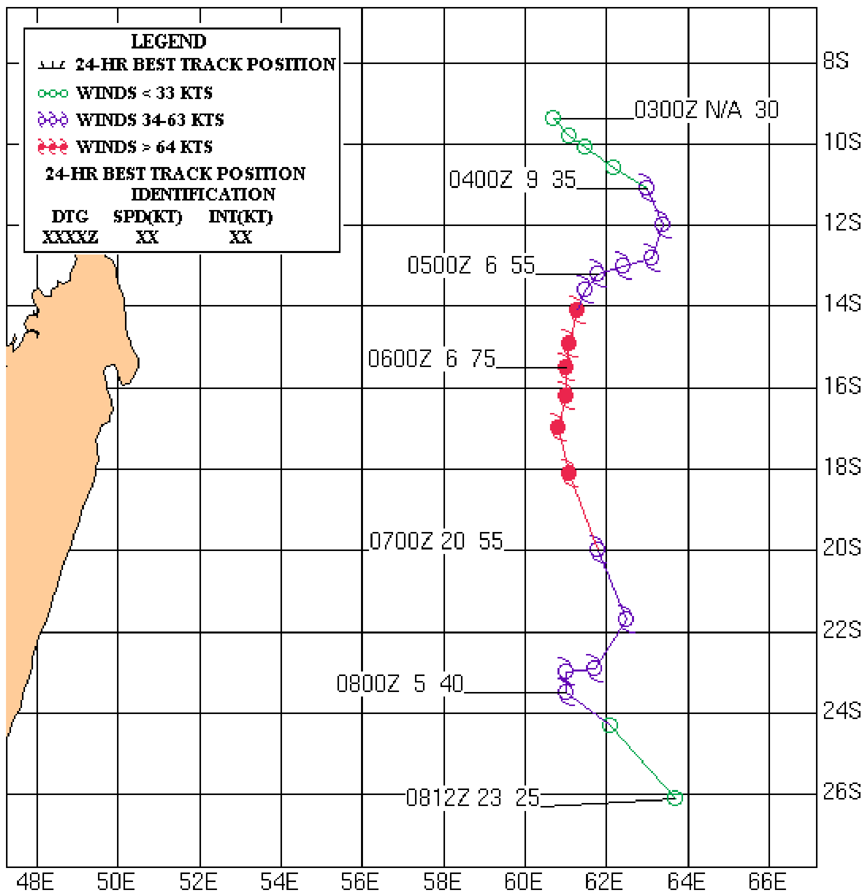


Figure 2-18S-1. 060528Z April 2001 TRMM 85 GHz microwave image of TC 18S, located 295 nm north-northwest of Port Mathurin. At this time, the deepest convection is sheared to the south of the low-level circulation center.

TROPICAL CYCLONE18S (EVARISTE)
03-08 APRIL



Tropical Cyclone (TC) 19P (Sose*)

First Poor : 1900Z 03 Apr 01

First Fair : 0600Z 04 Apr 01

First TCFA : 1930Z 04 Apr 01

First Warning : 1800Z 05 Apr 01

Last Warning : 0600Z 11 Apr 01

Max Intensity : 70 kts gusts to 90 kts

Landfall : None

Total Warnings : 12

Remarks : None

* Name assigned by RSMC Nadi

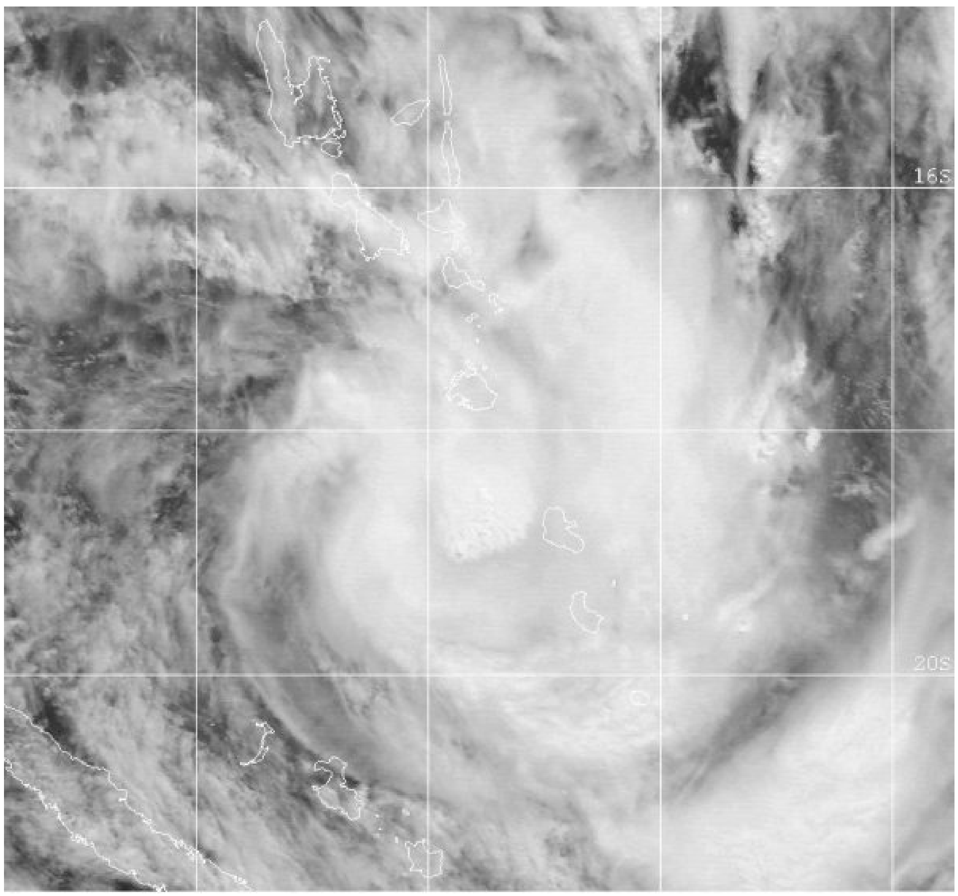
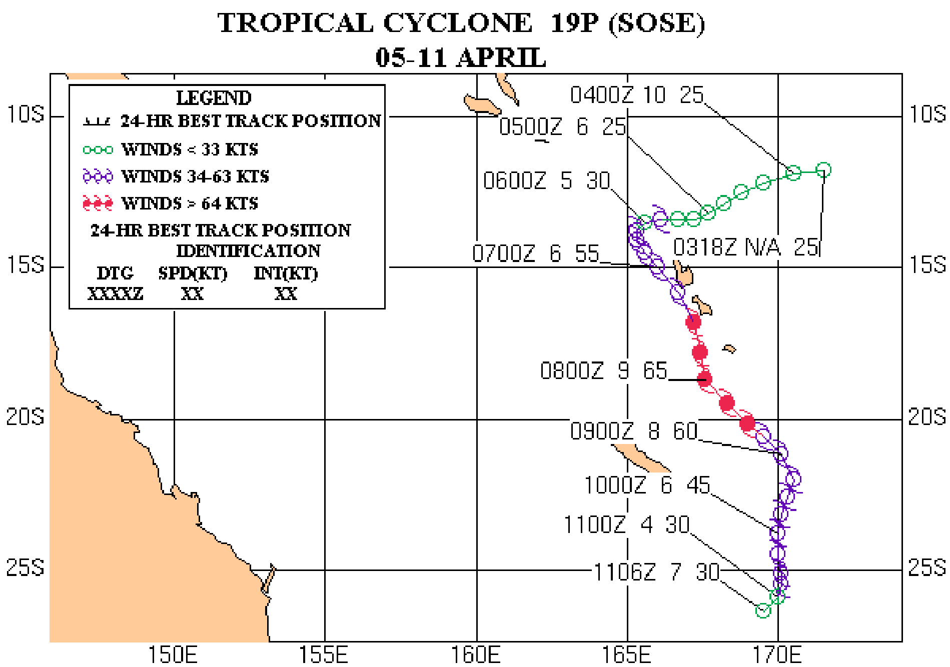


Figure 2-19P-1. 072331Z April 2001 GMS-5 visible image of TC 19P (Sose), located 200 nm northeast of New Caledonia with an intensity estimated at 65 knots. A spiral band feature is evident in the imagery at this time.


TROPICAL CYCLONE 19P (SOSE)
05-11 APRIL
LEGEND
24-HR BEST TRACK POSITION
WINDS < 33 KTS
WINDS 34-63 KTS
WINDS > 64 KTS
24-HR BEST TRACK POSITION IDENTIFICATION
DTG SPD(KT) INT(KT)
XXXXZ XX XX
0400Z 10 25
0500Z 6 25
0600Z 5 30
0318Z N/A 25
0700Z 6 55
0800Z 9 65
0900Z 8 60
1000Z 6 45
1100Z 4 30
1106Z 7 30
10S
15S
20S
25S
150E
155E
160E
165E
170E

Tropical Cyclone (TC) 20S (Alistair*)

First Poor : 0600Z 15 Apr 01

First Fair : 0830Z 15 Apr 01

First TCFA : 0100Z 16 Apr 01

First Warning : 0600Z 16 Apr 01

Last Warning : 1200Z 21 Apr 01

Max Intensity : 65 kts gusts to 80 kts

Landfall : None

Total Warnings : 19

Remarks : None

* Name assigned by Darwin TCWC

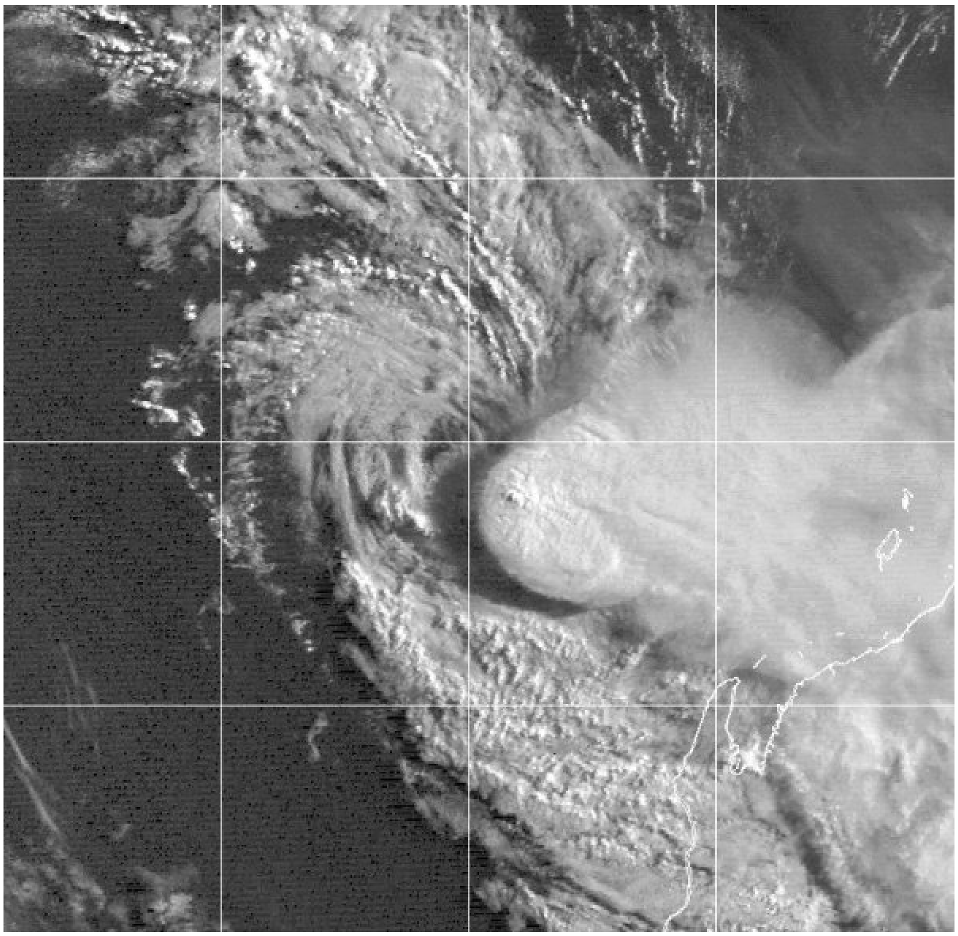
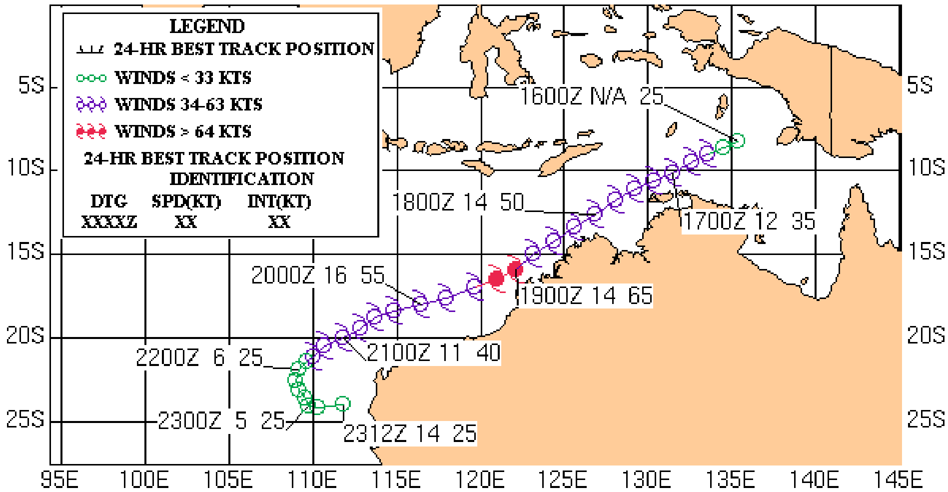


Figure 2-20S-1. 202331Z April 2001 GMS-5 visible image of TC 20S (Alistair), located 172 nm northwest of Learmonth, Australia. At this time, the system is experiencing strong vertical shear, with the deep convection displaced to the west of the low-level circulation center.

TROPICAL CYCLONE 20S (ALISTAIR)
16-21 APRIL



Tropical Cyclone (TC) 21S

First Poor : None

First Fair : 1500Z 21 Jun 01

First TCFA : 1700Z 21 Jun 01

First Warning : 1800Z 21 Jun 01

Last Warning : 0600Z 23 Jun 01

Max Intensity : 65 kts gusts to 80 kts

Landfall : None

Total Warnings : 4

Remarks:

(1) TC 21S was a very small tropical cyclone which developed east of Cape St. Lucia, South Africa.

(2) The cyclone tracked north as it intensified and then turned toward Madagascar, reaching a peak intensity of 65 knots.

(3) After reaching peak intensity, TC 21S continued to move east while weakening and dissipated off the west coast of Madagascar near Toliara.

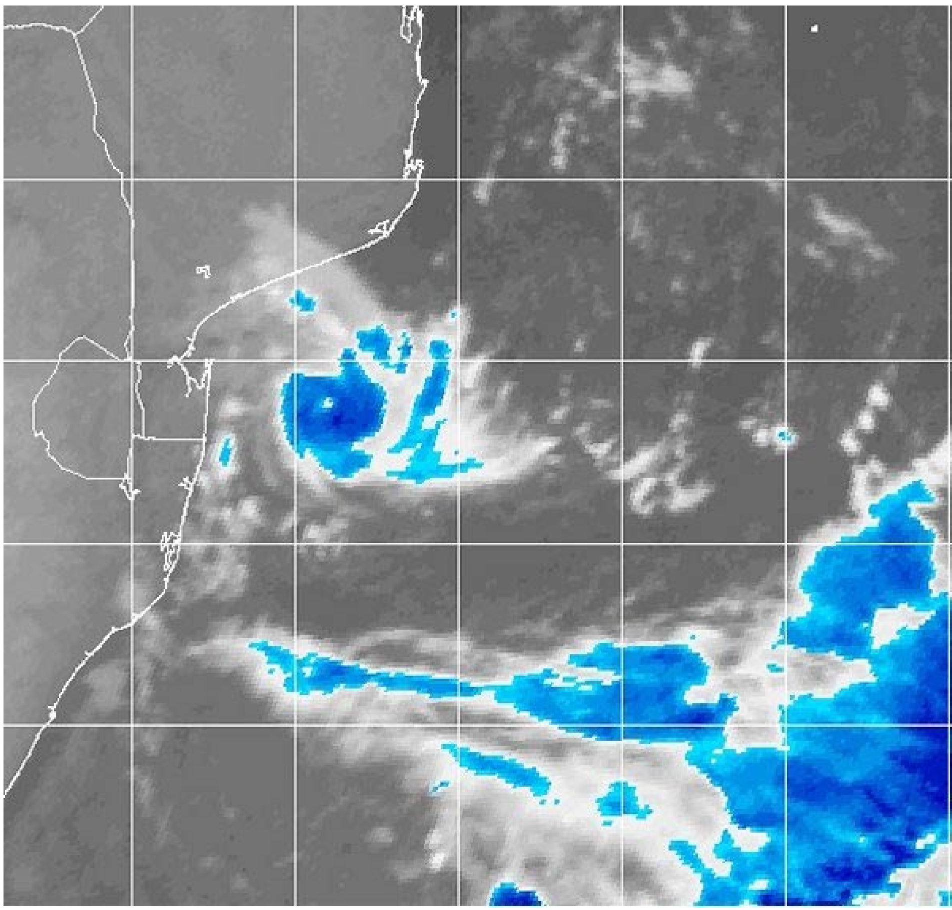


Figure 2-21S-1. 210530Z June 2001 enhanced infrared image of TC 21S, located east of Maputo, Mozambique. At this time, the cyclone has a peak intensity of 65 knots. Note the extremely small size of the system.

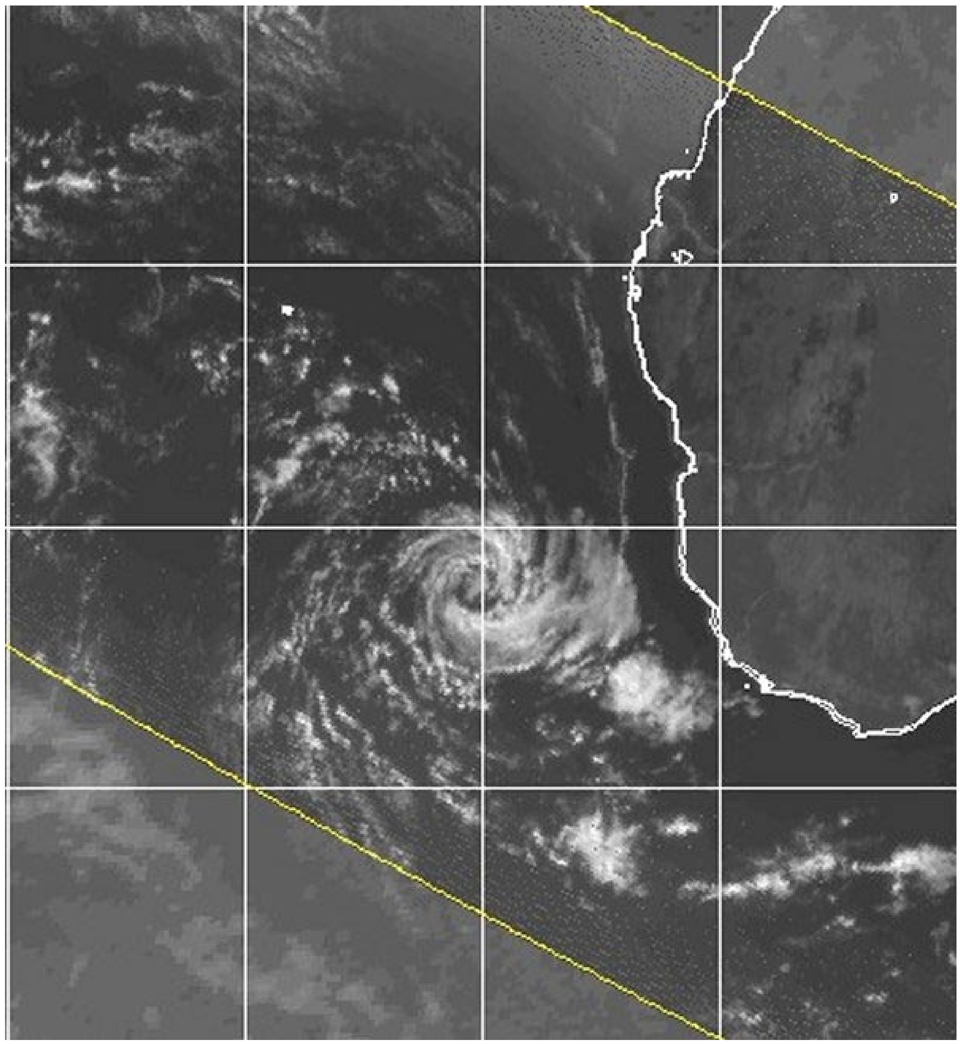
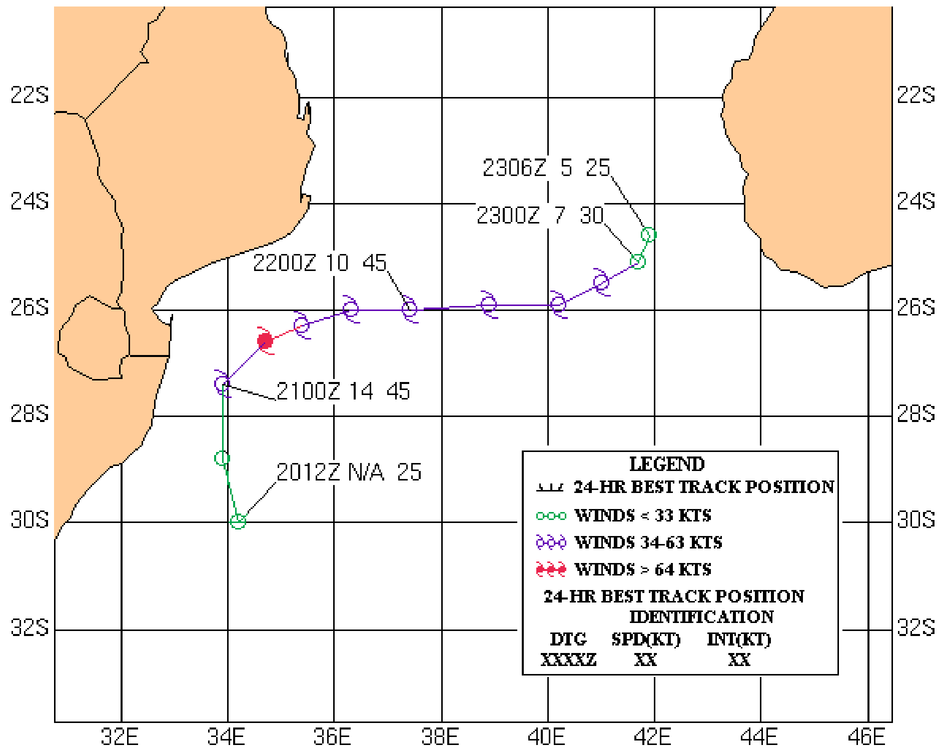


Figure 2-21S-2. 230632Z June 2001 TRMM visible image of TC 21S, located 100 nm west of Madagascar. At this time, the cyclone has lost most of its deep convection and has an estimated intensity of 25 knots. Note the very small areal extent of this system.

TROPICAL CYCLONE 21S
21-23 JUNE



3. TROPICAL CYCLONE FIX DATA

3.1 2001 SEASON

Tables 3-1 to 3-3 list the number of tropical cyclone center ”fixes”, or locations, made using satellite (visible, infrared, and microwave), scatterometer, radar, and synoptic data. Fixes made by the DOD tropical cyclone reconnaissance network sites are included in the tables as well as those fixes received from other sources (e.g., Japanese Meteorological Agency, Australian Bureau of Meteorology, and U.S. National Weather Service National Environmental Satellite Data and Information Service).

TABLE 3-1 SOUTH PACIFIC SOUTH INDIAN OCEAN FIX SUMMARY FOR 2001

Tropical Cyclone		Satellite	Scatt	Radar	Synoptic	Total
01S	-	45	2	0	0	47
02S	-	152	1	0	0	153
03S	Sam	156	0	2	2	160
04S	Ando	242	5	0	0	247
05S	Bindu	272	6	0	0	278
06S	Charly	203	2	0	0	205
07S	Terri	77	0	0	0	77
08P	Winsome	49	0	2	4	55
09S	Vincent	148	0	1	2	151
10S	-	50	0	0	1	51
11P	Oma	56	1	0	0	57
12P	Abigail	125	0	3	6	134
13P	Paula	137	2	0	0	139
14P	Rita	68	1	0	0	69
15S	Dera	157	2	0	0	159
16S	-	63	1	0	0	64
17S	Walter	126	5	2	0	133
18S	Evariste	122	2	0	0	124
19P	Sose	163	2	0	0	165
20S	Alistair	145	2	3	0	150
21S	-	43	1	0	0	44
	Totals	2599	35	13	15	2662
Percentage of Total		97.6	1.3	0.5	0.6	100

TABLE 3-2 WESTERN NORTH PACIFIC OCEAN FIX SUMMARY FOR 2001

Tropical Cyclone		Satellite	Scatt	Radar	Synoptic	Total
01W	-	80	2	0	16	98

TABLE 3-2 WESTERN NORTH PACIFIC OCEAN FIX SUMMARY FOR 2001						
02W	-	36	4	0	0	40
03W	Cimaron	156	2	33	5	196
04W	Chebi	133	1	0	0	134
05W	Durian	97	0	0	0	97
06W	Utor	170	6	0	6	182
07W	Trami	88	0	0	3	91
08W	-	7	0	0	0	7
09W	Kong-Rey	215	4	0	0	219
10W	Yutu	99	0	0	0	99
11W	Toraji	170	2	0	3	175
12W	Man-yi	252	3	0	0	255
13W	Usagi	59	1	0	5	65
14W	Pabuk	287	5	4	1	297
15W	-	19	0	0	0	19
16W	Wutip	214	3	0	0	217
17W	Sepat	105	2	0	0	107
18W	Fitow	60	0	0	13	73
19W	Danas	274	0	34	0	308
20W	Nari	441	2	242	10	695
21W	Vipa	139	2	16	0	157
22W	Francisco	208	2	0	0	210
23W	Lekima	215	0	0	4	219
24W	Krosa	158	1	0	0	159
25W	Haiyan	197	1	45	0	243
26W	Podul	271	1	0	0	272
27W	Lingling	186	1	0	6	193
28W	-	151	5	0	2	158
29W	-	91	2	0	0	93
30W	Kajiki	119	4	0	2	125
31W	-	55	3	0	5	63
32W	Vamei	97	0	0	3	100
33W	Faxai	383	3	0	6	392
	Totals	5232	62	374	90	5758
Percentage of Total		90.9	1.1	6.5	1.6	100

TABLE 3-3 NORTHERN INDIAN OCEAN FIX SUMMARY FOR 2001						
Tropical Cyclone		Satellite	Scatt	Radar	Synoptic	Total
01A	-	174	5	0	1	180
02A	-	78	1	0	0	79
03A	-	66	2	0	0	68
04B	-	34	4	0	0	38
	Totals	352	12	0	1	365
Percentage of Total		96.4	3.3	0	0.3	100

3.2 2001 Western North Pacific Satellite Fix Errors

Table 3-4 and Figure 3-1 depict 2001 western North Pacific fix errors (nm) of the Special Sensor Microwave Imager (SSMI), ERS-2 and SeaWinds Scatterometer (SCAT), Tropical Rainfall Measuring Mission (TRMM), and geostationary (VIS/IR) satellites based on Position Confidence Numbers (PCN). The TRMM sensor fixes have the lowest errors in the PCN 1,2 and PCN 5,6 category. However, Vis/IR fixes have slightly lower errors in the PCN 3,4 category.

TABLE 3-4 2001 Western North Pacific Satellite Fix Errors			
Sensor	PCN	Average Fix Error (nm)	Cases
SSMI	1,2	13.78	50
	3,4	16.87	115
	5,6	18.81	128
SCAT	1,2	22.74	24
	3,4	33.26	33
	5,6	0	0
TRMM	1,2	5.85	15
	3,4	12.98	22
	5,6	14.31	23
VIS/IR	1,2	7.11	627
	3,4	12.03	1095
	5,6	25.90	2897

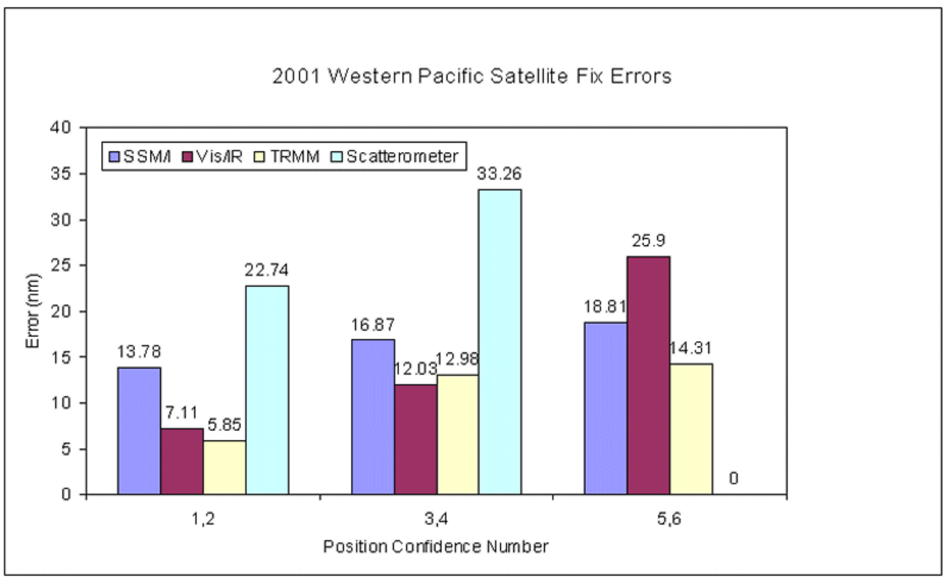


Figure 3-1. 2001 Western North Pacific fix errors (nm) based on Position Confidence Numbers (PCN).

4. SUMMARY OF FORECAST VERIFICATION

4.1 ANNUAL FORECAST VERIFICATION

Verification of warning positions and intensities at initial, 12-, 24-, 48-, and 72-hour forecast periods are made against the final best track. The (scalar) track forecast, along-track and cross-track errors (illustrated in Figure 4-1) were calculated for each verifying JTWC forecast. These data, in addition to a detailed summary for each tropical cyclone, are included as Chapter 4. This section summarizes verification data this year and contrasts it with annual verification statistics from previous years.

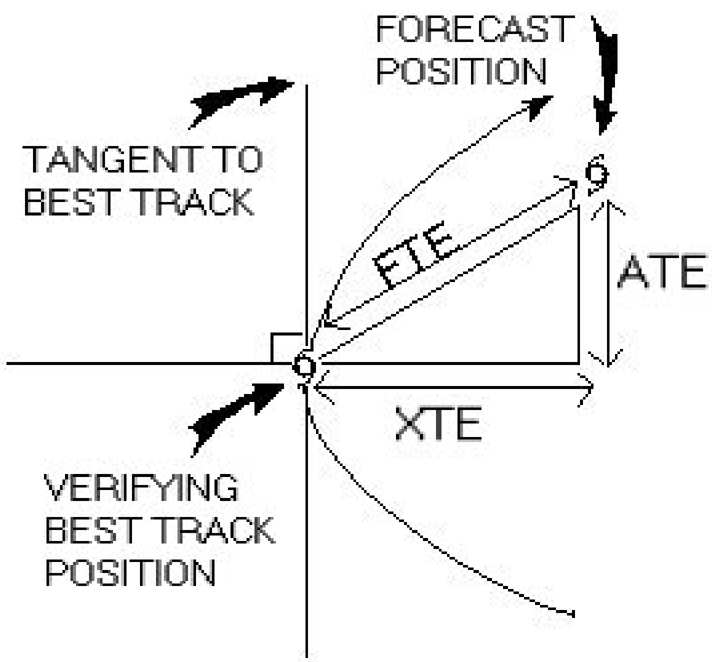


Figure 4-1. Definition of cross-track error (XTE), along-track error (ATE), and forecast track error (FTE). In this example, the forecast position is ahead of and to the right of the verifying best track position. Therefore, the XTE is positive (to the right of the best track) and the ATE is positive (ahead or faster than the best track). Adapted from Tsui and Miller, 1988.

4.1.1 WESTERN NORTH PACIFIC OCEAN

Table 4-1 includes mean track, along-track and cross-track errors from 1959, when JTWC was founded, until the present. Figure 4-2 shows mean track errors and a 5-year running mean of track errors at 24-, 48- and 72-hours since 1974.

Table 4-1 MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2001

	24-HOUR				48-HOUR				72-HOUR			
YEAR (Notes)	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)
1959	117*				267*							
1960	177*				354*							
1961	136				274							
1962	144				287				476			
1963	127				246				374			
1964	133				284				429			
1965	151				303				418			
1966	136				280				432			
1967	125				276				414			
1968	105				229				337			
1969	111				237				349			
1970	98	104			181	190			272	279		
1971	99	111	64		203	212	118		308	317	177	
1972	116	117	72		245	245	146		382	381	210	
1973	102	108	74		193	197	134		245	253	162	
1974	114	120	78		218	226	157		357	348	245	
1975	129	138	84		279	288	181		442	450	290	
1976	117	117	71		232	230	132		336	338	202	
1977	140	148	83		266	283	157		390	407	228	
1978	120	127	71	87	241	271	151	194	459	410	218	296
1979	113	124	76	81	219	226	138	146	319	316	182	214
1980	116	126	76	86	221	243	147	165	362	389	230	266
1981	117	124	77	80	215	221	131	146	342	334	219	206
1982	114	113	70	74	229	238	142	162	337	342	211	223
1983	110	117	73	76	247	260	164	169	384	407	263	259
1984	110	117	64	84	228	232	131	163	361	363	216	238
1985	112	117	68	80	228	231	138	153	355	367	227	230
1986	117	126	70	85	261	261	151	183	403	394	227	276
1987	101	107	64	71	211	204	127	134	318	303	186	198
1988	107	114	58	85	222	216	103	170	327	315	159	244
1989	107	120	69	83	214	231	127	162	325	350	177	265
1990	98	103	60	72	191	203	110	148	299	310	168	225
1991	93	96	53	69	187	185	97	137	298	287	146	229
1992	97	107	59	77	194	205	116	143	295	305	172	210
1993	102	112	63	79	205	212	117	151	320	321	173	226
1994**	96	105	56	76	172	186	105	131	244	258	152	176
1995	105	123	67	89	200	215	117	159	311	325	167	240
1996	85	105	56	76	157	178	89	134	252	272	137	203
1997	86	93	55	76	159	164	87	134	251	245	120	202
1998	127	124	58	98	263	239	127	178	392	370	201	274
1999	88	106	59	74	150	176	102	119	225	234	139	155
2000	75	81	45	57	136	142	80	98	205	209	118	144
2001	67	73	42	49	115	122	75	78	176	180	110	120

Table 4-1 MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2001

Averages (1978 - 2001)	103	111	63	78	203	211	120	148	315	317	180	222

1. Track errors were calculated for typhoons when intensities were at least 35kts at warning times

2. Cross-track and along-track errors were adopted by the JTWC in 1986. Right angle errors (used prior to 1986) were recomputed as cross-track errors after-the fact to extend the data base. See Figure 3-1 for the definitions of cross-track and along-track.

3. Mean forecast errors for all warned systems in Northwest Pacific.

*Forecast positions north of 35 degrees North latitude were not verified.

**1994 statistics were recalculated to resolve earlier Along and Cross-Track discrepancies.

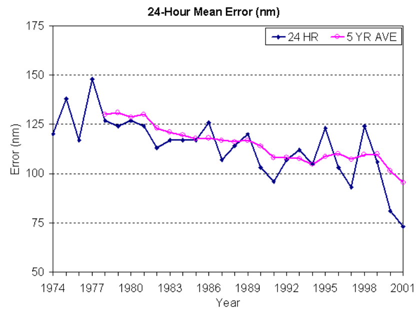


Figure 4-2a. Mean track forecast error (nm) and 5-year running mean for 24 hours for westerm North Pacific Ocean tropical cyclones from 1974-2001.

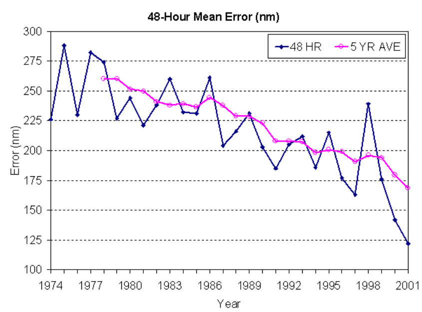


Figure 4-2b. Mean track forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1974-2001.

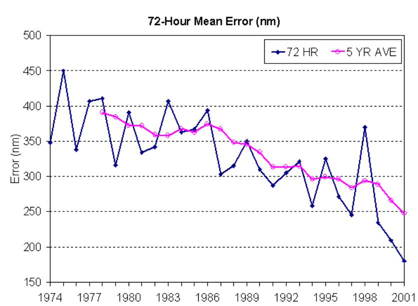


Figure 4-2c. Mean track forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1974-2001.

4.1.2 WESTERN NORTH PACIFIC OCEAN TRACK REVIEW WITH RESPECT TO THE SUBTROPICAL RIDGE

JTWC started to use a new forecast track review process during the 2000 western North Pacific Ocean tropical cyclone season that was adapted from the RSMC Tokyo procedures described in their Technical Review #2, JMA March 1998 by Nagata, Tahara and Muroi. This forecast track review process was very insightful and was used again for the 2001 western North Pacific Ocean tropical cyclone season.

For this statistical review (Table 4-2), JTWC and CLIP forecast positions for TAU 24, 48 and 72 were stratified into four categories according to past 6 hour movement noted on the final best track (see Figure 4-3 and 4-4). As with the RSMC Tokyo procedures, a direction of movement between 180 and 319 degrees indicated that a cyclone was located equatorward of (below) the subtropical ridge. A direction of movement between 010 and 179 degrees defined the cyclone as being located poleward of (above) the subtropical ridge and the direction of movement between 320 and 009 degrees placed the cyclone "on" the subtropical ridge. Another category, "QS" (quasi-stationary), was included to account for cyclones that had a speed of advance of 3 kts or less.

Table 4-2 summarizes a homogeneous comparision between JTWC and CLIP for tropical cyclones in 2000 with respect to stage of movement. Number of cases are given in parenthesis. % Improvement is defined as ((CLIP - JTWC)/CLIP)*100.

Table 4-2 Homogeneous comparison of JTWC and CLIP Forecast Errors (nm) for tropical cyclones in 2001 with respect to stage of movement.

TIME	FORECAST	BELOW	ON	ABOVE	QS	ALL
24 Hour	JTWC	71 (273)	69 (138)	86 (132)	64 (77)	73 (620)
	CLIP	97 (273)	104 (138)	110 (132)	103 (77)	102 (620)
	% Improvement	26.8	33.7	21.8	37.9	28.4
48 Hour	JTWC	127 (237)	118 (119)	129 (80)	110 (70)	123 (506)
	CLIP	202 (237)	246 (119)	212 (80)	233 (70)	218 (506)
	% Improvement	37.1	52.0	39.2	52.9	43.6
72 Hour	JTWC	202 (186)	177 (88)	136 (49)	163 (67)	182 (390)
	CLIP	302 (186)	387 (88)	331 (49)	411 (67)	344 (390)
	% Improvement	33.1	54.3	58.9	60.3	47.1

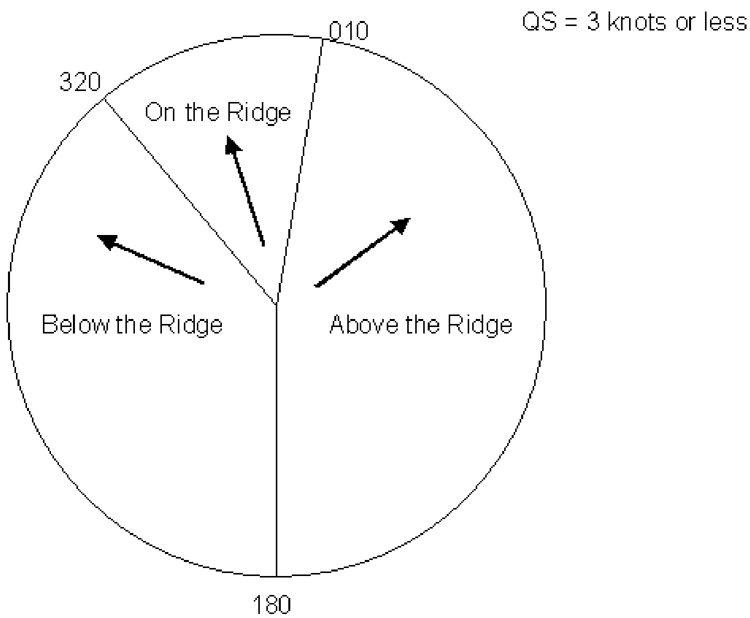


Figure 4-3. Graphical illustration of "Below", "On", "Above", and "QS". "Below" means that the direction of TC movement measured clockwise from the north is 180 to 319 degress, "On" is 320 - 009 degrees, and "Above" is 010 to 179 degrees respectfully. A fourth category "QS" is included to account for systems that are quasi-stationary (speed of advance of 3 knots or less).

Results for the 2001 season indicate a fast bias in the official JTWC forecast when the system was below the ridge (see Figure 4-4a). A slow bias is noted in the forecast when the system was above the ridge (see Figure 4-4c). When the system was on the ridge (Figure 4-4b) a westward bias is indicated in the JTWC forecast, indicating that systems recurved quicker than JTWC anticipated.

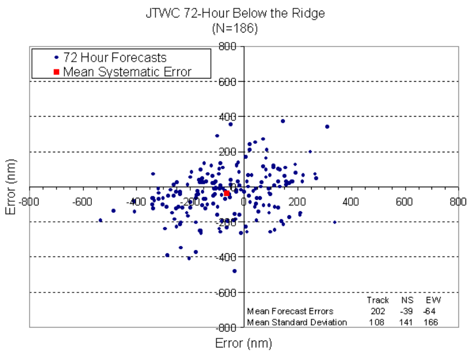


Figure 4-4a. Scatter diagram of center position errors of JTWC official forecasts at 72-hours for tropical cyclones (TC) in the western North Pacific during the 2001 season when the TC was below the ridge. Predicted TC centers are plotted in blue with respect to corresponding analyzed ones at the origin. Deviations upward (downward, leftward, rightward) from the origin indicate the predicted TC center is located north (south, east, west) of the analyzed one. The larger red square shows the mean (systematic) error, which is specified in nautical miles at the upper right hand corner of the graph. "EW" denotes the mean error in the "zonal" direction, "NS" denotes the mean error in the "meridional direction, while track error is the mean track error.

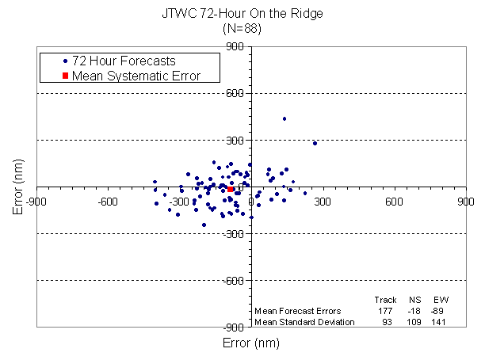


Figure 4-4b. Same as in Fig. 4-4a. except on the ridge.

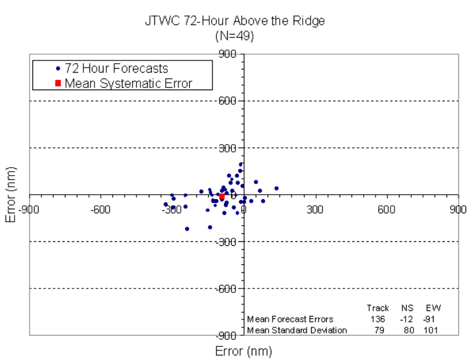


Figure 4-4c. Same as in Fig. 4-4a. except above the ridge.

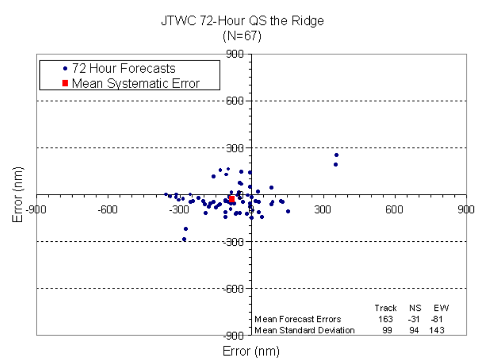


Figure 4-4d. Same as in Fig. 4-4a. except quasi-stationary.

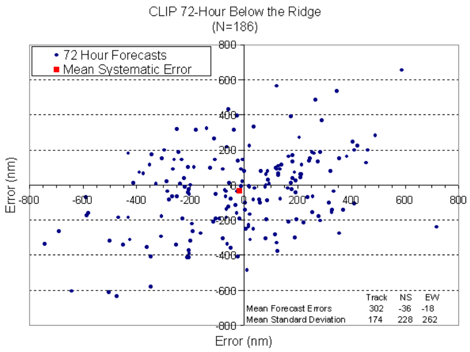


Figure 4-5a. Scatter diagram of center position errors of CLIP official forecasts at 72-hours for tropical cyclones (TC) in the western North Pacific during the 2001 season when the TC was below the ridge. Predicted TC centers are plotted in blue with respect to corresponding analyzed ones at the origin. Deviations upward (downward, leftward, rightward) from the origin indicate the predicted TC center is located north (south, east, west) of the analyzed one. The larger red square shows the mean (systematic) error, which is specified in nautical miles at the upper right hand corner of the graph. "EW" denotes the mean error in the "zonal" direction, "NS" denotes the mean error in the "meridional direction, while track error is the mean track error.

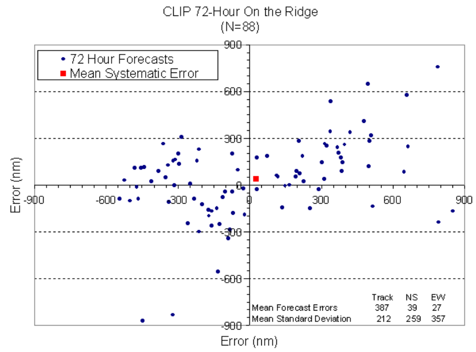


Figure 4-5b. Same as in Fig. 4-5a. except on the ridge.

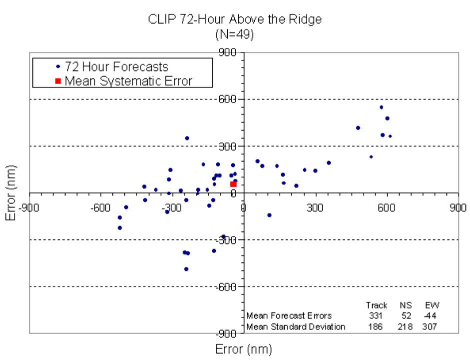


Figure 4-5c. Same as in Fig. 4-5a. except above the ridge.

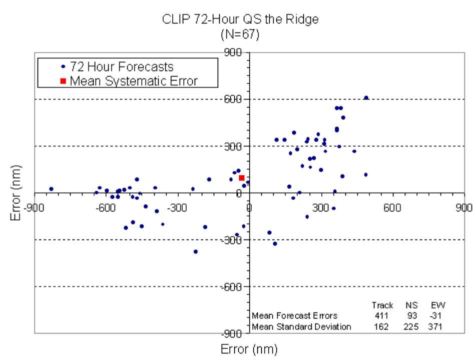


Figure 4-5d. Same as in Fig. 4-5a. except quasi-stationary.

4.1.3 NORTH INDIAN OCEAN

Table 4-3 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-6 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1985, and at 72-hours since 1986.

Table 4-3 JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE NORTH INDIAN OCEAN 1985-2001

	Initial Position		24-Hour				48-Hour				72-Hour			
	Number	Error	Number	Track	Along	Cross	Number	Track	Along	Cross	Number	Track	Along	Cross
1985	53	31	30	122	102	53	8	242	119	194	0			
1986	28	52	16	134	118	53	7	168	131	80	5	269	189	180
1987	83	42	54	144	97	100	25	205	125	140	21	305	219	188
1988	44	34	30	120	89	63	18	219	112	176	12	409	227	303
1989	44	19	33	88	62	50	17	146	94	86	12	216	164	11
1990	46	31	36	101	85	43	24	146	117	67	17	185	130	104
1991	56	38	43	129	107	54	27	235	200	89	14	450	356	178
1992	191	35	149	128	73	86	100	244	141	166	62	398	276	218
1993	36	27	28	125	87	79	20	198	171	74	12	231	176	116
1994	60	25	44	97	80	44	28	153	124	63	13	213	177	92
1995	54	30	47	138	119	58	32	262	247	77	20	342	304	109
1996	135	33	123	134	94	80	85	238	181	127	58	311	172	237
1997	56	29	42	119	87	49	29	201	168	92	17	228	195	110
1998	80	20	55	106	84	51	34	198	135	106	17	262	188	144
1999	49	8	41	79	59	38	22	184	130	116	10	374	309	177
2000	31	15	24	61	47	26	16	85	69	37	1	401	399	38
2001	50	12	41	61	40	37	31	115	71	71	22	166	44	154
(1985-2001)														
Avg	64	28	49	111	84	57	31	191	137	104	20	298*	220*	147*

*16 year average (1985 not available)

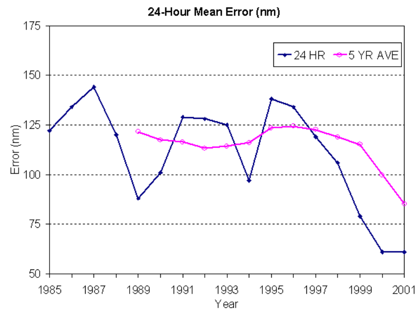


Figure 4-6a. Mean track forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1985-2001.

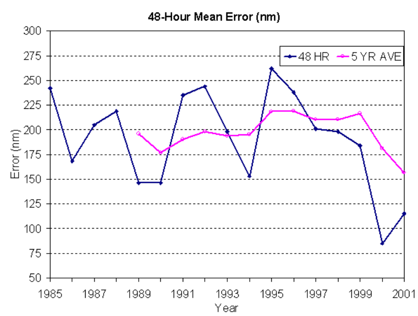


Figure 4-6b. Mean track forecast error (nm) and 5-year running mean for 48 hours, for North Indian Ocean tropical cyclones from 1985-2001.

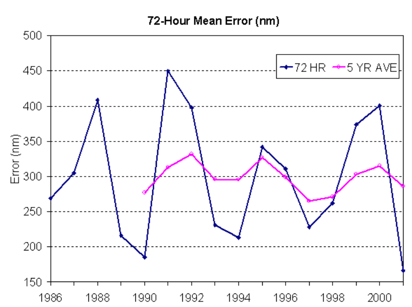


Figure 4-6c. Mean track forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1986-2001.

4.1.4 SOUTH PACIFIC AND SOUTH INDIAN OCEANS (SOUTHERN HEMISPHERE)

Table 4-4 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-7 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1981, and at 72-hours since 1995.

Table 4-4 JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE SOUTHERN HEMISPHERE 1985-2001

	Initial Position		24-Hour				48-Hour				72-Hour			
	Number	Error	Number	Track	Along	Cross	Number	Track	Along	Cross	Number	Track	Along	Cross
1985	306	36	257	134	92	79	193	236	169	132				
1986	279	40	227	129	86	77	171	262	169	164				
1987	189	46	138	145	94	90	101	280	153	138				
1988	204	34	99	146	98	83	48	290	246	144				
1989	287	31	242	124	84	73	186	240	166	136				
1990	272	27	228	143	105	74	177	263	178	152				
1991	264	24	231	115	75	69	185	220	152	129				
1992	267	28	230	124	91	64	208	240	177	129				
1993	257	21	225	102	74	57	176	199	142	114				
1994	386	28	345	115	77	68	282	224	147	134				
1995	245	24	222	108	82	55	175	198	144	108	53	291	169	190
1996	343	24	298	125	90	67	237	240	174	129	46	277	221	133
1997	561	24	499	109	82	72	442	210	163	135	150	288	248	175
1998	329	26	305	111	85	52	245	219	169	108	81	349	261	171
1999	348	17	322	113	80	64	245	226	159	132	59	286	198	164
2000	384	12	313	72	47	45	245	135	84	86	58	180	94	139
2001	187	13	147	84	61	44	113	148	105	86	11	248	132	197
(1985-2001)														
Avg	300	27	254	118	83	67	202	225	159	127	65*	274*	189*	167*

*7-year average

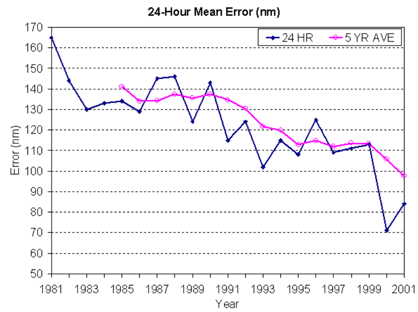


Figure 4-7a. Mean track forecast error (nm) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1981-2001.

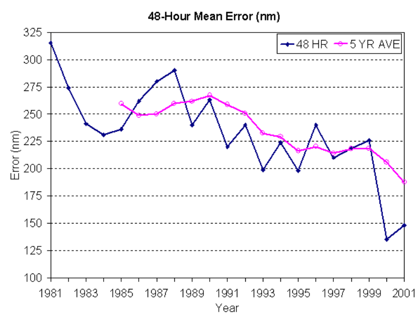


Figure 4-7b. Mean track forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1981-2001.

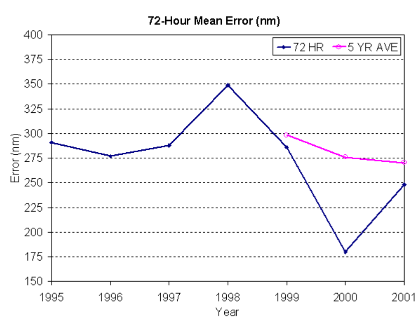


Figure 4-7c. Mean track forecast error (nm) at 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1995-2001.

4.2 TESTING AND RESULTS

A comparison of selected techniques is included in Table 4-5 for all western North Pacific tropical cyclones, Table 4-6 for North Indian Ocean tropical cyclones, and Table 4-7 for Southern Hemisphere tropical cyclones. For example, in Table 4-5 for the homogeneous comparison of the 12-hour mean forecast error between JTWC and NGPS, 332 cases were available. The average forecast error at 12 hours was 64 nm for NGPS and 44 nm for JTWC. The difference of 20 nm is shown in the lower right. Due to computational round-off, differences are not always exact.

Table 4-5 Error Statistics for Selected Objective Techniques (Western North Pacific)

12-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		JGSM		JTYM		CSUM		CLIP	
JTWC	684	42														
	42	0														
NGPS	332	44	365	69												
	64	20	69	0												
EGRR	303	43	291	64	322	57										
	51	8	53	-11	57	0										
GFDN	292	38	0	0	12	97	293	47								
	47	9	0	0	54	-43	47	0								
JGSM	260	42	256	62	232	47	0	0	262	53						
	52	10	53	-9	52	5	0	0	53	0						
JTYM	501	40	247	61	234	48	226	44	242	52	501	53				
	53	13	54	-7	55	7	53	9	48	-4	53	0				
CSUM	636	41	333	66	293	52	274	45	249	52	480	53	699	55		
	51	10	53	-13	51	-1	48	3	49	-3	49	-4	55	0		
CLIP	676	42	355	67	316	54	291	47	260	52	499	53	699	55	779	58
	52	10	56	-11	53	-1	50	3	49	-3	49	-4	54	-1	58	0

24-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		JGSM		JTYM		CSUM		CLIP		NCON	
JTWC	627	73																
	73	0																
NGPS	304	73	336	100														
	95	22	100	0														
EGRR	304	73	292	97	324	90												
	83	10	85	-12	90	0												
GFDN	264	68	0	0	11	121	266	74										
	74	6	0	0	84	-37	74	0										
JGSM	242	71	238	92	227	77	0	0	244	81								
	80	9	81	-11	80	3	0	0	81	0								
JTYM	468	69	228	93	229	78	211	71	226	79	468	86						
	86	17	85	-8	85	7	86	15	79	0	86	0						
CSUM	582	72	306	97	292	85	250	73	231	80	447	87	646	105				
	101	29	104	7	102	17	100	27	101	21	101	14	105	0				
CLIP	620	73	327	99	318	88	265	74	242	80	466	86	646	105	723	108		
	102	29	105	6	104	16	100	26	98	18	99	13	104	-1	108	0		
NCON	619	73	320	97	315	87	264	74	242	80	466	86	626	104	692	107	701	78
	73	0	76	-21	74	-13	70	-4	69	-11	67	-19	75	-29	78	-29	78	0

36-HOUR MEAN FORECAST ERROR (NM)

Table 4-5 Error Statistics for Selected Objective Techniques (Western North Pacific)

	JTWC		NGPS		EGRR		GFDN		JGSM		JTYM		CSUM		CLIP	
JTWC	569	99														
	99	0														
NGPS	274	98	301	133												
	131	33	133	0												
EGRR	245	97	234	128	262	113										
	109	12	108	-20	113	0										
GFDN	237	95	0	0	10	128	239	102								
	103	8	0	0	97	-31	102	0								
JGSM	215	95	213	129	187	100	0	0	218	108						
	108	13	108	-21	107	7	0	0	108	0						
JTYM	417	92	204	129	191	103	187	102	200	104	418	117				
	117	25	113	-16	115	12	119	17	111	7	117	0				
CSUM	530	99	276	132	237	110	226	101	206	107	399	118	592	159		
	157	58	160	28	158	48	154	53	160	53	157	39	159	0		
CLIP	562	99	294	132	257	112	238	102	216	107	416	117	592	159	662	162
	158	59	161	29	160	48	156	54	154	47	154	37	159	0	162	0

48-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		JGSM		JTYM		CSUM		CLIP		NCON	
JTWC	512	122																
	122	0																
NGPS	247	122	274	173														
	174	52	173	0														
EGRR	239	121	236	171	256	146												
	142	21	143	-28	146	0												
GFDN	209	118	0	0	7	157	210	137										
	137	19	0	0	92	-65	137	0										
JGSM	188	118	188	174	176	133	0	0	191	134								
	134	16	133	-41	131	-2	0	0	134	0								
JTYM	375	113	186	175	180	135	167	136	178	131	377	151						
	151	38	143	-32	146	11	156	20	138	7	151	0						
CSUM	479	123	251	173	234	145	201	136	180	132	362	152	540	216				
	218	95	218	45	215	70	216	80	222	90	218	66	216	0				
CLIP	506	123	269	173	252	145	210	137	189	134	375	152	540	216	603	220		
	218	95	220	47	214	69	214	77	212	78	212	60	217	1	220	0		
NCON	499	122	263	173	248	144	205	137	190	133	375	151	516	215	566	218	573	138
	134	12	133	-40	132	-12	126	-11	125	-8	122	-29	134	-81	137	-81	138	0

72-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		JGSM		JTYM		CSUM		CLIP		NCON	
JTWC	395	180																
	180	0																
NGPS	188	181	217	256														
	266	85	256	0														
EGRR	172	180	176	252	191	205												
	206	26	204	-48	205	0												
GFDN	155	176	0	0	5	219	159	219										
	221	45	0	0	200	-19	219	0										
JGSM	145	180	146	262	134	203	0	0	150	199								

Table 4-5 Error Statistics for Selected Objective Techniques (Western North Pacific)

	203	23	198	-64	190	-13	0	0	199	0								
JTYM	289	176	149	267	139	206	126	219	142	197	297	223						
	226	50	215	-52	216	10	227	8	208	11	223	0						
CSUM	368	182	198	258	174	209	152	216	142	194	286	224	432	327				
	339	157	327	69	320	111	336	120	338	144	341	117	327	0				
CLIP	390	182	212	257	188	206	159	219	149	200	295	224	432	327	485	339		
	344	162	338	81	327	121	341	122	334	134	339	115	336	9	339	0		
NCON	380	182	207	258	185	205	155	218	150	199	295	223	410	329	448	340	453	204
	203	21	196	-62	190	-15	192	-26	189	-10	188	-35	202	-127	205	-135	204	0

96-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR	
JTWC	191	289				
	289	0				
NGPS	90	294	160	351		
	371	77	351	0		
EGRR	83	294	122	339	134	283
	297	3	287	-52	283	0

120-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR	
JTWC	140	418				
	418	0				
NGPS	64	421	112	472		
	491	70	472	0		
EGRR	52	434	75	487	84	420
	416	-18	396	-91	420	0

Table 4-6 Error Statistics for Selected Objective Techniques (North Indian Ocean)

12-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		CLIP	
JTWC	46	40								
	40	0								
NGPS	22	49	31	87						
	70	21	87	0						
EGRR	10	64	13	115	16	87				
	79	15	88	-27	87	0				
GFDN	20	34	0	0	0	0	22	55		
	46	12	0	0	0	0	55	0		
CLIP	46	40	29	87	16	87	22	55	67	96
	43	3	84	-3	54	-33	84	29	96	0

24-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		CLIP	
JTWC	41	61								
	61	0								
NGPS	20	69	29	116						

Table 4-6 Error Statistics for Selected Objective Techniques (North Indian Ocean)

	107	38	116	0						
EGRR	19	70	23	120	26	91				
	82	12	84	-36	91	0				
GFDN	17	56	0	0	0	0	18	93		
	83	27	0	0	0	0	93	0		
CLIP	41	61	28	118	26	91	18	93	62	152
	68	7	106	-12	76	-15	141	48	152	0

36-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		CLIP	
JTWC	35	83								
	83	0								
NGPS	16	78	25	144						
	116	38	144	0						
EGRR	5	94	9	162	11	110				
	94	0	100	-62	110	0				
GFDN	12	86	0	0	0	0	12	125		
	125	39	0	0	0	0	125	0		
CLIP	35	83	24	144	11	110	12	125	56	193
	100	17	150	6	93	-17	102	-23	193	0

48-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		CLIP	
JTWC	31	115								
	115	0								
NGPS	12	104	19	131						
	98	-6	131	0						
EGRR	16	124	14	107	21	136				
	136	12	121	14	136	0				
GFDN	11	113	0	0	0	0	11	141		
	141	28	0	0	0	0	141	0		
CLIP	31	115	18	125	21	136	11	141	50	326
	141	26	278	153	135	-1	138	-3	326	0

72-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		CLIP	
JTWC	22	166								
	166	0								
NGPS	8	152	13	177						
	116	-36	177	0						
EGRR	10	182	10	175	14	173				
	191	9	174	-1	173	0				
GFDN	9	144	0	0	0	0	9	223		
	223	79	0	0	0	0	223	0		
CLIP	22	166	13	177	14	173	9	223	39	536
	192	26	151	-26	172	-1	192	-31	536	0

Table 4-7 Error Statistics for Selected Objective Techniques (Southern Hemisphere)

Table 4-7 Error Statistics for Selected Objective Techniques (Southern Hemisphere)

12-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		HPAC	
JTWC	164	50								
	50	0								
NGPS	48	58	164	81						
	76	18	81	0						
EGRR	43	56	141	79	179	74				
	64	8	64	-15	74	0				
GFDN	86	46	0	0	2	164	134	58		
	55	9	0	0	21	-143	58	0		
HPAC	161	50	156	78	168	74	129	58	416	69
	65	15	69	-9	72	-2	66	8	69	0

24-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		HPAC		NCON		SCON	
JTWC	147	84												
	84	0												
NGPS	43	94	150	103										
	105	11	103	0										
EGRR	40	89	139	102	181	108								
	95	6	97	-5	108	0								
GFDN	78	77	0	0	1	116	119	83						
	83	6	0	0	55	-61	83	0						
HPAC	145	83	144	101	170	109	114	84	389	118				
	112	29	114	13	119	10	115	31	118	0				
NCON	141	83	136	97	151	103	112	84	328	118	330	90		
	81	-2	80	-17	93	-10	79	-5	90	-28	90	0		
SCON	137	80	133	95	147	100	107	81	316	115	318	88	318	102
	111	31	79	-16	122	22	76	-5	102	-13	102	14	102	0

36-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		HPAC	
JTWC	129	113								
	113	0								
NGPS	37	122	136	137						
	137	15	137	0						
EGRR	28	136	98	136	128	148				
	129	-7	134	-2	148	0				
GFDN	68	111	0	0	0	0	104	106		
	114	3	0	0	0	0	106	0		
HPAC	128	113	132	134	119	149	100	107	359	170
	162	49	163	29	182	33	164	57	170	0

48-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		HPAC		NCON		SCON	
JTWC	113	148												
	148	0												
NGPS	33	162	121	180										
	184	22	180	0										

Table 4-7 Error Statistics for Selected Objective Techniques (Southern Hemisphere)

EGRR	31	166	114	181	153	185								
	167	1	179	-2	185	0								
GFDN	59	142	0	0	1	186	93	137						
	144	2	0	0	69	-117	137	0						
HPAC	113	148	118	177	144	187	89	138	325	221				
	219	71	215	38	226	39	215	77	221	0				
NCON	111	146	114	173	129	181	87	138	275	219	276	156		
	146	0	144	-29	162	-19	144	6	157	-62	156	0		
SCON	110	145	112	173	125	177	85	138	268	215	269	155	269	154
	147	2	142	-31	160	-17	144	6	155	-60	154	-1	154	0

72-HOUR MEAN FORECAST ERROR (NM)

	JTWC		NGPS		EGRR		GFDN		HPAC		NCON		SCON	
JTWC	11	248												
	248	0												
NGPS	2	174	87	255										
	241	67	255	0										
EGRR	4	156	78	253	118	255								
	128	-28	244	-9	255	0								
GFDN	5	365	0	0	1	469	62	200						
	382	17	0	0	145	-324	200	0						
HPAC	11	248	85	252	110	258	59	197	258	318				
	355	107	307	55	311	53	321	124	318	0				
NCON	11	248	82	250	97	255	57	199	212	314	213	227		
	259	11	220	-30	230	-25	201	2	227	-87	227	0		
SCON	10	254	80	251	93	248	55	196	206	311	207	225	207	227
	261	7	216	-35	233	-15	210	14	227	-84	227	2	227	0

5. TROPICAL CYCLONE WARNING VERIFICATION STATISTICS

5.1 WARNING VERIFICATION STATISTICS

The verification data in this chapter includes best tracks (6-hourly positions and intensities), and JTWC forecasts (12-, 24-, 36-, 48-, and 72-hour position, and intensity). These data are archived and available for download from the JTWC web page.

5.2 WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN VERIFICATION TABLES

This section includes this year's verification statistics for each western North Pacific and North Indian Ocean tropical cyclone warned on by JTWC.

Statistics for JTWC on TD 01W

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01021606	2	8.8N	133.9E	15 2	14								0							
01021612	3	9.0N	133.1E	20 2	07								0							
01021618	4	9.3N	131.8E	20 1	91								0							
01021700	5	9.6N	130.5E	20	13								0							
01021706	6	9.8N	129.3E	20	6								0							
01021712	7	10.0N	128.1E	20	6								0							
01021718	8	10.2N	127.0E	20	45								0							
01021800	9	10.5N	125.9E	25	30	36	37	49	77	165			0	5	5	10	15	15		
01021806	10	10.9N	124.8E	25	18	43	67	63	86	143			0	0	5	10	15	20		
01021812	11	11.2N	123.9E	25	18	6	13	21	58	131			0	0	5	15	15	20		
01021818	12	11.3N	123.3E	25	56	96	122	139	172	172			0	0	5	15	10	20		
01021900	13	11.4N	122.6E	25	64	91	113	149	180	250			0	0	10	15	15	20		
01021906	14	11.4N	122.0E	25	13	37	77	113	152				0	0	10	10	15			
01021912	15	11.4N	121.5E	25	34	54	107	147	186				0	5	10	15	20			
01021918	16	11.6N	121.0E	25	16	42	101	145	194				0	5	5	15	20			
01022000	17	11.8N	120.7E	20	63	63	114	160	205				0	5	5	10	10			
01022006	18	12.0N	120.5E	20	69	92							0	-10						
			AVERAGE		63	56	84	109	145	172			0	3	7	13	15	19		
			BIAS										0	1	7	13	15	19		
			# CASES		17	10	9	9	9	5			17	10	9	9	9	5		

Statistics for JTWC on TD 02W

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120

Statistics for JTWC on TD 02W

01041600		4.2N	138.2E	20																
01041606		4.6N	137.5E	20																
01041612		4.9N	136.8E	20																
01041618	1	5.3N	136.1E	20	37								0							
01041712	2	6.5N	134.0E	20 1	85								0							
01041718	3	6.9N	133.2E	20	33								0							
01041806	4	7.9N	132.0E	20 1	57								0							
01041812	5	8.4N	131.5E	25 1	20	143	183	218	255	346			0	5	10	10	15	15		
01041818	6	8.8N	131.1E	25	35	48	40	38	8	38			0	5	5	5	0	0		
01041900	7	9.3N	130.6E	20	29	8							5	0						
01042006	8	11.5N	128.8E	20	76								0							
01042012	9	11.7N	128.4E	20	47								0							
01042018	10	11.9N	128.1E	20	64								0							
01042112	11	12.9N	127.2E	20	5								0							
01042118	12	13.2N	126.8E	20	5								0							
01042200		13.6N	126.4E	20																
01042206		14.1N	126.2E	20																
01042212		14.7N	126.0E	20																
01042218		15.5N	126.1E	20																
			AVERAGE		67	66	112	128	132	192			0	3	8	8	8	8		
			BIAS										0	3	8	8	8	8		
			# CASES		12	3	2	2	2	2			12	3	2	2	2	2		

Statistics for JTWC on TS 03W Cimaron

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01050500		5.3N	129.0E	25																
01050506	1	5.9N	128.2E	20	25								0							
01050512	2	6.5N	127.7E	20	33								0							
01050518	3	7.0N	127.3E	20	89								0							
01050606	4	8.3N	126.8E	20 1	36								0							
01050612	5	9.0N	126.6E	20	56								0							
01050618	6	9.5N	126.5E	20	24								0							
01050700	7	9.9N	126.5E	25	13	36	86	144	208	153			-5	0	5	10	10	5		
01050706	8	10.3N	126.5E	25	30	36	60	80	137	50			0	5	10	10	5	5		
01050712	9	10.7N	126.2E	25	13	19	42	103	134	70			5	5	5	5	5	-5		
01050718	10	11.0N	125.6E	25	13	32	71	147	147	107			0	0	0	-5	0	-5		
01050800	11	11.3N	124.9E	25	6	19	76	113	50	79			0	0	0	0	0	0		
01050806	12	11.6N	124.2E	25	41	75	134	123	42	117			0	0	-5	0	0	0		
01050812	13	11.7N	123.5E	25	78	104	122	59	18	157			0	0	-5	-5	-5	-5		
01050818	14	11.8N	122.6E	25	24	89	70	27	68	126			0	-5	-5	-5	-5	0		
01050900	15	11.9N	121.5E	25	17	36	76	121	154	183			0	0	0	-5	0	0		
01050906	16	12.0N	120.4E	30	13	49	114	160	191	267			0	0	0	-5	0	0		
01050912	17	12.5N	119.6E	30	18	64	121	166	211	325			0	-5	-5	-5	-5	0		
01050918	18	13.1N	119.3E	30	12	59	123	176	203	355			0	0	-5	-5	-5	-5		
01051000	19	13.8N	119.3E	35	16	47	92	138	182	292	561		0	-5	0	-5	0	-5	-10	
01051006	20	14.5N	119.3E	35	13	35	77	108	152	228	460		0	0	10	15	30	25	20	
01051012	21	15.3N	119.2E	40	13	49	51	69	119	221	333		0	5	5	15	25	10	5	
01051018	22	16.1N	119.1E	40	5	13	64	93	99	134			0	5	5	15	15	5		
01051100	23	17.0N	119.0E	40	17	24	74	80	83	180			0	-5	-5	-10	-20	-30		
01051106	24	17.7N	119.2E	40	18	56	108	128	155	140			0	0	5	-10	-20	-20		
01051112	25	18.1N	119.5E	45	48	102	109	120	105	245			-5	5	5	-10	-25	-25		

Statistics for JTWC on TS 03W Cimaron

01051118	26	18.4N	119.8E	45	29	29	57	98	96				0	5	5	10	-10			
01051200	27	18.8N	120.1E	45	5	17	33	42	71				0	5	5	5	-5			
01051206	28	19.4N	120.4E	45	23	45	13	77	130				-5	-10	-15	-25	-15			
01051212	29	20.0N	120.9E	45	5	25	50	92	122				-5	-15	-20	-25	-20			
01051218	30	20.7N	121.4E	50	8	48	90	110					-5	-5	-20	-10				
01051300	31	21.5N	122.1E	50	23	53	87	97					0	-5	-10	-10				
01051306	32	22.1N	122.7E	50	0	42	61						0	-15	-5					
01051312	33	23.2N	124.0E	55	16	33	48						-5	-10	-10					
01051318	34	24.2N	125.2E	60	8	8							-5	5						
01051400	35	25.3N	126.5E	55	8	11							0	-5						
01051406	36	26.4N	127.9E	45	0								0							
01051412	37	27.4N	129.3E	50	0								0							
			AVERAGE		25	43	78	107	125	181	451		1	4	6	9	10	8	12	
			BIAS										-1	-2	-2	-2	-2	-3	5	
			# CASES		37	29	27	25	23	19	3		37	29	27	25	23	19	3	

Statistics for JTWC on TY 04W Chebi

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01061906		11.1N	138.4E	20																
01061912		11.7N	137.5E	25																
01061918	1	11.8N	135.9E	30	13	61	161	152	170	264			-5	0	0	5	5	-5		
01062000	2	12.3N	134.5E	30	39	139	216	172	217	242			0	-5	0	10	15	-5		
01062006	3	13.0N	133.1E	35	29	140	152	178	210	259	397		0	-5	-5	-5	-10	-15	30	
01062012	4	13.7N	131.4E	40	8	97	110	120	164	162			0	0	-5	-5	-5	-5		
01062018	5	14.1N	129.2E	45	6	18	47	103	158	258			0	0	-5	-10	-15	0		
01062100	6	14.6N	127.9E	45	21	26	60	106	136	413			0	-5	-10	-15	-35	30		
01062106	7	15.2N	127.2E	50	0	50	107	152	160	482			-5	-10	-20	-30	-30	40		
01062112	8	16.0N	125.9E	55	0	56	107	125	162				0	-5	-10	-35	-20			
01062118	9	17.1N	124.7E	60	12	46	86	98	192				0	-15	-25	-30	-10			
01062200	10	18.3N	123.6E	65	8	37	25	84	207				0	-5	-25	-10	25			
01062206	11	19.3N	122.4E	75	0	18	30	119	294				0	0	-10	-15	15			
01062212	12	20.3N	121.1E	75	6	43	77	180					0	-10	-5	20				
01062218	13	21.1N	119.9E	90	0	6	49	149					0	-15	-20	0				
01062300	14	22.1N	119.4E	100	0	23	70						-10	-10	10					
01062306	15	23.3N	119.1E	95	0	45	156						5	-5	20					
01062312	16	24.8N	119.4E	90	12	43							0	30						
01062318	17	26.3N	119.7E	85	10	45							5	15						
01062400	18	28.3N	120.5E	45	18								10							
01062406		30.1N	121.9E	35																
			AVERAGE		10	52	97	134	188	297	397		2	8	11	15	17	14	30	
			BIAS										0	-3	-7	-9	-6	6	30	
			# CASES		18	17	15	13	11	7	1		18	17	15	13	11	7	1	

Statistics for JTWC on TY 05W Durian

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01062900	2	15.0N	117.8E	20	0								5							
01062906	3	15.4N	117.2E	25	8								-5							
01062912	4	15.8N	116.7E	25	0								0							

Statistics for JTWC on TY 05W Durian

01062918	5	16.3N	116.2E	30	18	29	77	87	90	101			-5	-10	-20	-20	-20	-5		
01063000	6	16.7N	115.6E	35	13	45	48	43	41	46			0	-5	-5	-10	-10	0		
01063006	7	17.3N	115.0E	40	11	34	18	29	37	123			0	-5	0	-15	-30	5		
01063012	8	18.1N	114.3E	45	0	12	25	34	72				0	0	-5	-15	-15			
01063018	9	18.9N	113.9E	55	11	29	40	98	137				-5	-5	-10	-30	-15			
01070100	10	19.2N	112.9E	55	16	49	83	132					0	-5	-35	-30				
01070106	11	19.7N	112.2E	65	5	38	56	98	168				0	-10	-20	-5	-5			
01070112	12	20.3N	111.5E	70	13	36	60	98					0	-15	-10	0				
01070118	13	20.9N	110.7E	75	5	48	90	120					0	-10	5	5				
01070200	14	21.3N	109.8E	75	5	18	42						-5	5	15					
01070206	15	21.7N	108.7E	70	6	21	24						0	15	15					
01070212	16	22.1N	108.1E	55	8	6							10	15						
01070218	17	22.5N	107.4E	40	18	25							0	5						
01070300		22.9N	106.8E	30																
01070306		23.5N	106.2E	25																
			AVERAGE		9	30	51	82	91	90			2	8	13	14	16	3		
			BIAS										0	-2	-6	-13	-16	0		
			# CASES		16	13	11	9	6	3			16	13	11	9	6	3		

Statistics for JTWC on TY 06W Utor

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01063000	7	8.3N	140.6E	25	54								-5							
01063006	8	8.1N	139.9E	25	81								-5							
01063012	9	7.8N	139.4E	25 1	00								-5							
01063018	10	7.6N	138.8E	25	80								0							
01070100	11	7.5N	138.2E	25	59								0							
01070106	12	7.6N	137.8E	30	29	59	125	181	264	395			0	5	5	-15	-15	-25		
01070112	13	8.2N	137.6E	30	23	51	21	24	50	136			0	0	-5	-15	-5	-5		
01070118	14	9.2N	137.6E	30	37	56	59	106	150	178	296	584	5	0	-15	-10	-5	5	30	50
01070200	15	10.5N	137.1E	35	16	72	73	49	113	165	269	575	0	-5	-15	-5	-5	15	25	20
01070206	16	11.5N	136.1E	35	13	17	65	92	125	160	272		0	-20	-15	-10	-10	20	45	
01070212	17	12.3N	134.9E	45	8	42	66	105	147	181	371		0	-10	0	0	0	25	45	
01070218	18	13.2N	133.5E	60	13	76	152	228	201	189	284		-15	0	5	5	20	30	60	
01070300	19	14.0N	131.6E	65	17	78	153	199	158	208	378		-5	5	5	10	30	35	60	
01070306	20	15.1N	129.7E	65	21	36	60	81	69	32			0	5	10	20	35	30		
01070312	21	16.2N	128.0E	65	12	29	66	60	31	51			0	0	10	20	15	5		
01070318	22	17.3N	126.1E	70	8	74	96	79	66	98			0	-5	10	20	15	10		
01070400	23	18.2N	124.1E	75	34	93	90	108	98	70			0	0	20	20	0	20		
01070406	24	18.7N	122.1E	80	18	62	57	86	85				-5	10	25	10	5			
01070412	25	19.1N	120.5E	80	18	51	46	60	56				5	20	20	10	10			
01070418	26	19.5N	119.8E	75	18	26	25	55	79				0	20	15	30	15			
01070500	27	20.4N	118.6E	70	0	26	19	56	83				0	10	5	20	15			
01070506	28	20.9N	117.6E	65	6	21	6	49					0	0	10	10				
01070512	29	21.4N	116.7E	65	8	19	66	67					-10	-10	5	10				
01070518	30	21.9N	115.9E	65	11	47	45						0	20	10					
01070600	31	22.5N	114.8E	65	0	33	39						0	15	20					
01070606	32	23.2N	113.6E	45	0	17							0	0						
01070612	33	23.6N	112.3E	40	0	6							0	5						
01070618	34	23.8N	111.4E	35	0								0							
01070700		24.0N	110.4E	25																
			AVERAGE		25	45	66	94	111	155	312	579	2	8	11	13	13	19	44	35

Statistics for JTWC on TY 06W Utor

			BIAS										-1	3	6	7	8	14	44	35
			# CASES		28	22	20	18	16	12	6	2	28	22	20	18	16	12	6	2

Statistics for JTWC on TD 07W Trami

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01070718		12.8N	130.3E	25																
01070800	1	13.4N	129.6E	25	60								0							
01070806	2	14.2N	128.8E	25	16								0							
01070812	3	15.1N	128.0E	25	37								0							
01070818	4	16.4N	126.8E	25	29								0							
01070900	5	17.4N	126.0E	25	11	21	61	94	123	229			0	5	0	10	20	40		
01070906	6	18.1N	125.6E	25	17	29	66	107	107	164			0	0	-5	10	20	35		
01070912	7	18.7N	125.2E	25	5	38	59	78	98				0	-5	0	10	20			
01070918	8	19.4N	124.6E	30	5	36	64	66	105				-5	-5	10	20	30			
01071000	9	20.0N	124.0E	35	11	50	79	96	144				-5	0	10	20	30			
01071006	10	20.5N	123.5E	40	8	22	11	56	87				-5	0	10	20	30			
01071012	11	21.0N	123.0E	35	12	35	71	55					0	0	10	25				
01071018	12	21.5N	122.5E	35	28	50	16	20					0	10	5	20				
01071100	13	22.0N	122.2E	35	30	38	44						0	-5	0					
01071106	14	22.5N	122.0E	35	30	49	65						0	0	5					
01071112	15	22.9N	121.5E	35	11	44							0	5						
01071118	16	23.4N	120.7E	30	35	72							0	5						
01071200	17	24.1N	120.2E	25	8								0							
01071206	18	24.6N	119.9E	20	0								0							
			AVERAGE		20	40	54	72	111	197			1	3	6	17	25	38		
			BIAS										-1	1	5	17	25	38		
			# CASES		18	12	10	8	6	2			18	12	10	8	6	2		

Statistics for JTWC on TD 08W

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01071018	1	21.4N	176.9E	25	21	96							0	5						
01071100	2	20.9N	177.7E	25	11								0							
01071106	3	21.1N	179.0E	20	5								5							
			AVERAGE		13	96							2	5						
			BIAS										2	5						
			# CASES		3	1							3	1						

Statistics for JTWC on TY 09W Kong-Rey

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01072100	1	23.3N	152.0E	20	0								0							
01072106	2	24.0N	151.8E	25	0	16	40	54	66	66			0	0	0	0	5	10		
01072112	3	24.6N	151.5E	30	5	50	70	74	108	113			0	-5	-5	-5	0	5		
01072118	4	24.9N	151.1E	35	10	45	43	72	85	60	232	587	0	-5	-10	-5	-5	-5	5	0
01072200	5	25.0N	150.3E	40	5	27	69	85	77	113	358	775	0	-5	-5	0	0	5	5	0
01072206	6	25.2N	149.6E	45	0	33	84	90	53	91	307	585	0	0	5	5	10	5	5	5

Statistics for JTWC on TY 09W Kong-Rey

01072212	7	25.4N	149.0E	50	0	44	74	77	64	118	340	632	0	0	5	5	10	0	-10	-5
01072218	8	25.4N	148.4E	55	5	57	74	66	96	275	546	889	0	0	0	5	10	15	10	25
01072300	9	25.3N	148.0E	60	0	6	22	50	96	254	523	832	-5	-10	-15	-15	-5	5	0	20
01072306	10	25.2N	147.2E	60	5	13	34	60	106	288	561	836	-5	-10	-10	-10	5	15	10	25
01072312	11	25.2N	146.2E	65	5	20	50	68	136	343	586	888	0	-5	-5	-5	5	10	15	45
01072318	12	25.2N	145.3E	70	0	53	69	75	144	344	603	881	-5	-5	-5	-5	5	10	15	40
01072400	13	25.6N	144.1E	75	8	25	64	107	170	319	518	740	0	-5	-5	0	5	10	30	60
01072406	14	26.0N	143.0E	75	0	6	38	91	141	320	503		0	0	5	10	0	-15	0	
01072412	15	26.3N	142.0E	80	28	40	78	113	126	170	219		-5	0	5	5	-10	-15	5	
01072418	16	26.8N	141.4E	80	18	26	53	77	118	187	307		-5	0	5	5	-10	-10	45	
01072500	17	27.1N	140.9E	80	17	32	65	101	136	212	359		-5	0	5	0	-10	-5	35	
01072506	18	27.5N	140.5E	80	36	37	68	111	156	234			0	5	0	-15	-20	-15		
01072512	19	28.0N	140.4E	80	26	39	100	168	233	405			5	5	-5	-15	-15	5		
01072518	20	28.6N	140.6E	80	10	22	67	113	173	302			0	0	-10	-15	-5	25		
01072600	21	29.2N	140.9E	80	13	36	78	129	186	295			-5	-15	-20	-20	-10	25		
01072606	22	29.7N	141.3E	80	5	45	87	127	185				-5	-15	-20	-10	-5			
01072612	23	30.3N	142.1E	85	16	48	102	173	299				-10	-15	-15	-5	15			
01072618	24	30.7N	142.8E	85	26	36	82	202	343				-5	0	5	10	35			
01072700	25	31.2N	143.7E	85	15	85	173	329	496				0	5	10	30	40			
01072706	26	31.6N	144.8E	85	7	39	105	216					-5	10	15	40				
01072712	27	31.9N	145.8E	80	0	35	122	231					-5	10	25	30				
01072718	28	32.3N	146.9E	70	0	21	23						-5	-5	15					
01072800	29	33.0N	148.2E	65	0	30	62						-10	15	20					
01072806	30	33.8N	149.9E	60	0	15							-10	15						
01072812		34.6N	151.6E	40																
01072818		35.7N	153.3E	30																
01072900		36.9N	154.9E	25																
			AVERAGE		9	34	71	118	158	225	426	765	3	6	9	10	10	11	14	23
			BIAS										-3	-1	0	1	2	4	12	22
			# CASES		30	29	28	26	24	20	14	10	30	29	28	26	24	20	14	10

Statistics for JTWC on TY 10W Yutu

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01072212	2	18.7N	126.7E	25 1	30								0							
01072218	3	19.1N	125.4E	25	23	59	77	108	125	168			0	0	0	-25	-30	-40		
01072300	4	19.6N	123.9E	25	35	57	119	166	186	155			0	-5	-20	-45	-35	-25		
01072306	5	20.0N	122.6E	30	0	41	74	109	136	163			-5	5	-25	-35	-30	-10		
01072312	6	20.1N	121.1E	35	20	53	90	125	130	164			0	-15	-40	-30	-35	-5		
01072318	7	20.2N	119.7E	35	11	33	70	95	114	135			0	-30	-40	-25	-30	5		
01072400	8	20.4N	118.3E	55	8	31	78	87	109				-10	-30	-25	-35	-30			
01072406	9	20.5N	116.9E	70	13	51	54	82	109				0	-5	5	-20	-15			
01072412	10	20.6N	115.7E	85	21	36	45	58	70				-15	5	10	-5	-5			
01072418	11	20.7N	114.6E	85	0	21	16	33	38				0	10	15	10	5			
01072500	12	20.6N	113.9E	85	0	32	48	66					0	5	25	50				
01072506	13	20.8N	113.1E	80	0	29	33	45					0	5	25	40				
01072512	14	21.2N	112.4E	80	16	40	46						0	10	25					
01072518	15	21.4N	111.2E	75	0	18	16						5	0	10					
01072600	16	21.6N	110.4E	60	0	21							0	10						
01072606		21.8N	109.6E	45																
01072612		22.1N	108.8E	35																
01072618		22.4N	108.1E	25																

Statistics for JTWC on TY 10W Yutu

			AVERAGE		19	37	59	89	113	157			2	10	20	29	24	17		
			BIAS										-2	-3	-3	-11	-23	-15		
			# CASES		15	14	13	11	9	5			15	14	13	11	9	5		

Statistics for JTWC on TY 11W Toraji

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01072506	1	14.3N	134.7E	20	42								0							
01072512	2	14.5N	133.8E	25	11								-5							
01072518	3	15.0N	132.8E	25	13	18	93	140	188	273			0	0	-5	-15	-30	-35		
01072600	4	15.7N	131.9E	25	8	46	113	142	182	220			0	0	-10	-20	-30	-35		
01072606	5	16.2N	130.8E	25	46	111	163	207	239	275			0	-10	-15	-30	-35	-25		
01072612	6	16.6N	129.6E	25	53	145	194	259	282	229	224	181	0	-10	-20	-30	-35	-30	-20	35
01072618	7	16.8N	128.3E	35	11	29	67	53	34	41	53		0	-10	-30	-40	-35	-45	0	
01072700	8	17.0N	127.4E	40	0	8	6	38	48	82	128		-5	-10	-20	-30	-25	-15	20	
01072706	9	17.2N	126.8E	50	12	13	31	23	18	93	146		0	-20	-20	-5	-5	0	50	
01072712	10	17.6N	126.1E	55	0	36	45	68	66	117	92		0	-20	-20	-5	-10	0	55	
01072718	11	17.8N	125.6E	75	0	18	34	33	66	132			0	-15	-10	-5	-15	30		
01072800	12	18.3N	124.8E	75	0	13	25	63	70	113			0	-5	0	0	5	50		
01072806	13	19.1N	124.2E	90	0	18	25	55	62	87			0	5	10	0	20	55		
01072812	14	19.7N	123.7E	90	0	18	11	53	65	74			0	5	5	5	15	55		
01072818	15	20.5N	123.1E	90	8	25	23	28	58				0	5	0	20	35			
01072900	16	21.3N	122.8E	90	6	16	49	65	76				0	0	10	20	45			
01072906	17	22.2N	122.4E	90	0	33	45	74	83				0	-5	20	35	50			
01072912	18	23.2N	122.0E	95	0	41	57	83	42				0	5	20	45	55			
01072918	19	23.8N	121.3E	100	0	24	38	54					0	25	40	55				
01073000	20	24.3N	121.0E	90	8	13	32	26					0	15	45	55				
01073006	21	25.1N	120.6E	75	10	22	34						0	30	40					
01073012	22	25.6N	120.2E	75	6	27	36						0	20	25					
01073018	23	26.2N	119.8E	55	8	26							0	10						
01073100	24	26.8N	119.5E	45	18	34							0	10						
01073106	25	27.4N	119.3E	35	0								0							
01073112	26	28.6N	119.8E	30	23								0							
			AVERAGE		11	34	56	81	99	145	129	181	0	11	18	23	28	31	29	35
			BIAS										0	1	3	3	0	0	21	35
			# CASES		26	22	20	18	16	12	5	1	26	22	20	18	16	12	5	1

Statistics for JTWC on TY 12W Man-yi

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01073106	1	10.1N	157.8E	15	6								10							
01073112	2	9.8N	157.2E	15	18								10							
01073118	3	9.5N	156.3E	15	34								10							
01080100	4	9.5N	155.4E	15	5								10							
01080106	5	10.0N	154.4E	15	6								10							
01080112	6	10.3N	153.6E	20	26								5							
01080118	7	10.7N	152.8E	25	11	35	102	199	289	481			0	-20	-20	-30	-40	-60		
01080200	8	11.2N	151.9E	35	5	19	80	150	226	419	502	682	0	0	0	-15	-30	-50	-10	-15
01080206	9	11.7N	150.9E	45	0	42	95	132	194	318	492	708	0	5	0	-10	-25	-15	15	15
01080212	10	12.4N	150.2E	45	11	80	96	101	164	307	506	757	0	0	-10	-20	-35	-10	-5	0

Statistics for JTWC on TY 12W Man-yi

01080218	11	13.6N	149.5E	50	13	54	91	144	166	262	448	688	0	-10	-20	-35	-30	-5	-15	-10
01080300	12	14.8N	148.7E	55	0	18	29	69	105	123	203	352	0	-20	-30	-45	-30	-10	-25	-10
01080306	13	16.1N	147.6E	65	0	31	25	46	65	118	251	385	0	-10	-25	-25	-20	-5	-15	5
01080312	14	17.4N	146.7E	75	0	41	50	78	102	171	322	497	0	-10	-30	-20	-15	-25	-10	20
01080318	15	18.4N	145.9E	85	0	42	82	106	117	192	347	452	-5	-25	-25	-20	-10	-20	0	40
01080400	16	19.7N	145.2E	95	0	54	88	72	81	159	272	354	0	-20	-10	0	10	-5	20	50
01080406	17	21.1N	144.5E	110	0	12	38	22	48	112	224	253	0	0	5	10	15	5	35	55
01080412	18	22.4N	144.1E	120	0	8	24	53	97	117			-5	5	5	20	-5	5		
01080418	19	23.5N	143.7E	115	0	13	74	115	157	168	64	197	0	5	10	20	-5	10	55	70
01080500	20	24.7N	143.5E	115	0	64	135	169	200	161	85		-5	-5	10	-15	-15	5	40	
01080506	21	25.3N	143.6E	115	0	43	66	115	132	90	92		0	5	10	-15	-10	5	40	
01080512	22	25.6N	143.9E	110	6	25	39	80	84	35			0	15	-10	-10	-10	15		
01080518	23	25.9N	144.3E	105	8	28	61	95	105	90			0	10	-15	-5	-5	25		
01080600	24	26.1N	144.6E	95	0	13	24	53	94	158			0	-20	-20	-15	-5	20		
01080606	25	26.5N	145.0E	95	0	36	32	59	86	140			0	-25	-20	-20	-5	15		
01080612	26	26.8N	145.3E	115	8	32	68	86	112	254			-5	-5	-10	-5	10	25		
01080618	27	27.2N	145.8E	115	0	26	67	109	144	325			0	5	-5	5	20	30		
01080700	28	27.9N	146.5E	110	0	29	61	114	148				0	5	5	20	20			
01080706	29	28.9N	147.4E	100	0	21	61	90	94				0	5	15	30	25			
01080712	30	30.0N	148.2E	100	0	32	92	108	132				0	5	10	10	15			
01080718	31	31.1N	149.2E	95	7	19	30	66	180				0	15	20	15	20			
01080800	32	32.6N	150.0E	85	0	42	56	123					0	10	10	15				
01080806	33	34.3N	150.8E	75	5	19	60	91					0	20	15	20				
01080812	34	36.0N	151.1E	65	0	31	70						0	0	5					
01080818	35	37.6N	151.1E	55	7	27	133						0	0	5					
01080900		38.9N	151.4E	55																
01080906		40.4N	151.8E	50																
01080912		41.9N	152.8E	40																
01080918		43.7N	154.3E	35																
			AVERAGE		5	32	67	98	133	200	293	484	2	10	13	17	17	17	22	26
			BIAS										1	-2	-4	-5	-6	-2	10	20
			# CASES		35	29	29	27	25	21	13	11	35	29	29	27	25	21	13	11

Statistics for JTWC on TS 13W Usagi

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01080806		16.8N	117.5E	25																
01080812	1	16.8N	116.2E	25	8								0							
01080818	2	16.7N	115.0E	25	29								0							
01080900	3	16.6N	114.2E	25	21	39	26	81	149				0	5	5	0	20			
01080906	4	16.4N	113.5E	25	6	21	52	92	194				0	0	-5	0	10			
01080912	5	16.8N	112.8E	25	11	52	86	151					0	0	-5	15				
01080918	6	17.4N	111.6E	30	31	103	165	277					0	0	0	20				
01081000	7	17.7N	110.1E	30	29	81	169						5	0	20					
01081006	8	17.8N	108.7E	35	0	31	132						0	10	5					
01081012	9	18.1N	107.4E	40	12	81							0	0						
01081018	10	18.4N	105.9E	40	18	72							-5	0						
01081100		18.3N	104.1E	30																
01081106		18.2N	102.4E	25																
			AVERAGE		17	60	105	150	171				1	2	7	9	15			
			BIAS										0	2	3	9	15			
			# CASES		10	8	6	4	2				10	8	6	4	2			

Statistics for JTWC on TY 14W Pabuk

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01081306		17.5N	145.6E	25																
01081312		18.0N	145.7E	25																
01081318		18.3N	145.6E	25																
01081400	1	18.5N	145.5E	30	26	58	149	237	295	402			0	5	10	10	25	35		
01081406	2	18.6N	145.3E	30	23	91	196	269	326	437	528	658	5	0	5	10	20	35	15	25
01081412	3	18.8N	144.9E	35	28	108	177	236	310	462	590	753	0	-5	0	5	25	30	15	20
01081418	4	19.1N	144.2E	40	40	96	135	166	210	316	428	581	0	0	5	5	15	35	40	25
01081500	5	19.5N	143.2E	45	16	13	53	93	158	279	316	338	0	-10	-10	-10	-10	20	-20	5
01081506	6	19.8N	142.3E	50	11	18	29	80	145	241	291	304	0	-5	-10	-5	0	20	-10	-10
01081512	7	20.1N	141.5E	60	8	19	64	134	199	256	384	428	0	0	0	-5	5	15	5	10
01081518	8	20.4N	140.7E	60	0	13	55	103	144	211	291	348	5	10	25	25	30	35	20	35
01081600	9	20.7N	140.2E	65	5	25	80	124	156	227	274	304	0	10	20	25	35	30	20	40
01081606	10	21.0N	139.6E	70	8	21	63	119	147	129	126	45	0	0	10	25	35	30	30	45
01081612	11	21.3N	139.1E	70	0	34	90	142	137	140	114	81	5	-5	10	30	30	30	45	55
01081618	12	21.4N	138.6E	75	6	25	13	6	13	68	114	131	0	0	10	30	25	30	30	40
01081700	13	21.5N	138.1E	80	0	5	28	44	52	119	256	267	5	10	20	25	20	30	40	45
01081706	14	21.7N	137.7E	80	5	50	81	97	97	133	180	291	5	10	20	20	20	40	60	70
01081712	15	22.0N	137.3E	80	12	23	38	72	102	158	193	251	-5	0	0	-10	-5	10	20	40
01081718	16	22.3N	137.0E	80	11	33	45	25	45	137	117	74	-10	0	-5	5	25	30	65	70
01081800	17	22.7N	136.7E	75	8	36	47	34	24	92	139	71	-5	-5	-10	5	25	30	50	85
01081806	18	23.4N	136.2E	75	5	38	76	84	91	131	226		-5	-10	-10	5	30	35	70	
01081812	19	24.2N	135.7E	80	5	42	69	76	62	104	123		-5	-10	-5	5	30	35	45	
01081818	20	24.7N	135.1E	85	0	20	46	69	88	15	54		-5	-5	5	25	25	35	65	
01081900	21	25.4N	134.4E	90	0	12	41	80	75	16	199		0	5	15	35	30	40	65	
01081906	22	26.2N	133.7E	90	8	29	48	89	27	89			5	10	25	40	35	45		
01081912	23	26.9N	133.2E	90	0	34	84	96	35	85			5	5	30	40	40	50		
01081918	24	27.7N	132.9E	90	0	22	68	43	39	144			5	20	35	55	55	45		
01082000	25	28.5N	132.8E	90	0	37	56	16	53	213			5	25	40	60	60	45		
01082006	26	29.5N	133.1E	80	8	20	26	61	91				10	15	25	25	30			
01082012	27	30.2N	133.7E	75	47	19	20	15	80				-5	10	20	25	30			
01082018	28	30.9N	134.4E	70	8	51	65	117	11				0	10	15	25	30			
01082100	29	31.7N	135.1E	65	5	47	27	43	111				5	10	10	0	5			
01082106	30	33.0N	135.1E	60	7	36	133	118					5	5	10	10				
01082112	31	33.7N	135.9E	55	15	67	89	84					0	5	10	5				
01082118	32	34.5N	136.8E	50	18	105	65						-5	0	5					
01082200	33	34.9N	138.2E	45	19	94	188						0	5	5					
01082206	34	35.2N	139.8E	40	17	6							0	5						
01082212	35	37.2N	141.2E	35	20	9							0	5						
01082218	36	39.4N	142.4E	30	7								0							
01082300		41.8N	143.5E	30																
			AVERAGE		11	39	74	96	115	184	247	308	3	7	13	20	26	33	37	39
			BIAS										1	4	10	18	25	33	34	38
			# CASES		36	35	33	31	29	25	20	16	36	35	33	31	29	25	20	16

Statistics for JTWC on TD 15W

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01082400	2	20.6N	160.9E	25	34								0							
01082406	3	21.2N	161.8E	25 1	04								0							

Statistics for JTWC on TD 15W

01082412	4	21.8N	162.6E	25	52								5							
01082418	5	22.6N	163.0E	25	16	131							0	15						
01082500	6	23.7N	162.4E	30	31								0							
01082506	7	24.5N	161.4E	20	12								0							
			AVERAGE		42	131							1	15						
			BIAS										1	15						
			# CASES		6	1							6	1						

Statistics for JTWC on STY16W Wutip

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01082600	1	15.6N	139.1E	20	11								0							
01082606	2	15.9N	139.7E	25	6								-5							
01082612	3	16.1N	140.3E	25	11								-5							
01082618	4	16.5N	140.1E	30	11								-5							
01082700	5	16.9N	140.5E	35	20	59	123	168	184	123			-5	-10	-30	-55	-75	-75		
01082706	6	17.5N	141.0E	40	11	6	46	69	43	48	62	163	-5	-15	-35	-55	-60	-50	-15	0
01082712	7	18.1N	141.5E	45	8	30	68	85	94	91	143	54	0	-15	-40	-60	-60	-35	0	15
01082718	8	18.8N	142.2E	55	5	32	60	66	61	53	43	177	-5	-20	-45	-55	-55	-15	10	15
01082800	9	19.6N	143.0E	65	5	16	19	30	50	100			0	-20	-35	-35	-30	5		
01082806	10	20.5N	143.7E	80	5	25	50	83	99	124	200	290	-5	-25	-35	-40	-35	0	10	30
01082812	11	21.3N	144.3E	95	8	26	45	54	86	133	290	416	-5	-25	-35	-30	-25	5	20	45
01082818	12	22.1N	145.0E	110	11	36	67	100	98	135	151	132	-5	-5	-5	-15	-5	15	20	20
01082900	13	22.8N	145.5E	120	11	41	64	88	73	95	144		5	0	-10	-10	5	20	40	
01082906	14	23.3N	145.9E	125	5	12	32	60	36	76			5	-10	-10	0	10	10		
01082912	15	24.0N	146.4E	130	0	26	42	77	36	108			-5	-10	-10	0	0	10		
01082918	16	24.6N	146.8E	130	6	56	92	119	133	124	246		-5	-5	5	10	5	15	40	
01083000	17	25.0N	147.1E	125	0	34	73	80	47	85			0	0	15	10	10	20		
01083006	18	25.5N	147.4E	120	0	27	42	26	41	136			0	15	20	10	0	10		
01083012	19	26.1N	147.8E	115	0	38	32	13	58	193			0	15	10	10	0	10		
01083018	20	26.9N	147.7E	100	0	43	69	60	97	138			-10	5	0	0	5	15		
01083100	21	27.7N	147.7E	90	8	21	32	72	98				0	-5	-5	-10	-5			
01083106	22	28.5N	148.0E	80	0	25	52	110	169				0	0	-5	-5	-5			
01083112	23	29.4N	148.5E	80	0	18	62	182	313				0	0	-10	-5	5			
01083118	24	30.1N	149.2E	75	0	33	84	199	330				0	0	5	10	15			
01090100	25	31.2N	150.1E	70	0	79	168	256					0	0	0	10				
01090106	26	32.0N	151.1E	70	7	61	79	209					0	5	5	15				
01090112	27	32.6N	152.2E	65	7	42	113						5	10	15					
01090118	28	33.2N	153.2E	60	5	38	46						0	5	15					
01090200	29	33.9N	154.5E	55	16	53							0	15						
01090206	30	34.7N	155.8E	50	13	92							0	10						
01090212	31	35.2N	156.7E	40	50								5							
01090218	32	35.9N	158.0E	35	15								5							
			AVERAGE		8	37	65	100	107	110	160	205	3	9	17	20	21	19	19	21
			BIAS										-1	-3	-9	-14	-15	-3	16	21
			# CASES		32	26	24	22	20	16	8	6	32	26	24	22	20	16	8	6

Statistics for JTWC on TY 17W Sepat

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120

Statistics for JTWC on TY 17W Sepat

01082606	3	17.7N	161.6E	15	5								0							
01082612	4	18.9N	162.6E	20	24								0							
01082618	5	20.5N	163.3E	25	16								-5							
01082700	6	21.5N	162.7E	30	16	45	36	55	64	118			-5	-5	-10	-5	5	5		
01082706	7	22.5N	162.1E	30	0	30	66	61	36	138			0	-5	-5	0	15	20		
01082712	8	23.2N	161.7E	35	17	45	84	113	139	221			-5	-10	-5	5	15	20		
01082718	9	23.9N	161.4E	40	8	30	32	70	181				-5	-5	0	10	15			
01082800	10	24.4N	161.3E	45	5	36	70	101	119				0	5	15	25	15			
01082806	11	25.3N	161.3E	45	5	37	92	152	173				0	5	15	10	15			
01082812	12	26.3N	161.2E	45	12	42	112	184	228				0	5	10	5	10			
01082818	13	27.7N	161.0E	45	0	39	102	132					-10	15	10	15				
01082900	14	29.0N	160.8E	40	0	60	132	173					-5	-5	-5	0				
01082906	15	30.7N	160.5E	35	5	75	104						0	-5	0					
01082912	16	32.3N	160.1E	35	18	75	114						0	-5	0					
01082918	17	34.8N	159.4E	35	0	48							0	0						
01083000	18	36.6N	159.4E	35	20	121							-5	-5						
01083006	19	38.4N	160.1E	30	0								0							
01083012		40.5N	161.1E	30																
			AVERAGE		9	53	86	116	134	159			2	6	7	8	13	15		
			BIAS										-2	-1	2	7	13	15		
			# CASES		17	13	11	9	7	3			17	13	11	9	7	3		

Statistics for JTWC on TY 18W Fitow

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01082706	1	18.7N	116.8E	15	8								0							
01082712	2	18.9N	115.5E	15	85								0							
01082718	3	19.1N	114.4E	15	71								5							
01082800	4	19.2N	113.6E	20	51								5							
01082806	5	19.2N	113.3E	20	36								5							
01082812	6	19.2N	113.0E	20	18								5							
01082900	7	19.4N	112.1E	25	12	45	62	70	43	18			0	5	5	5	0	15		
01082906	8	19.6N	111.4E	25	11	11	23	45	64				0	0	0	0	0			
01082912	9	19.6N	110.7E	25	5	28	56	104	163				0	-5	-5	-5	-5			
01082918	10	19.7N	110.2E	25	28	41	79	124	171				0	-5	-5	-10	0			
01083000	11	19.8N	109.7E	30	41	69	126	168	228				-5	-5	-15	-5	0			
01083006	12	20.0N	109.3E	30	13	36	70	94					-5	-10	-10	5				
01083012	13	20.2N	109.0E	35	17	36	75	140					0	-10	0	0				
01083018	14	20.6N	108.9E	35	12	8	6						0	-5	5					
01083100	15	21.0N	108.7E	45	5	26	40						0	10	5					
01083106	16	21.3N	108.6E	40	32	40							-5	5						
01083112	17	21.5N	108.6E	30	69	131							0	-5						
01083118		21.7N	108.6E	25																
01090100		22.0N	108.8E	25																
			AVERAGE		31	43	59	107	134	18			2	6	6	4	1	15		
			BIAS										0	-2	-2	-1	-1	15		
			# CASES		17	11	9	7	5	1			17	11	9	7	5	1		

Statistics for JTWC on TY 19W Danas

	WRN	BEST TRACK	POSITION ERRORS	WIND ERRORS

Statistics for JTWC on TY 19W Danas

DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01090300	3	18.9N	156.4E	25	20	31	74	81	66	134	197	124	0	5	0	-10	-15	-10	-40	-20
01090306	4	19.0N	155.6E	25	6	57	85	96	62	96	181	56	0	-5	-15	-15	-25	-10	-50	-20
01090312	5	18.8N	154.8E	30	24	77	75	55	18	150	208	165	0	-10	-15	-25	-15	-10	-35	-15
01090318	6	18.5N	153.9E	35	29	40	8	62	135	261	253	259	-5	-15	-20	-25	-10	-15	-30	-20
01090400	7	18.5N	152.8E	40	0	40	68	128	193	269	237	371	-5	-15	-20	-10	-10	0	-20	0
01090406	8	18.6N	152.1E	50	11	54	81	140	218	232	103	138	-5	-15	-15	-10	-10	-5	0	-20
01090412	9	18.8N	151.7E	60	0	47	119	196	276	271	141	196	0	-5	-5	-10	-10	0	0	-15
01090418	10	19.2N	151.3E	65	5	52	114	201	262	299	333	437	0	0	10	10	15	15	10	25
01090500	11	19.9N	151.0E	75	8	34	119	207	237	225	324	483	5	10	10	20	20	20	20	35
01090506	12	20.7N	150.8E	80	11	5	67	101	128	120	227	405	0	5	0	-5	-5	0	0	20
01090512	13	21.6N	150.7E	80	8	28	75	93	116	128	242	435	0	-5	-5	-5	0	0	5	20
01090518	14	22.4N	150.5E	80	0	38	56	82	81	76	136	217	5	-5	-10	-10	5	-5	15	25
01090600	15	23.0N	150.5E	90	0	30	43	62	45	76			-5	-5	-5	5	10	0		
01090606	16	23.7N	150.5E	90	0	11	63	74	51	166	392	770	0	-5	-5	5	5	0	25	35
01090612	17	24.7N	150.2E	95	0	16	36	42	40	193	446	953	5	10	15	15	10	10	30	50
01090618	18	25.5N	149.5E	100	0	48	68	42	22	178	329	806	5	10	25	25	10	15	25	50
01090700	19	26.3N	148.7E	100	0	21	32	43	119	207			15	25	20	15	15	25		
01090706	20	27.3N	147.6E	105	0	8	74	132	102	152	312		10	25	15	5	0	10	35	
01090712	21	27.8N	146.2E	100	5	19	80	110	117	206	361		15	10	0	0	15	-15	55	
01090718	22	28.3N	144.9E	100	7	54	103	109	167	357	259		5	0	-5	0	10	-15	50	
01090800	23	28.4N	143.6E	100	0	60	100	85	110	305	228		5	5	0	5	15	-10	60	
01090806	24	28.3N	142.6E	100	0	43	71	82	98	198			0	-5	0	10	20	-5		
01090812	25	28.4N	141.9E	100	6	54	105	114	108	163			5	0	5	15	20	5		
01090818	26	28.7N	141.5E	105	5	51	52	24	37	166			0	5	15	20	15	5		
01090900	27	29.7N	140.6E	100	6	40	25	13	78	214			0	10	20	20	15	5		
01090906	28	30.5N	139.2E	100	7	44	96	139	120				-5	5	15	10	0			
01090912	29	31.1N	138.4E	95	0	8	91	126	145				5	15	15	15	10			
01090918	30	31.8N	137.7E	90	11	19	114	180	171				10	20	0	-10	-5			
01091000	31	32.5N	137.4E	85	7	66	127	171	104				0	5	-15	-10	5			
01091006	32	33.1N	137.5E	80	19	38	65	116					-10	-10	-15	-5				
01091012	33	33.6N	137.8E	80	0	25	69	105					-5	-5	-5	5				
01091018	34	34.2N	138.5E	75	0	27	33						-5	-5	0					
01091100	35	35.2N	139.5E	70	6	48	58						0	5	10					
01091106	36	36.4N	140.5E	65	4	44							-5	5						
01091112	37	37.6N	141.9E	55	5	113							0	5						
01091118	38	39.5N	143.6E	50	0								0							
01091200	39	41.9N	145.8E	40	0								5							
			AVERAGE		6	40	74	104	118	194	258	388	4	8	10	11	11	8	27	25
			BIAS										1	2	1	2	4	0	8	10
			# CASES		37	35	33	31	29	25	19	15	37	35	33	31	29	25	19	15

Statistics for JTWC on TY 20W Nari

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01090512	1	23.7N	124.0E	20	31								0							
01090518	2	24.4N	124.1E	25	24								0							
01090600	3	25.0N	124.7E	25	55	109	162	212	211				0	5	-20	-25	-45			
01090606	4	25.6N	125.5E	30	24	69	100	128	92	95			-5	-5	-10	-40	-35	-50		
01090612	5	25.9N	126.3E	25	18	61	117	116	84	107			5	-15	-20	-40	-40	-50		
01090618	6	26.0N	127.0E	35	8	48	79	91	130	151			0	-5	-20	-15	-10	-15		
01090700	7	26.2N	127.7E	45	8	29	69	66	59	49			-5	5	-5	5	10	15		

Statistics for JTWC on TY 20W Nari

01090706	8	26.3N	128.1E	45	12	45	48	76	69	25	238	371	0	-20	-10	0	-10	10	-30	-15
01090712	9	26.4N	128.2E	50	5	20	43	61	71	142	273	366	0	-15	0	0	-5	10	-30	-10
01090718	10	26.4N	127.8E	70	0	50	72	79	96	170	263	330	-5	10	15	10	10	5	-10	5
01090800	11	26.7N	127.4E	70	0	37	48	42	50	190	257	292	0	10	15	10	20	-5	-10	5
01090806	12	27.1N	126.7E	65	32	41	36	21	81	210	228	227	5	0	-10	-15	-5	-35	-30	-5
01090812	13	27.2N	126.0E	65	0	8	33	72	154	239	259	241	0	0	-10	-5	-5	-40	-25	-5
01090818	14	27.2N	125.5E	65	8	20	53	101	180	241	250	250	0	-10	-10	-5	-15	-35	-15	-10
01090900	15	27.2N	125.1E	65	0	34	54	124	181	219	210	246	0	-5	10	10	-15	-30	-5	-5
01090906	16	27.2N	125.0E	75	0	22	67	131	175	195	194	212	0	0	10	0	-25	-25	0	0
01090912	17	27.2N	125.1E	75	0	16	76	119	148	164	184	190	0	10	10	-10	-30	-20	0	5
01090918	18	27.1N	125.0E	75	0	37	88	113	117	129	192	204	0	10	0	-20	-25	-10	0	5
01091000	19	26.7N	125.1E	65	0	40	59	84	99	98	152	183	10	0	-20	-35	-30	-10	-5	0
01091006	20	26.4N	125.4E	65	6	38	74	93	106	104	121	111	0	-10	-30	-30	-25	0	0	-5
01091012	21	26.1N	126.0E	65	5	25	61	81	113	145	136	114	0	-20	-35	-30	-20	0	0	-10
01091018	22	26.0N	126.4E	75	0	36	42	32	45	94	136	336	0	-15	-20	-25	-10	-5	5	-15
01091100	23	26.1N	126.7E	85	0	19	26	22	6	17			-10	-10	0	-5	-10	-5		
01091106	24	26.3N	127.0E	95	0	16	29	30	8	18	74	126	0	0	10	25	35	25	30	0
01091112	25	26.4N	127.1E	100	0	24	54	60	32	48			0	5	10	20	25	25		
01091118	26	26.4N	127.0E	95	0	24	48	36	29	87	201	394	10	5	15	25	10	15	0	10
01091200	27	26.4N	127.0E	95	0	48	45	16	24	79			0	10	15	25	10	10		
01091206	28	26.3N	127.0E	90	0	12	22	32	37	150	215	309	0	15	20	10	15	5	-10	30
01091212	29	26.1N	127.2E	85	0	39	74	77	66	138	189	293	0	10	15	10	20	15	-5	40
01091218	30	26.4N	126.9E	75	13	36	56	37	30	113	129	290	0	5	0	0	5	-25	-25	-5
01091300	31	26.5N	126.5E	75	6	30	30	24	81	153	245	392	0	5	0	0	-5	-35	-10	-5
01091306	32	26.9N	126.2E	65	0	8	40	96	144	180			0	-5	-5	-5	-20	-40		
01091312	33	27.3N	125.8E	65	0	24	80	128	180	220			0	-5	-5	-10	-25	-50		
01091318	34	27.4N	125.5E	70	10	29	72	111	136	189	287	339	0	10	10	-5	-20	-30	25	5
01091400	35	27.5N	125.2E	70	0	28	69	100	117	194			0	0	0	-15	-35	-10		
01091406	36	27.4N	125.0E	65	6	51	92	113	125	203			0	5	-5	-20	-35	-10		
01091412	37	27.1N	124.8E	65	13	25	38	40	64	163			0	0	-10	-30	-30	0		
01091418	38	26.7N	124.5E	60	13	13	17	29	24	21			0	-10	-25	-35	-15	-5		
01091500	39	26.4N	124.3E	65	0	20	37	50	45	83			0	-5	-25	-35	-20	-10		
01091506	40	26.0N	124.0E	70	0	20	25	12	13	78			0	-5	-10	5	5	-5		
01091512	41	25.8N	123.8E	75	8	33	52	56	41	33			0	-5	5	45	35	15		
01091518	42	25.6N	123.5E	80	6	25	44	53	30	93	84	178	0	-10	10	30	15	-5	5	0
01091600	43	25.5N	123.0E	90	10	28	58	71	56				0	-5	30	25	5			
01091606	44	25.3N	122.6E	90	6	26	49	42	38				0	20	20	10	-10			
01091612	45	25.1N	122.2E	85	0	38	48	36	61				0	25	10	0	-10			
01091618	46	24.6N	121.7E	65	6	19	13	23	34				0	-15	-10	-15	-10			
01091700	47	24.2N	121.5E	45	21	18	28	28	55				0	-5	-10	-15	-10			
01091706	48	23.8N	121.4E	45	37	53	58	11	72				0	-5	-10	-10	-10			
01091712	49	23.6N	121.4E	35	56	50	16	77					0	-5	-10	-10				
01091718	50	23.5N	121.4E	35	57	65	38	16	35	101			0	0	5	5	-15	5		
01091800	51	23.4N	121.3E	35	57	63	16	29	49	189			0	0	5	5	-25	10		
01091806	52	23.2N	121.1E	35	33	72	74	30	35				-5	0	5	-5	-20			
01091812	53	23.0N	120.5E	35	61	122	79	46	76				0	0	5	-15	0			
01091818	54	22.8N	119.5E	30	33	78	53	66	125				0	0	-10	-20	10			
01091900	55	22.7N	118.5E	30	85	116	103	135	201				0	5	-20	-5	5			
01091906	56	22.7N	118.0E	30	67	29	50	93					0	-15	-25	5				
01091912	57	22.7N	117.7E	30	51	25	71	137					0	-25	-5	10				
01091918	58	22.7N	117.3E	45	40	74	103						-5	5	20					
01092000	59	22.7N	116.8E	55	0	25	79						0	20	25					
01092006	60	22.8N	115.4E	55	12	36							-5	30						

Statistics for JTWC on TY 20W Nari

01092012	61	22.9N	114.2E	35	13	49							5	15						
01092018	62	22.9N	113.0E	25	28								0							
01092100	63	23.2N	111.5E	20	0								0							
			AVERAGE		16	39	57	69	83	130	196	261	1	8	12	15	18	18	12	8
			BIAS										0	0	-2	-5	-8	-10	-6	1
			# CASES		63	59	57	55	52	41	23	23	63	59	57	55	52	41	23	23

Statistics for JTWC on TY 21W Vipa

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01091600		20.1N	138.0E	25																
01091606		20.6N	138.9E	25																
01091612	1	21.1N	139.6E	25	34								0							
01091618	2	22.0N	140.0E	25	0								0							
01091700	3	22.4N	140.1E	25	8	13	25	79	91	183			0	0	0	-5	-5	5		
01091706	4	22.9N	140.1E	30	6	33	113	186	183	316			0	0	0	-10	-10	5		
01091712	5	23.7N	140.0E	30	12	33	66	76	68	255			5	0	-10	-20	0	15		
01091718	6	24.3N	139.8E	35	0	53	99	97	76	225			0	0	-10	-15	0	10		
01091800	7	25.1N	139.4E	35	0	48	52	27	21	186			0	-10	-20	-15	-5	-10		
01091806	8	26.4N	138.9E	40	5	5	27	45	78	106			-5	-15	-15	-10	-5	-5		
01091812	9	27.5N	138.5E	50	5	21	26	75	142	124			0	-5	5	-5	-10	-20		
01091818	10	28.9N	138.2E	55	5	54	134	180	216				10	5	5	-5	-15			
01091900	11	30.0N	138.1E	65	0	26	79	120	85				10	15	10	5	-15			
01091906	12	30.9N	138.3E	65	5	33	89	84	26				10	10	0	-15	-25			
01091912	13	31.8N	138.9E	65	5	35	72	110	54				10	5	-5	-20	-25			
01091918	14	32.6N	139.6E	65	0	16	54	96					5	-5	-15	-25				
01092000	15	33.4N	140.6E	70	0	56	57	49					0	-5	-15	-20				
01092006	16	34.2N	142.1E	70	5	27	106						-5	-20	-25					
01092012	17	34.9N	143.7E	70	0	82	249						5	-10	-5					
01092018	18	36.1N	145.8E	75	0	47							0	-5						
01092100	19	37.7N	148.5E	75	0	99							0	0						
01092106	20	40.1N	152.4E	70	0								0							
01092112	21	42.6N	157.4E	65	48								-10							
			AVERAGE		7	40	83	94	94	199			4	6	9	13	10	10		
			BIAS										2	-2	-7	-12	-10	0		
			# CASES		21	17	15	13	11	7			21	17	15	13	11	7		

Statistics for JTWC on TY 22W Francisco

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01091706	2	13.5N	166.5E	20	31								5							
01091712	3	13.8N	165.9E	20	18								5							
01091800	4	14.2N	164.3E	20 2	12								0							
01091806	5	14.3N	163.7E	20	32								0							
01091812	6	14.4N	163.2E	25	78								-5							
01091818	7	14.5N	162.8E	25 1	10								-5							
01091900	8	14.5N	162.4E	30	55	110	99	81	51	30	135	248	0	0	10	10	10	-10	-5	-5
01091906	9	14.4N	162.1E	30	36	63	60	36	29	45	126	266	0	0	10	5	5	0	5	0
01091912	10	14.6N	161.5E	35	13	43	83	128	128	130	154	322	0	10	10	10	10	-5	-25	0
01091918	11	14.9N	160.4E	35	11	50	154	191	227	242	109	108	0	10	5	5	5	0	-20	20

Statistics for JTWC on TY 22W Francisco

01092000	12	15.4N	159.3E	35	34	61	103	100	78	154			0	0	0	0	0	0		
01092006	13	15.9N	158.2E	35	16	133	147	182	196	276	360	613	0	-10	-15	-20	-20	-5	0	35
01092012	14	16.7N	156.9E	45	17	124	180	202	215	271	366	688	0	-5	-5	-10	-5	-10	0	35
01092018	15	17.6N	155.2E	50	29	53	87	111	124	189	379	869	0	-5	-10	-15	0	-5	20	55
01092100	16	18.2N	153.9E	55	13	45	21	8	47	160	349		0	0	-10	-10	0	5	25	
01092106	17	18.4N	152.7E	60	8	18	31	45	68	190	288		0	-10	-10	-5	5	15	35	
01092112	18	19.2N	151.6E	65	0	19	45	74	89	150	420		0	-5	-5	5	5	25	50	
01092118	19	20.0N	150.8E	75	30	33	20	37	39	207	601		0	-10	-5	5	5	40	70	
01092200	20	20.8N	150.0E	80	8	28	42	43	74	160			10	-5	0	-5	5	45		
01092206	21	21.5N	149.4E	85	8	53	42	38	70	67			0	5	15	15	20	45		
01092212	22	22.5N	148.9E	90	6	21	27	70	92	66			0	10	15	15	20	30		
01092218	23	23.5N	148.5E	90	5	12	29	59	71	221			0	10	15	20	35	45		
01092300	24	24.5N	148.1E	90	0	25	62	60	90				0	0	15	30	40			
01092306	25	25.5N	147.6E	90	0	27	50	50	73				0	0	15	40	40			
01092312	26	26.3N	147.5E	100	6	21	52	42	84				0	5	25	40	30			
01092318	27	27.2N	147.6E	100	0	13	77	136	158				0	10	40	45	45			
01092400	28	28.4N	147.8E	100	0	26	132	134					0	15	35	40				
01092406	29	29.9N	148.1E	95	0	62	123	124					5	20	20	25				
01092412	30	31.5N	148.4E	85	16	130	139						10	20	15					
01092418	31	33.4N	148.0E	70	0	28	196						0	0	15					
01092500	32	35.3N	148.1E	65	0	153							0	5						
01092506	33	37.2N	149.4E	60	0	27							0	15						
01092512	34	39.6N	152.7E	55	0								0							
01092518	35	41.9N	156.4E	40	0								0							
			AVERAGE		24	53	83	89	100	160	299	445	1	7	13	17	15	18	23	21
			BIAS										1	3	8	11	13	13	14	20
			# CASES		34	26	24	22	20	16	11	7	34	26	24	22	20	16	11	7

Statistics for JTWC on TY 23W Lekima

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01092118	4	19.4N	124.8E	20	98								0							
01092200	5	19.4N	124.5E	30	24	23	41	57	103	246			0	0	10	-5	-10	-15		
01092206	6	19.4N	124.3E	35	12	37	54	83	124	227	281	327	0	0	0	-15	-20	-20	-35	15
01092212	7	19.4N	123.9E	35	13	8	12	38	90	174	217	245	0	0	-10	-15	-20	-25	-10	25
01092218	8	19.4N	123.5E	35	16	46	57	34	6	70			0	-5	-25	-35	-30	-50		
01092300	9	19.4N	123.0E	35	23	50	54	42	62	90			0	-15	-25	-35	-35	-55		
01092306	10	19.4N	122.5E	45	12	18	31	54	71	107	192	256	0	-15	-20	-10	-15	-15	20	40
01092312	11	19.4N	122.1E	55	18	23	45	74	112	174	263	378	-5	0	0	10	0	25	50	55
01092318	12	19.5N	121.8E	65	12	13	41	98	140	182	273	386	0	-10	5	5	0	40	60	50
01092400	13	19.6N	121.7E	65	16	58	110	155	179	205	269	301	0	-10	0	-5	-5	45	65	60
01092406	14	19.8N	121.6E	75	16	64	100	119	134	156	190	283	0	10	5	0	0	45	55	50
01092412	15	20.0N	121.7E	75	28	48	74	90	106	171	213	333	0	5	-5	-5	25	50	55	55
01092418	16	20.0N	121.7E	70	18	37	45	46	51	105	143	206	0	0	-5	0	40	60	60	70
01092500	17	20.2N	121.7E	75	21	12	24	21	23	55			0	-5	0	15	25	45		
01092506	18	20.5N	121.8E	80	26	31	49	48	55	61			0	0	-25	-15	-5	10		
01092512	19	20.8N	121.8E	90	24	41	49	45	48	95			0	-5	0	15	15	20		
01092518	20	21.1N	121.6E	90	21	29	34	28	40	83			0	10	35	40	55	60		
01092600	21	21.4N	121.4E	95	24	21	28	39	61	131			0	35	40	45	75	55		
01092606	22	21.8N	121.2E	90	29	29	33	33	56	117			0	25	25	40	45	60		
01092612	23	22.1N	120.9E	65	41	19	19	12	23	119			0	10	10	20	15	30		
01092618	24	22.6N	120.7E	50	30	5	12	16	28	136			0	0	15	15	20	30		

Statistics for JTWC on TY 23W Lekima

01092700	25	23.0N	120.6E	45	17	40	28	36	40				0	-5	10	0	5			
01092706	26	23.4N	120.4E	45	42	45	61	53	50				0	10	0	5	10			
01092712	27	23.6N	120.3E	40	55	55	50	42	74				0	10	0	5	15			
01092718	28	23.8N	120.2E	30	0	12	12	72	145				0	-10	-5	0	0			
01092800	29	23.9N	120.1E	25	77	91	93						0	-15	-10					
01092806	30	23.9N	120.1E	35	94	89	81	100					-5	5	10	20				
01092812	31	24.1N	120.1E	35	96	85	85						0	5	10					
01092818	32	24.4N	120.2E	30	37	58	101						0	10	15					
01092900	33	24.8N	120.1E	30	24	84							0	10						
01092906	34	25.5N	120.1E	25	8	20							0	5						
01092912	35	26.3N	120.2E	25	10								0							
01092918	36	26.9N	120.4E	20	12								5							
			AVERAGE		31	40	51	58	76	135	227	302	0	8	11	15	20	38	46	47
			BIAS										0	2	2	4	9	20	36	47
			# CASES		33	30	28	25	24	20	9	9	33	30	28	25	24	20	9	9

Statistics for JTWC on TY 24W Krosa

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01100306	1	13.4N	146.4E	25	58								0							
01100312	2	13.9N	145.4E	25	13								0							
01100318	3	14.4N	144.6E	30	23	57	131	161	220	228	309	583	-5	-10	-25	-30	-50	-25	-35	0
01100400	4	15.1N	144.0E	35	13	81	109	152	149	198	331	715	0	-5	-10	-40	-20	-5	-5	15
01100406	5	15.8N	142.7E	40	8	37	37	62	72	259	435	819	5	-5	0	-15	-5	10	20	45
01100412	6	16.6N	141.5E	50	8	18	41	45	98	309	545		0	-5	-30	-10	5	20	30	
01100418	7	17.5N	140.2E	60	12	49	31	29	93	308	607		0	0	-15	0	15	35	40	
01100500	8	17.9N	139.4E	65	0	34	29	45	120	347	673		0	-25	-5	5	25	45	45	
01100506	9	18.8N	138.2E	75	0	25	42	97	182	319	646		0	-15	5	15	35	45	70	
01100512	10	19.6N	137.2E	105	0	19	66	114	200	356			0	25	25	25	30	40		
01100518	11	20.7N	136.4E	105	0	5	61	135	187	366			0	5	15	25	20	25		
01100600	12	21.4N	135.8E	100	0	20	56	130	165	293			0	0	0	0	0	5		
01100606	13	22.4N	135.1E	100	8	77	140	164	151	403			0	-5	5	0	10	25		
01100612	14	23.3N	135.3E	100	0	12	97	121	142				0	0	5	5	10			
01100618	15	24.0N	135.5E	100	0	35	90	111	205				0	5	5	15	10			
01100700	16	25.0N	135.8E	95	0	60	88	138	197				0	0	0	5	0			
01100706	17	25.5N	136.7E	90	0	36	36	43	182				0	0	10	5	20			
01100712	18	26.2N	137.7E	90	10	8	24	132					0	5	10	5				
01100718	19	27.0N	138.5E	90	6	26	143	229					0	15	10	25				
01100800	20	28.0N	139.6E	85	0	48	163						0	5	0					
01100806	21	28.9N	140.7E	75	0	72	201						0	-10	5					
01100812	22	29.7N	142.5E	75	0	93							0	-10						
01100818	23	31.0N	145.0E	75	0	46							0	10						
01100900	24	32.7N	147.6E	75	0								0							
01100906	25	34.3N	151.2E	55	0								0							
			AVERAGE		7	41	83	112	158	308	507	706	0	8	9	13	17	25	35	20
			BIAS										0	-1	1	2	7	20	24	20
			# CASES		25	21	19	17	15	11	7	3	25	21	19	17	15	11	7	3

Statistics for JTWC on TY 25W Haiyan

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							

Statistics for JTWC on TY 25W Haiyan

DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01101106	4	16.1N	131.7E	25	40								0							
01101112	5	16.4N	131.2E	25	20	59	128	203	289	418			5	0	0	-5	-5	-15		
01101118	6	16.8N	130.7E	25	51	86	132	204	273	262			0	-5	0	-5	-5	-20		
01101200	7	17.0N	130.4E	30	34	58	87	122	183	190			0	0	-5	-5	-10	-25		
01101206	8	17.2N	130.3E	35	28	12	46	74	120	150	245	378	0	0	-5	-5	-10	-25	-35	-20
01101212	9	17.3N	130.2E	35	11	17	55	76	124	151	289	547	0	-10	-10	-15	-20	-30	-30	-15
01101218	10	17.5N	130.1E	35	16	46	69	103	124	135	311	666	0	0	5	0	-15	-35	-15	-5
01101300	11	17.7N	130.0E	45	66	95	82	121	101	147	378	800	0	5	5	5	0	0	10	35
01101306	12	17.8N	130.0E	45	55	41	61	70	42	130	437	1029	0	5	5	0	10	5	20	50
01101312	13	18.1N	130.0E	50	54	18	69	60	48	180	533		0	-5	-5	-5	-5	0	15	
01101318	14	18.7N	130.0E	50	24	66	102	111	122	192	502		0	-5	-15	-15	-20	0	10	
01101400	15	19.5N	129.9E	60	23	37	62	71	55	275	728		-5	0	-5	-5	-10	5	25	
01101406	16	20.5N	129.7E	60	0	41	56	56	54	374	893		5	-5	-5	-10	-10	5	35	
01101412	17	21.4N	129.4E	70	5	45	68	40	67	412			0	-5	0	0	-5	15		
01101418	18	21.9N	128.5E	75	0	13	18	77	154	431			0	5	0	0	5	10		
01101500	19	22.4N	127.6E	80	0	26	16	97	152	505			0	5	-5	-5	0	5		
01101506	20	22.7N	126.5E	80	6	22	55	134	207	567			0	0	-5	5	0	15		
01101512	21	23.1N	125.7E	85	0	24	92	208	293				0	0	0	10	5			
01101518	22	23.8N	125.1E	90	6	19	115	237	442				0	0	10	5	0			
01101600	23	24.5N	124.5E	90	0	66	154	264	486				0	0	5	0	0			
01101606	24	25.4N	124.4E	90	0	25	76	132	241				0	10	5	5	10			
01101612	25	26.2N	124.9E	85	0	42	121	270					0	5	5	5				
01101618	26	27.0N	125.8E	75	8	24	107	249					0	5	10	15				
01101700	27	27.7N	127.0E	70	10	59	191						0	0	5					
01101706	28	28.2N	128.6E	70	8	42	94						0	5	15					
01101712	29	28.9N	130.5E	65	0	62							0	0						
01101718	30	29.5N	133.0E	60	0	30							0	5						
01101800		30.5N	136.0E	55																
01101806		31.8N	138.4E	45																
			AVERAGE		18	41	86	135	179	282	480	684	1	3	5	6	7	13	22	25
			BIAS										0	1	0	-1	-4	-6	4	9
			# CASES		27	26	24	22	20	16	9	5	27	26	24	22	20	16	9	5

Statistics for JTWC on STY26W Podul

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01101712	1	4.5N	157.6E	20	94								0							
01101718	2	4.9N	157.0E	25	13								0							
01101800	3	5.2N	156.6E	25	24								0							
01101806	4	5.5N	156.4E	20	13								0							
01101812	5	5.7N	156.2E	20	8								0							
01101818	6	5.9N	156.0E	25	30								0							
01101900	7	5.6N	156.1E	30	5	48	78	202	236	315	464	632	0	0	0	5	0	0	-40	-65
01101906	8	5.5N	156.4E	30	24	8	89	218	289	403	614	772	0	0	0	-5	-5	-5	-25	-40
01101912	9	5.7N	156.3E	35	0	37	142	180	222	353	528	669	0	-5	0	-15	-10	-10	-60	-60
01101918	10	6.0N	155.9E	35	18	43	145	205	250	378	503	538	0	-5	-10	-15	-10	-10	-55	-60
01102000	11	6.6N	156.1E	45	5	110	140	153	164	256	379	393	0	5	-10	-10	0	-10	-45	-40
01102006	12	7.4N	156.4E	45	13	63	62	69	77	180	178	116	0	0	0	0	5	-20	-55	-35
01102012	13	8.9N	157.1E	45	21	36	27	42	65	133	177	215	0	-10	-10	0	-5	-25	-55	-40
01102018	14	9.9N	156.8E	55	8	19	24	55	107	179			0	-10	-10	-5	-5	-35		
01102100	15	10.9N	156.5E	65	0	46	85	133	208	275	276	342	0	-5	0	-5	-10	-35	-30	-50

Statistics for JTWC on STY26W Podul

01102106	16	11.8N	156.4E	65	5	54	89	132	196	208	192	384	0	0	10	10	-10	-30	-25	-30
01102112	17	12.3N	156.6E	75	0	21	48	93	127	146	184	482	0	15	10	5	-10	-25	-25	-15
01102118	18	12.9N	156.7E	75	16	13	53	110	116	108			0	10	10	-10	-20	-25		
01102200	19	13.6N	156.7E	75	5	30	89	132	155	108	234	701	0	-10	-10	-25	-20	-15	-25	15
01102206	20	13.9N	156.8E	80	5	46	98	86	80	52	261	798	0	0	-15	-30	-25	-15	-25	25
01102212	21	14.5N	157.0E	90	8	42	63	89	91	74	309	895	0	0	-10	-15	-20	-25	-10	40
01102218	22	14.8N	157.3E	90	8	34	27	48	61	93	71	487	0	-15	-20	-20	-20	-25	0	60
01102300	23	15.1N	157.6E	100	0	33	46	75	95	71			0	-15	-10	-10	0	-15		
01102306	24	15.5N	158.0E	115	0	13	27	67	95	142	155		0	-5	-5	-10	-5	-25	35	
01102312	25	16.1N	157.7E	125	5	32	54	80	74	107	174		0	0	-15	-10	-25	-20	40	
01102318	26	16.4N	157.5E	135	6	12	36	81	102	118	319		0	0	-5	-5	-20	-5	65	
01102400	27	16.7N	157.3E	135	5	18	54	77	90	119	355		0	0	5	-10	-15	15	85	
01102406	28	17.2N	156.9E	140	0	26	58	77	61	124			0	0	5	-10	-15	25		
01102412	29	17.5N	156.4E	140	0	31	39	38	53	89			0	10	-5	-10	-5	40		
01102418	30	18.0N	155.7E	140	13	30	40	19	37	196			0	10	-5	-10	-5	35		
01102500	31	18.5N	155.0E	130	8	0	40	36	54	264			10	-10	-25	-30	-10	35		
01102506	32	19.3N	154.5E	130	0	8	47	45	114				0	-25	-35	-25	-5			
01102512	33	20.0N	154.0E	140	0	17	44	85	174				0	-10	-15	0	10			
01102518	34	20.9N	154.0E	140	5	0	58	149	157				0	-10	-5	0	20			
01102600	35	21.9N	154.0E	140	11	45	112	202	252				0	0	15	15	35			
01102606	36	23.3N	154.4E	140	13	44	98	145					0	10	25	30				
01102612	37	24.7N	154.9E	130	6	36	98	199					0	15	25	45				
01102618	38	26.8N	155.9E	120	13	30	65						0	20	35					
01102700	39	28.9N	157.0E	100	27	52	156						-5	10	30					
01102706	40	31.3N	158.6E	90	46	76							0	25						
01102712	41	33.7N	160.4E	75	26	99							5	40						
01102718	42	36.3N	161.9E	55	43								10							
01102800		39.2N	162.8E	40																
			AVERAGE		14	36	71	107	131	180	299	530	1	9	12	13	12	21	39	41
			BIAS										0	1	-2	-6	-7	-9	-14	-21
			# CASES		42	35	33	31	29	25	18	14	42	35	33	31	29	25	18	14

Statistics for JTWC on TY 27W Lingling

	WRN	BEST TRACK			POSITION ERRORS															
											WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01110506	4	9.8N	130.4E	20	6								0							
01110512	5	9.9N	129.7E	20	23								0							
01110518	6	9.9N	128.7E	25	54								0							
01110600	7	10.0N	127.7E	25	8	21	37	25	40	121			0	0	-10	-10	-20	-35		
01110606	8	10.3N	126.8E	25	13	59	83	69	83	176			0	0	-15	-15	-20	-40		
01110612	9	10.6N	125.9E	30	24	53	42	67	90	143			0	-5	-15	-20	-25	-45		
01110618	10	10.7N	125.0E	30	21	24	63	88	109	177			0	-10	-15	-20	-20	-50		
01110700	11	10.8N	124.2E	35	11	47	101	100	88	93	151	218	0	10	0	-5	-10	-35	-55	-5
01110706	12	10.8N	123.6E	40	0	21	59	72	68	57	66	140	0	5	5	0	-10	-40	-50	10
01110712	13	11.0N	123.1E	35	13	32	59	63	48	42	112	238	0	0	0	-10	-20	-45	-40	45
01110718	14	11.2N	122.7E	40	5	24	21	25	42	64	154		0	0	-5	-15	-30	-45	-35	
01110800	15	11.4N	122.2E	45	8	19	30	55	55	108	197		0	0	-5	-15	-30	-45	10	
01110806	16	11.8N	121.5E	45	23	71	76	141	71	134	240		0	0	-10	-25	-40	-40	40	
01110812	17	12.1N	120.8E	55	23	59	88	93	88	183	327		0	-5	-15	-30	-40	-25	50	
01110818	18	12.4N	119.8E	55	13	25	13	26	54	170			0	-5	-15	-30	-35	-20		
01110900	19	12.6N	118.8E	65	0	13	17	17	48	158			0	-5	-15	-30	-35	15		
01110906	20	12.9N	117.8E	70	13	8	21	18	25	163			5	-15	-25	-30	-30	30		

Statistics for JTWC on TY 27W Lingling

01110912	21	13.1N	116.9E	80	5	21	24	39	88	231			-5	-20	-25	-25	-15	60		
01110918	22	13.4N	116.0E	90	0	6	8	64	140				0	-15	-15	-5	-5			
01111000	23	13.4N	115.3E	100	0	21	58	111	205				0	-5	0	5	30			
01111006	24	13.5N	114.8E	110	5	37	78	124	162				5	5	10	30	70			
01111012	25	13.5N	114.0E	115	8	29	74	113	167				0	5	20	55	85			
01111018	26	13.6N	113.3E	115	0	24	77	118					0	0	5	45				
01111100	27	13.6N	112.4E	115	0	19	55	88					0	10	40	35				
01111106	28	13.5N	111.6E	110	11	67	133						0	5	45					
01111112	29	13.5N	110.5E	100	5	58	113						0	30	45					
01111118	30	13.6N	109.4E	95	0	29							0	15						
01111200	31	13.6N	108.3E	60	0	30							0	10						
01111206	32	13.5N	107.3E	45	6								0							
01111212		13.3N	106.4E	25																
			AVERAGE		11	33	58	72	88	135	178	199	1	7	15	22	30	38	40	20
			BIAS										0	0	-1	-5	-11	-24	-11	17
			# CASES		29	25	23	21	19	15	7	3	29	25	23	21	19	15	7	3

Statistics for JTWC on TS 28W

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01111612	2	6.9N	147.6E	20 1	20								5							
01111618	3	7.3N	146.6E	25	18								-5							
01111700	4	7.8N	145.6E	25	18								-5							
01111706	5	8.0N	144.4E	25	0								-5							
01111712	6	9.0N	143.8E	25	89								-5							
01111718	7	10.0N	143.3E	25	39								-5							
01111800	8	10.8N	142.7E	25	42								-5							
01111806	9	11.5N	142.3E	25	24								-5							
01111812	10	12.2N	142.1E	25	29	63	40	58	92	181	272	303	0	5	10	15	20	35	25	35
01111818	11	12.9N	141.9E	25	5	32	124	230	321	384			0	5	10	15	20	35		
01111900	12	13.8N	141.6E	25	6	113	204	282	360	454			0	5	5	10	20	35		
01111906	13	14.0N	140.6E	25	17	107	204	263	301	399			0	5	5	0	10	20		
01111912	14	14.1N	139.4E	25	17	76	98	111	123	182	187	696	0	0	0	0	15	20	15	25
01111918	15	14.3N	137.9E	25	48	105	142	147	155	164			0	0	0	0	15	15		
01112000	16	14.4N	136.5E	30	11	21	33	21	29	86			0	0	5	15	20	20		
01112006	17	14.3N	135.2E	30	5	8	76	91	115	126			0	0	5	15	15	20		
01112012	18	14.0N	134.1E	35	8	13	48	53	148	72			0	5	15	15	20	20		
01112018	19	13.7N	133.1E	35	8	30	58	85	165	34			5	10	15	15	20	25		
01112100	20	13.4N	132.1E	35	11	39	69	117	136	100	334		5	10	10	15	10	20	15	
01112106	21	13.2N	131.2E	35	29	18	54	110	78	191			0	10	10	15	15	20		
01112112	22	13.0N	130.1E	30	21	42	78	60	103	311			0	0	10	10	15	20		
01112118	23	12.4N	129.5E	30	72	163	170	171	145	322			0	5	10	10	15	20		
01112200	24	11.8N	129.0E	30	53	111	97	61	127	456			0	5	5	5	5	10		
01112206	25	11.0N	128.6E	30	25	79	30	142	282				0	0	0	5	5			
01112212	26	11.0N	127.8E	30	43	54	108	222	356				0	0	0	5	10			
01112218	27	11.4N	127.3E	30	37	46	176	327	452				0	0	0	0	5			
01112300	28	11.8N	127.7E	30	30	83	143	237	316				0	0	0	5	5			
01112306	29	12.0N	128.5E	30	34	130	242	309					0	0	0	5				
01112312	30	12.9N	129.3E	30	46	102	187	268					0	5	10	10				
01112318	31	14.4N	130.1E	30	26	90	174						-5	0	10					
01112400	32	15.9N	130.6E	30	45	170	270						0	5	10					
01112406	33	17.4N	131.4E	30	6	45							0	5						

Statistics for JTWC on TS 28W

01112412	34	19.0N	132.0E	25	0	98							0	0						
01112418	35	20.5N	132.1E	25	68								0							
01112500		22.3N	132.3E	25																
			AVERAGE		31	74	123	160	200	231	264	500	2	3	6	9	14	22	18	30
			BIAS										-1	3	6	9	14	22	18	30
			# CASES		34	25	23	21	19	15	3	2	34	25	23	21	19	15	3	2

Statistics for JTWC on TS 29W

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01111818	2	5.4N	107.2E	25	26								-5							
01111900	3	4.6N	106.7E	25	11								-5							
01111906	4	4.6N	108.1E	25	47								-5							
01111912	5	4.6N	109.1E	25	48								-5							
01111918	6	4.9N	110.1E	25	61								-5							
01112000	7	5.3N	110.8E	25	73								0							
01112006	8	5.6N	111.3E	25	59	64	87	203	254	334			0	-5	-5	-10	-15	-10		
01112012	9	5.8N	111.7E	30	6	62	145	198	258	310			0	-5	-5	-5	-10	-10		
01112018	10	6.0N	112.0E	35	8	102	169	209	216				-5	0	-5	-10	-10			
01112100	11	6.7N	112.6E	35	45	99	131	161	187				0	0	-5	-10	-5			
01112106	12	7.3N	113.2E	35	37	22	35	69	136				0	-5	-10	-10	-10			
01112112	13	7.8N	113.6E	35	25	34	42	73	159				-5	0	5	10	0			
01112118	14	8.1N	114.0E	35	36	51	72	126					0	0	0	5				
01112200	15	8.3N	114.4E	35	33	70	88	152					0	0	5	5				
01112206	16	8.4N	115.1E	35	26	12	65						0	0	5					
01112212	17	8.4N	115.7E	35	17	8	55						0	5	0					
01112218	18	8.3N	116.2E	35	13	68							0	5						
01112300	19	8.1N	116.9E	30	39	89							0	0						
01112306	20	7.6N	117.7E	30	56								0							
01112312		7.1N	118.6E	30																
			AVERAGE		36	57	89	149	202	322			2	2	5	8	8	10		
			BIAS										-2	0	-2	-3	-8	-10		
			# CASES		19	12	10	8	6	2			19	12	10	8	6	2		

Statistics for JTWC on TS 30W Kajiki

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01120406	1	10.1N	129.1E	25	33								0							
01120412	2	10.1N	128.0E	25	37								0							
01120418	3	10.1N	126.9E	25	74								0							
01120500	4	10.3N	125.8E	30	24	38	48	46	55	74			-5	0	5	10	10	20		
01120506	5	10.6N	124.8E	30	8	19	53	65	94	88			0	5	5	10	20	25		
01120512	6	10.9N	123.9E	35	13	24	41	59	71	109			0	5	10	15	25	30		
01120518	7	11.1N	123.0E	30	13	32	32	19	23	112			0	5	10	15	25	35		
01120600	8	11.3N	122.1E	35	23	42	47	39	61	160			0	5	10	15	30	30		
01120606	9	11.4N	121.2E	35	13	37	66	51	38	106			0	5	10	15	30	35		
01120612	10	11.6N	120.1E	35	18	34	34	19	54				0	5	10	20	30			
01120618	11	11.8N	119.0E	35	24	36	32	27	63				0	5	10	25	25			
01120700	12	12.0N	117.9E	35	0	13	53	58	126				0	5	15	25	25			
01120706	13	12.4N	116.6E	35	5	29	53	130	179				0	5	15	15	5			

Statistics for JTWC on TS 30W Kajiki

01120712	14	12.6N	115.6E	35	40	37	78	185					0	0	-5	-5				
01120718	15	12.7N	114.7E	35	23	43	111	164					0	0	0	0				
01120800	16	13.0N	113.8E	30	6	8	82						0	0	0					
01120806	17	13.1N	112.9E	30	34	87	159						0	5	10					
01120812	18	13.1N	112.3E	30	29	97							0	0						
01120818	19	13.0N	112.0E	25	37	82							0	5						
01120900	20	12.8N	111.7E	25	13								0							
01120906		12.8N	111.2E	20																
			AVERAGE		24	41	64	72	76	108			0	3	8	14	23	29		
			BIAS										0	3	8	13	23	29		
			# CASES		20	16	14	12	10	6			20	16	14	12	10	6		

Statistics for JTWC on TS 31W

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01121012		4.6N	155.4E	20																
01121018	1	4.8N	155.3E	25	51								0							
01121100	2	5.0N	155.2E	25	37								0							
01121106	3	5.2N	155.1E	25	17								0							
01121112	4	5.5N	155.5E	25	19								0							
01121118	5	5.0N	156.5E	25	86	273	316						0	5	0					
01121200	6	4.2N	157.9E	25	64	80	89						0	-5	10					
01121206	7	4.5N	159.2E	25	0	42							0	-5						
01121212	8	5.3N	159.3E	30	8	59							0	15						
01121218	9	5.7N	159.7E	35	18								0							
01121300	10	5.9N	160.5E	20	21								5							
			AVERAGE		33	114	202						1	8	5					
			BIAS										1	3	5					
			# CASES		10	4	2						10	4	2					

Statistics for JTWC on TY 32W Vamei

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01122612	2	1.4N	106.5E	25	36								0							
01122618	3	1.5N	105.8E	35	30								-10							
01122700	4	1.5N	105.1E	65	24	6	48	65	32	67			-40	10	10	10	5	10		
01122706	5	1.5N	104.4E	65	0	13	22	43	30	73			10	0	10	5	5	5		
01122712	6	1.6N	103.7E	45	11	12	27	19	27	42			0	5	5	5	0	5		
01122718	7	1.6N	102.9E	40	18	13	40	31	35	107			5	10	5	5	5	-5		
01122800	8	1.7N	102.2E	30	13	12	75	118	236				0	0	5	0	-5			
01122806	9	1.8N	101.4E	30	5	17	68	103					0	0	0	-5				
01122812	10	1.9N	100.7E	25	6	19							0	0						
01122918	11	3.3N	95.7E	25	16								0							
01123000	12	3.8N	94.3E	25	32								0							
01123006	13	4.1N	93.3E	25	13								0							
01123012	14	4.4N	92.5E	25	51								0							
01123018	15	4.6N	91.8E	35	73	115	199	271					0	0	10	20				
01123100	16	4.6N	91.2E	35	85								0							
01123106	17	4.5N	90.8E	35	30	95	160						0	5	15					
01123112	18	4.2N	90.5E	35	67								0							

Statistics for JTWC on TY 32W Vamei

01123118	19	3.8N	90.3E	30 1	15	24							0	0						
02010100		3.4N	90.0E	25																
02010106		3.0N	89.3E	25																
			AVERAGE		35	33	80	93	72	72			4	3	8	7	4	6		
			BIAS										-2	3	8	6	2	4		
			# CASES		18	10	8	7	5	4			18	10	8	7	5	4		

Statistics for JTWC on STY33W Faxai

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01121306	1	4.2N	162.0E	20	51	44	97	89	65	54			0	0	0	0	-5	0		
01121312	2	4.4N	162.6E	25	30	78	126	96	62	53			0	-5	0	-5	-5	0		
01121318	3	4.8N	162.5E	25	24	38	66	74	59	38			0	-5	0	-5	0	0		
01121400	4	5.1N	162.4E	30	0	47	36	35	110	132			0	5	0	5	5	5		
01121406	5	5.1N	162.2E	30	12	32	59	53	32	107			0	5	0	5	5	0		
01121412	6	5.1N	162.1E	30	8	19	30	25	32	57			0	0	5	5	5	-5		
01121418	7	5.1N	162.1E	30	6	17	17	30	60	93			0	0	5	5	5	-15		
01121500	8	5.1N	162.1E	35	8	17	27	51	77	103			0	0	5	5	5	-15		
01121506	9	5.2N	162.1E	35	13	13	27	64	93	60			0	0	0	0	-5	-20		
01121512	10	5.2N	161.9E	35	41	30	30	59	97	140			0	0	0	0	-10	-20		
01121518	11	5.3N	161.7E	35	11	6	13	35	48	113			0	5	5	0	-15	-15		
01121600	12	5.3N	161.5E	35	23	78	126	162	221	358			0	5	10	0	-5	-5		
01121606	13	5.4N	161.5E	35	13	22	51	91	168	317			0	0	-5	-15	-10	-10		
01121612	14	5.5N	161.5E	35	6	22	40	86	162	288			0	0	-10	-20	-10	-10		
01121618	15	5.6N	161.5E	35	6	19	42	108	180	256			0	-5	-20	-20	-10	-5		
01121700	16	5.7N	161.5E	35	8	13	62	129	198	222			-5	-10	-20	-20	-10	0		
01121706	17	5.8N	161.4E	40	5	48	115	208	294	339			0	-10	-10	-10	-5	0		
01121712	18	5.8N	161.3E	45	13	53	144	235	300	305	279	265	0	-10	-10	-10	-5	-5	-55	-85
01121718	19	5.8N	161.2E	55	8	57	146	223	281	260	301	293	0	5	15	20	25	10	-45	-75
01121800	20	5.8N	161.3E	55	21	67	122	191	229	206	215	138	0	5	15	20	30	0	-60	-80
01121806	21	5.7N	161.5E	55	24	72	103	125	132	114	196	219	0	0	5	10	10	-25	-75	-85
01121812	22	5.7N	161.7E	55	18	66	78	83	78	127			0	0	5	15	5	-40		
01121818	23	5.8N	162.0E	55	8	12	25	67	73	118	209	293	0	0	10	10	5	-50	-80	-55
01121900	24	6.0N	162.2E	55	13	43	51	48	42	60	165	189	5	10	25	10	0	-55	-80	-35
01121906	25	6.1N	162.2E	55	8	30	63	36	51	78	156	292	0	5	5	-5	-25	-70	-85	-45
01121912	26	6.3N	162.1E	55	13	60	53	17	36	102	186	382	0	10	0	-15	-40	-70	-75	-35
01121918	27	6.6N	161.8E	50	34	89	150	178	190	261	374	498	0	-5	-10	-30	-55	-80	-60	-25
01122000	28	7.1N	161.3E	45	26	59	91	118	129	198	312	603	0	-10	-20	-45	-70	-80	-40	-20
01122006	29	7.7N	160.7E	55	0	13	8	38	70	163	299	686	0	-10	-30	-55	-70	-70	-45	5
01122012	30	8.1N	159.8E	60	0	19	49	75	101	214	391	929	0	-10	-35	-65	-65	-55	-30	15
01122018	31	8.6N	159.0E	65	18	35	59	85	126	242	444	1125	0	-20	-45	-60	-60	-25	-5	35
01122100	32	9.2N	158.2E	75	11	38	71	111	153	272	555		-5	-15	-40	-40	-50	5	20	
01122106	33	9.9N	157.5E	90	16	34	55	89	140	257			-10	-30	-40	-40	-35	10		
01122112	34	10.5N	156.7E	105	5	32	61	105	157	309			0	-20	-15	-25	-5	30		
01122118	35	11.1N	155.9E	120	12	31	78	127	170	301	885		0	-10	-15	-10	15	35	75	
01122200	36	11.6N	155.0E	135	0	35	78	103	126	339			0	5	-10	0	20	40		
01122206	37	12.3N	153.9E	140	0	13	38	54	86	268			0	-5	-10	10	15	50		
01122212	38	13.1N	152.7E	140	0	17	32	55	75	283			0	-10	0	20	25	55		
01122218	39	13.9N	151.5E	150	0	27	38	49	103	361			0	0	20	20	35	50		
01122300	40	14.7N	150.2E	155	0	24	27	36	167				0	10	25	35	50			
01122306	41	15.6N	149.1E	150	0	13	36	77	219				0	15	15	30	40			
01122312	42	16.3N	148.1E	140	0	17	36	126	254				0	15	20	30	35			

Statistics for JTWC on STY33W Faxai

01122318	43	17.3N	147.1E	125	5	13	53	143	249				0	0	15	25	30			
01122400	44	18.0N	146.5E	115	13	17	106	189					0	5	15	15				
01122406	45	19.1N	146.2E	115	0	46	139	213					-5	15	25	20				
01122412	46	20.1N	146.3E	105	0	83	145						0	5	10					
01122418	47	21.6N	147.2E	95	0	44	189						0	5	5					
01122500	48	23.3N	149.0E	85	0	28							0	0						
01122506	49	25.2N	151.4E	75	48	89							0	0						
01122512	50	27.1N	153.9E	70	0								0							
01122518	51	29.1N	158.1E	65	0								0							
			AVERAGE		12	37	70	98	132	194	331	455	1	7	13	18	22	27	55	46
			BIAS										0	-1	-2	-4	-5	-12	-43	-37
			# CASES		51	49	47	45	43	39	15	13	51	49	47	45	43	39	15	13

Statistics for JTWC on TC 01A

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01052106	5	13.7N	68.1E	25	44								0							
01052112	6	13.7N	69.0E	30	37								-5							
01052118	7	13.7N	69.9E	35	13	6	25	68	108	230			0	-20	-25	-30	-30	-25		
01052200	8	13.9N	70.6E	45	5	13	40	88	129	231			-5	-15	-20	-20	-30	-15		
01052206	9	14.1N	71.2E	60	0	43	107	165	242	328			-5	5	0	-10	-25	-20		
01052212	10	14.5N	71.6E	65	13	68	157	215	322	373			0	0	-5	-20	-45	-35		
01052218	11	14.9N	71.7E	70	8	59	100	161	208	192			0	0	-5	-25	-20	0		
01052300	12	15.4N	71.4E	75	11	53	75	155	145	116			0	-5	-10	-25	-10	10		
01052306	13	15.7N	70.9E	80	29	12	35	53	24	49			-5	-15	-20	-15	-10	15		
01052312	14	15.9N	70.4E	85	0	24	52	13	47	197			-5	-10	-15	10	10	30		
01052318	15	16.4N	70.2E	95	11	40	57	50	66	95			-5	-20	-5	10	15	35		
01052400	16	16.7N	69.8E	100	5	70	72	87	132	169			-5	-10	15	25	30	40		
01052406	17	16.8N	69.0E	110	17	6	29	84	142	200			-10	15	30	45	55	65		
01052412	18	16.8N	68.2E	110	45	46	86	176	214	271			5	25	40	55	60	65		
01052418	19	16.9N	68.1E	100	20	34	18	41	72	139			15	25	30	40	45	55		
01052500	20	17.0N	68.0E	90	5	18	45	46	54	105			10	5	5	5	5	15		
01052506	21	17.2N	67.8E	90	0	48	85	94	117	168			10	10	10	10	10	25		
01052512	22	17.2N	67.6E	80	16	73	87	96	103	144			5	20	15	10	10	25		
01052518	23	17.1N	67.7E	75	8	34	26	50	76	84			10	15	15	15	15	20		
01052600	24	17.0N	67.9E	65	25	35	31	54	74	61			5	5	5	5	5	10		
01052606	25	17.2N	67.8E	60	12	12	8	23	62	39			5	10	10	10	15	15		
01052612	26	17.6N	67.8E	55	11	8	12	13	59	49			0	5	10	10	15	-20		
01052618	27	18.0N	67.7E	50	8	12	26	62	29				5	0	0	10	10			
01052700	28	18.3N	67.6E	50	12	13	58	107	73				-5	0	0	10	10			
01052706	29	18.6N	67.6E	45	13	36	74	39	33				5	5	10	15	15			
01052712	30	19.0N	67.6E	45	12	13	29	38	83				0	0	5	10	-25			
01052718	31	19.5N	67.7E	40	8	27	36	48					0	5	5	5				
01052800	32	19.9N	67.7E	40	8	23	28	25					0	5	5	-30				
01052806	33	20.2N	68.2E	30	30	46	57						5	10	10					
01052812	34	21.0N	68.4E	30	8	73	53						5	10	-25					
01052818	35	21.8N	67.9E	25	5	21							0	0						
01052906	36	22.8N	68.2E	20	71								5							
01052912		23.4N	68.8E	55																
			AVERAGE		16	33	54	79	109	162			4	9	13	18	22	27		
			BIAS										1	3	3	5	5	16		
			# CASES		32	29	28	26	24	20			32	29	28	26	24	20		

Statistics for JTWC on TC 02A

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01092400	1	16.6N	69.8E	25	26								-5							
01092406	2	16.7N	69.5E	25	43								0							
01092412	3	16.8N	69.2E	25	45								0							
01092418	4	16.8N	68.9E	25 1	07								0							
01092500	5	16.9N	68.7E	30	8								0							
01092506	6	17.1N	68.4E	30	11								-5							
01092512	7	17.3N	68.1E	25	16								0							
01092518	8	17.5N	67.7E	30	12								0							
01092600	9	17.8N	67.2E	30	17	24	80	117	139				0	5	10	20	30			
01092606	10	18.2N	66.6E	35	11	17	62	85	108				0	5	15	15	30			
01092612	11	18.5N	65.9E	35	6	21	51	61	64				0	5	15	25	30			
01092618	12	18.7N	65.1E	35	5	13	38	60					0	10	15	25				
01092700	13	18.8N	64.3E	35	0	23	17	26					0	5	15	20				
01092706	14	18.9N	63.6E	30	17	13	25						5	5	15					
01092712	15	19.0N	63.0E	30	22	40	68						5	15	15					
01092718	16	19.1N	62.5E	30	6	31							0	5						
01092800	17	19.2N	62.0E	20	22	51							0	0						
01092806	18	19.2N	61.5E	20	8								0							
01092812	19	19.4N	61.1E	20	12								0							
			AVERAGE		21	26	49	70	104				1	6	14	21	30			
			BIAS										0	6	14	21	30			
			# CASES		19	9	7	5	3				19	9	7	5	3			

Statistics for JTWC on TC 03A

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01100806	2	17.7N	70.8E	25	5								0							
01100812	3	17.9N	70.2E	25	13								0							
01100818	4	18.1N	69.8E	25	21								-5							
01100900	5	18.3N	69.5E	25	8								0							
01100906	6	18.6N	69.3E	30	18	21	72	78	83	187			0	5	15	20	25	25		
01100912	7	18.6N	68.8E	35	22	67	103	121	131	216			0	10	25	25	35	25		
01100918	8	18.3N	68.4E	30	74	149	164	169	209				0	10	10	10	10			
01101000	9	18.0N	68.1E	30	99	128	133	146	213				0	5	0	5	0			
01101006	10	17.8N	67.9E	25	45	29	12						0	-5	-5					
01101012	11	18.1N	67.7E	20	12	51							5	-5						
01101018		18.6N	67.5E	25																
01101100		18.6N	67.0E	25																
01101106		18.7N	66.4E	25																
01101112		18.7N	66.1E	15																
01101118		18.8N	66.1E	20																
01101200		18.9N	66.2E	20																
01101206		19.0N	66.3E	20																
01101212		19.3N	66.3E	20																
01101218		19.6N	66.2E	20																
01101300		19.8N	65.8E	20																
01101306		20.0N	65.0E	20																
			AVERAGE		32	74	97	128	159	202			1	7	11	15	18	25		
			BIAS										0	3	9	15	18	25		

Statistics for JTWC on TC 03A																				
			# CASES		10	6	5	4	4	2			10	6	5	4	4	2		

Statistics for JTWC on TC 04B																				
	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01110900	1	12.0N	83.6E	25	72								0							
01110906	2	12.9N	83.0E	25	66								0							
01110912	3	13.2N	82.7E	25	76								-5							
01111000	4	13.8N	82.2E	25	11								0							
01111006	5	14.1N	82.1E	25	13								0							
01111012	6	14.4N	82.1E	30	29								0							
01111018	7	14.8N	82.2E	30	25								0							
01111100	8	15.1N	82.7E	30	62	87	178						0	5	0					
01111106	9	15.4N	83.4E	30	25								0							
01111112	10	15.6N	84.2E	30	26	121							0	5						
01111118	11	16.0N	84.9E	30	36								5							
01111200	12	16.6N	85.5E	30	21								5							
01111206	13	17.3N	85.7E	20	5								5							
			AVERAGE		36	104	178						2	5	0					
			BIAS										1	5	0					
			# CASES		13	2	1						13	2	1					

5.3 SOUTHERN HEMISPHERE VERIFICATION TABLES

This section includes this year's verification statistics for each Southern Hemisphere tropical cyclone warned on by JTWC.

Statistics for JTWC on TC 01S

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00080100		6.1S	79.7E	25																
00080106		6.1S	78.9E	30																
00080112		6.2S	78.2E	30																
00080118	1	6.2S	77.7E	35	6	51	59	43					0	0	5	5				
00080200	2	6.2S	77.2E	35	32	72	66	63					0	5	5	10				
00080206	3	6.1S	76.9E	35	21	47	114						0	5	5					
00080212	4	6.2S	76.6E	35	18	59	119						0	5	10					
00080218	5	6.5S	76.1E	35	25	80							0	0						
00080300	6	7.0S	75.4E	35	13	38							0	5						
00080306	7	7.6S	74.6E	35	38								0							
00080312	8	8.2S	73.9E	30	43								0							
			AVERAGE		25	58	89	53					0	3	6	8				
			BIAS										0	3	6	8				
			# CASES		8	6	4	2					8	6	4	2				

Statistics for JTWC on TC 02S

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00111006		7.6S	83.1E	25																
00111012		8.6S	82.7E	25																
00111018		9.3S	82.2E	30																
00111100		9.7S	81.8E	25																
00111106		10.2S	81.4E	25																
00111112		10.7S	80.7E	30																
00111118		11.0S	80.0E	30																
00111200	1	11.0S	79.6E	30	24	87	209	341	453				0	0	10	15	15			
00111212	2	10.5S	79.4E	35	42	139	242	360	470				0	5	10	15	15			
00111300	3	9.9S	79.9E	30	5	19	139						-5	-10	-5					
00111306		9.7S	80.2E	30																
00111312		9.6S	80.5E	30																
00111318		9.6S	80.9E	30																
00111400		9.7S	81.3E	30																
00111406		9.7S	81.6E	30																
00111412		9.7S	81.9E	30																
00111418		9.7S	82.2E	30																
00111500		9.6S	82.8E	30																
00111506		9.4S	83.3E	30																
00111512		9.4S	83.7E	30																
00111518		9.8S	83.9E	30																
00111600		10.2S	84.3E	30																
00111606		10.5S	84.9E	25																
00111612		10.9S	85.5E	25																
00111618		11.1S	85.9E	25																
00111700		11.1S	86.3E	25																

Statistics for JTWC on TC 02S

00111706		10.9S	86.7E	30																
00111712		10.7S	87.2E	30																
00111718		10.8S	87.6E	30																
00111800		11.3S	87.5E	30																
00111806		11.7S	87.0E	30																
00111812		12.0S	86.4E	30																
00111818		12.6S	85.5E	30																
00111900		13.3S	84.3E	30																
00111906		14.0S	83.1E	30																
00111912		14.4S	81.9E	25																
00111918		14.8S	80.5E	25																
00112000		15.4S	79.3E	25																
00112006		16.5S	78.2E	25																
			AVERAGE		24	82	197	350	462				2	5	8	15	15			
			BIAS										-2	-2	5	15	15			
			# CASES		3	3	3	2	2				3	3	3	2	2			

Statistics for JTWC on TC 03S Sam

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00120300		11.2S	127.8E	25																
00120306		12.2S	128.2E	25																
00120312		12.8S	128.2E	25																
00120318		13.6S	128.1E	30																
00120400		14.3S	127.6E	30																
00120406		14.5S	126.6E	30																
00120412		14.6S	125.7E	30																
00120418		14.6S	125.1E	30																
00120500	1	14.5S	124.4E	30	13	25	25	29	79				5	5	0	0	-10			
00120512	2	14.5S	123.2E	35	11	8	25	79	116				0	-5	-5	-15	-25			
00120600	3	14.8S	122.3E	45	5	13	63	85	93				0	5	-5	-20	-35			
00120612	4	15.4S	121.7E	50	8	64	99	105	129				5	0	-10	-25	-10			
00120700	5	16.7S	121.5E	65	16	33	44	72	123				0	-10	-25	-15	15			
00120712	6	17.6S	121.1E	85	8	26	60	93	132				0	-20	-5	-5	-5			
00120718	7	17.8S	121.0E	110	18	46	91	142	190				5	15	40	65	50			
00120806	8	18.4S	121.2E	110	6	29	87	148	231				15	30	55	65	50			
00120818	9	19.2S	121.8E	95	8	21	67						5	-15	-20					
00120906	10	20.3S	122.7E	70	0	25							-5	-5						
00120912		20.7S	123.1E	55																
00120918		21.0S	123.7E	50																
00121000		21.2S	124.3E	45																
00121006		21.3S	124.9E	40																
00121012		21.4S	125.3E	30																
00121018		21.3S	125.8E	25																
			AVERAGE		10	29	62	94	137				4	11	18	26	25			
			BIAS										3	0	3	6	4			
			# CASES		10	10	9	8	8				10	10	9	8	8			

Statistics for JTWC on TC 04S Ando

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									

Statistics for JTWC on TC 04S Ando

DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00123106		8.7S	67.4E	30																
00123112		9.2S	67.1E	20																
00123118		9.7S	66.5E	20																
01010100		10.2S	65.4E	25																
01010106		10.7S	64.0E	25																
01010112		11.1S	62.9E	25																
01010118		11.2S	62.1E	25																
01010200		11.1S	61.6E	25																
01010206		11.1S	61.3E	25																
01010212		11.1S	61.0E	35																
01010218	1	11.2S	60.6E	40	8	25	31	36	55				-5	-20	-30	-40	-50			
01010306	2	11.6S	59.6E	60	0	21	67	51	40				0	-5	-10	-40	-60			
01010318	3	12.4S	58.7E	75	0	35	54	57	80				0	-10	-20	-40	-60			
01010406	4	13.7S	57.5E	90	0	25	38	86	130				0	-15	-30	-40	-45			
01010418	5	14.8S	56.4E	105	17	35	40	54	56				10	10	0	-15	-30			
01010506	6	16.3S	55.5E	115	13	21	40	45	56				0	5	0	-15	-20			
01010518	7	17.8S	54.7E	120	0	8	13	18	33				5	5	-5	-5	-10			
01010606	8	19.4S	53.8E	120	0	12	24	56	34				5	5	5	5	10			
01010618	9	20.9S	53.1E	120	0	6	28	45	71				-5	-5	-10	5	15			
01010706	10	22.3S	52.3E	110	5	38	51	93	130				5	5	10	25	30			
01010718	11	23.7S	51.9E	100	0	55	100	139	181				5	20	30	40	40			
01010806	12	24.3S	51.2E	80	21	32	92	143	184				-5	5	10	10	10			
01010818	13	25.3S	50.8E	60	13	27	85	183					-5	10	20	20				
01010906	14	26.7S	50.6E	45	18	37	117						-5	0	5					
01010918	15	28.2S	50.8E	35	13	113							-5	5						
01011006	16	30.4S	52.3E	25	21								0							
			AVERAGE		8	33	56	77	88				4	8	13	23	32			
			BIAS										0	1	-2	-7	-14			
			# CASES		16	15	14	13	12				16	15	14	13	12			

Statistics for JTWC on TC 05S Bindu

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01010600		10.2S	79.6E	25																
01010606		10.4S	79.1E	25																
01010612		10.6S	78.6E	25																
01010618		10.8S	78.2E	30																
01010700		11.1S	77.4E	30																
01010706		11.6S	76.3E	30																
01010712		11.7S	75.1E	35																
01010718	1	11.9S	74.1E	40	11	51	130	146	209				-5	-20	-30	-35	-35			
01010806	2	13.3S	73.5E	60	18	36	35	82	145				-5	-10	-10	-5	15			
01010818	3	15.2S	73.1E	75	0	18	26	87	115				-10	-20	-15	0	30			
01010906	4	15.9S	72.5E	85	13	55	101	91	47				-5	-10	0	20	35			
01010918	5	16.1S	72.7E	90	6	21	75	69	70				0	5	25	30	30			
01011006	6	16.4S	72.9E	85	8	35	27	12	12				-10	0	0	-10	-30			
01011018	7	16.6S	72.4E	70	6	18	41	34	29				-5	5	-5	-25	-45			
01011106	8	16.6S	71.3E	65	8	13	18	68	109				0	5	0	-25	-30			
01011118	9	16.9S	70.1E	70	0	18	36	83	145				-5	-10	-15	-20	-25			
01011206	10	17.3S	69.3E	85	5	46	87	160	256				5	0	10	5	0			
01011218	11	18.0S	69.1E	100	6	6	33	99	127				15	20	15	30	40			

Statistics for JTWC on TC 05S Bindu

01011306	12	18.9S	68.8E	95	13	46	121	162	130				5	0	10	20	35			
01011318	13	19.4S	68.7E	90	0	68	86	70	32				0	15	20	35	40			
01011406	14	19.9S	69.0E	75	6	48	68	78	108				-5	-5	0	0	0			
01011418	15	20.2S	68.2E	65	11	80	123	162	178				-10	5	0	5	10			
01011506	16	20.1S	66.2E	50	20	25	32	80	145				-5	0	5	10	5			
01011518	17	20.7S	64.2E	45	21	51	85	118					0	10	15	10				
01011606	18	21.7S	62.1E	35	5	0	19						5	10	5					
01011618	19	22.7S	60.5E	25	11	6							5	5						
01011700		23.3S	59.8E	25																
01011706		24.2S	59.2E	25																
01011712		25.1S	59.3E	25																
			AVERAGE		9	34	63	94	116				5	8	10	17	25			
			BIAS										-2	0	2	3	5			
			# CASES		19	19	18	17	16				19	19	18	17	16			

Statistics for JTWC on TC 06S Charly

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01011712		12.3S	86.4E	25																
01011718		12.4S	86.5E	25																
01011800		12.5S	86.5E	25																
01011806		12.7S	86.3E	25																
01011812		13.0S	86.0E	25																
01011818		13.3S	85.6E	25																
01011900		13.6S	85.2E	30																
01011906		14.0S	84.7E	30																
01011912		14.5S	84.2E	35																
01011918	1	15.0S	83.6E	40	6	40	79	112	149				0	-5	-10	-5	0			
01012006	2	16.1S	82.2E	55	6	6	40	44	55				0	-5	0	5	10			
01012018	3	16.9S	80.5E	70	18	42	46	35	72				-5	0	5	15	10			
01012106	4	17.3S	78.2E	75	0	19	55	72	82				0	-5	-10	-30	-30			
01012118	5	17.9S	76.1E	85	11	27	56	90	98				5	10	10	0	10			
01012206	6	18.4S	74.0E	90	8	29	66	93	64				0	-5	5	15	25			
01012218	7	19.3S	72.1E	105	6	6	25	46	51				0	5	20	30	30			
01012306	8	20.8S	70.2E	100	0	28	78	101	66				0	15	35	40	40			
01012318	9	22.1S	67.7E	75	0	42	53	55	110				-5	5	0	0	0			
01012406	10	22.6S	64.6E	55	0	8	28	85					0	10	10	5				
01012418	11	23.4S	61.5E	45	8	23	73						0	5	5					
01012506	12	24.5S	59.1E	35	6	37							0	0						
01012518	13	25.2S	57.5E	30	0								0							
01012600		25.3S	56.9E	25																
			AVERAGE		5	26	55	73	83				1	6	10	15	17			
			BIAS										0	3	6	8	11			
			# CASES		13	12	11	10	9				13	12	11	10	9			

Statistics for JTWC on TC 07S Terri

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01012718		15.4S	128.0E	25																
01012800		15.4S	127.0E	25																

Statistics for JTWC on TC 07S Terri

01012806		15.3S	125.9E	25																
01012812		15.2S	124.8E	25																
01012818		15.3S	123.7E	25																
01012900		15.7S	122.8E	30																
01012906	1	16.1S	122.0E	30	13	66	88	123	179				0	5	0	0	0			
01012918	2	16.7S	120.9E	30	16	21	113	227	471				0	5	5	15	40			
01013006	3	17.6S	119.7E	35	12	53	168	407					0	-5	0	25				
01013018	4	19.0S	119.2E	45	40	118	281						0	10	5					
01013106	5	21.0S	119.6E	45	18	73							10	5						
01013118	6	25.0S	120.9E	30	21								5							
			AVERAGE		20	66	163	252	325				3	6	3	13	20			
			BIAS										3	4	3	13	20			
			# CASES		6	5	4	3	2				6	5	4	3	2			

Statistics for JTWC on TC 08P Winsome

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01020918		10.6S	137.7E	25																
01021000		11.6S	137.7E	25																
01021006	1	13.0S	137.6E	30	18	59	71	93	104				0	0	5	5	5			
01021018	2	14.3S	136.2E	35	17	31	76	110	137				0	0	5	5	5			
01021106	3	14.9S	135.0E	40	13	51	70	91	110				5	10	10	5	0			
01021118	4	15.9S	133.5E	30	6	81	158	81	150				0	0	-5	0	-5			
01021200		16.3S	132.8E	25																
01021206		16.7S	132.1E	25																
01021212		17.0S	131.5E	25																
01021218		17.4S	130.8E	25																
01021300		17.7S	130.2E	25																
01021306		18.1S	129.6E	25																
01021312		18.7S	129.2E	25																
01021318		19.3S	129.1E	25																
01021400		20.0S	129.1E	25																
			AVERAGE		14	56	94	93	125				1	3	6	4	4			
			BIAS										1	3	4	4	1			
			# CASES		4	4	4	4	4				4	4	4	4	4			

Statistics for JTWC on TC 09S Vincent

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01020718		13.3S	116.8E	25																
01020800		13.4S	116.4E	25																
01020806		13.6S	115.9E	25																
01020812		13.8S	115.3E	25																
01020818		14.1S	114.8E	25																
01020900		14.5S	114.4E	30																
01020906		14.8S	114.0E	30																
01020912		14.9S	113.7E	25																
01020918		14.9S	113.3E	25																
01021000		15.0S	112.9E	25																
01021006		15.2S	112.6E	30																

Statistics for JTWC on TC 09S Vincent

01021012		15.4S	112.3E	30																
01021018		15.6S	112.2E	30																
01021100		15.8S	112.2E	25																
01021106		15.9S	112.3E	25																
01021112		16.0S	112.3E	25																
01021118		15.8S	111.9E	25																
01021200		15.5S	111.4E	30																
01021206	1	15.2S	111.4E	30	39	58	113	141	197				0	0	5	10	20			
01021218	2	14.7S	112.8E	35	21	48	60	87	92				0	5	10	20	30			
01021306	3	15.1S	115.1E	35	11	12	31	41	75				0	5	10	20	30			
01021318	4	15.6S	117.0E	35	0	6	36	42	91				0	5	10	20	35			
01021406	5	16.1S	118.6E	35	21	27	25	85					0	5	10	25				
01021418	6	16.7S	119.8E	35	11	29	80						0	5	15					
01021506	7	17.6S	120.3E	35	43	171							0	5						
01021518	8	19.7S	121.8E	30	28								0							
			AVERAGE		22	50	58	79	114				0	4	10	19	29			
			BIAS										0	4	10	19	29			
			# CASES		8	7	6	5	4				8	7	6	5	4			

Statistics for JTWC on TC 10P

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01021600		16.8S	157.4E	25																
01021606		17.6S	158.5E	25																
01021612		18.2S	159.7E	25																
01021618		18.9S	160.8E	30																
01021700	1	19.2S	162.4E	30	18	29	16						5	5	15					
01021712	2	19.6S	165.5E	35	18	25							0	0						
01021800	3	21.0S	167.2E	30	11								5							
01021806		22.0S	168.0E	30																
			AVERAGE		16	27	16						3	3	15					
			BIAS										3	3	15					
			# CASES		3	2	1						3	2	1					

Statistics for JTWC on TC 11S

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01021818		18.9S	163.6W	25																
01021900		19.0S	164.2W	25																
01021906		19.2S	164.7W	25																
01021912		19.7S	164.9W	25																
01021918		20.1S	165.0W	25																
01022000		20.5S	164.9W	30																
01022006		21.1S	164.2W	30																
01022012		21.8S	163.5W	30																
01022018	1	22.6S	162.5W	35	33								0							
01022106	2	24.6S	159.3W	45	48								5							
01022118	3	27.6S	155.3W	45	37								0							
01022200		29.6S	152.9W	45																
01022206		32.6S	150.2W	45																

Statistics for JTWC on TC 11S

			AVERAGE		40								2							
			BIAS										2							
			# CASES		3								3							

Statistics for JTWC on TC 12P Abigail

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01022300		15.5S	155.2E	25																
01022306		16.2S	153.1E	30																
01022312		16.6S	151.0E	30																
01022318		16.6S	149.1E	30																
01022400		16.6S	147.4E	30																
01022406		16.5S	145.8E	30																
01022412		16.3S	144.4E	30																
01022418		16.0S	143.2E	30																
01022500		16.2S	142.3E	30																
01022506		16.9S	141.2E	30																
01022512		16.3S	140.4E	35																
01022518	1	16.2S	140.0E	40	8	36	80	116	149				-5	-10	0	25	40			
01022606	2	16.5S	139.2E	55	5	34	70	91	103				0	-5	0	-5	0			
01022618	3	16.9S	137.8E	60	8	13	18	46					-5	-5	0	5				
01022706	4	17.1S	136.1E	45	5	13	13						0	0	5					
01022712		17.4S	135.3E	40																
01022718		17.4S	134.5E	35																
01022800		17.4S	133.6E	30																
01022806		17.4S	132.8E	25																
01022812		17.4S	132.1E	25																
01022818		17.4S	131.2E	25																
01030100		17.5S	130.3E	25																
01030106		17.6S	129.3E	25																
01030112		17.8S	128.5E	25																
01030118		18.0S	127.8E	25																
01030200		18.4S	127.3E	25																
01030206		18.9S	126.8E	25																
01030212		19.5S	126.1E	25																
01030218		19.7S	125.5E	25																
01030300		19.8S	124.9E	25																
01030306		19.8S	124.5E	25																
01030312		19.9S	124.3E	25																
01030318		20.0S	124.2E	25																
01030400		20.1S	124.2E	25																
			AVERAGE		7	24	45	84	126				3	5	1	12	20			
			BIAS										-3	-5	1	8	20			
			# CASES		4	4	4	3	2				4	4	4	3	2			

Statistics for JTWC on TC 13P Paula

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01022506		10.5S	162.8E	20																
01022512		10.7S	163.1E	20																

Statistics for JTWC on TC 13P Paula

01022518		11.1S	163.5E	25																
01022600		11.6S	163.9E	30																
01022606		12.1S	164.2E	30																
01022612	1	12.5S	164.4E	35	24	47	41	40	133				0	-15	-20	-25	-30			
01022700	2	13.4S	164.7E	50	26	38	64	144	239				-5	-10	-10	-10	-5			
01022712	3	14.4S	165.4E	65	8	63	160	227	336				-10	-10	-10	-5	0			
01022800	4	16.1S	166.8E	75	17	63	131	243	308				10	20	25	20	5			
01022812	5	17.4S	169.0E	85	11	24	90	136	122				0	5	10	15	0			
01030100	6	18.7S	171.8E	90	18	51	104	131	115				0	-5	-15	-20	-5			
01030112	7	19.8S	175.4E	95	11	66	85	90	40				-5	-15	-25	-5	5			
01030200	8	21.2S	179.1E	100	8	8	23	47	75				-10	-15	5	10	5			
01030212	9	22.9S	177.8W	105	5								-15							
01030300	10	24.7S	175.5W	80	31								0							
01030312	11	25.9S	174.0W	65	20								0							
01030400	12	27.8S	172.2W	55	5								0							
01030406		28.7S	171.4W	45																
01030412		29.8S	170.4W	45																
01030418		31.0S	169.2W	35																
			AVERAGE		16	45	87	132	171				5	12	15	14	7			
			BIAS										-3	-6	-5	-3	-3			
			# CASES		12	8	8	8	8				12	8	8	8	8			

Statistics for JTWC on TC 14S

	WRN	BEST TRACK			POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01022818		19.3S	136.8W	25																
01030100		19.5S	136.3W	30																
01030106		19.7S	135.9W	30																
01030112		19.8S	135.5W	30																
01030118	1	19.9S	135.1W	30	8								5							
01030206	2	20.7S	134.8W	35	8								0							
01030218	3	21.8S	135.1W	35	8								0							
01030306	4	23.4S	135.4W	35	8								5							
01030318	5	24.8S	136.2W	40	5								0							
01030406	6	26.8S	136.7W	40	17								0							
01030418	7	28.9S	136.8W	30	26								5							
01030500		30.4S	136.1W	30																
01030506		31.7S	135.4W	30																
			AVERAGE		12								2							
			BIAS										2							
			# CASES		7								7							

Statistics for JTWC on TC 15S Dera

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01030718		14.8S	41.0E	25																
01030800		15.3S	40.7E	25																
01030806		16.3S	40.3E	25																
01030812		17.0S	39.9E	30																
01030818		17.4S	39.8E	30																
01030900	1	18.1S	40.2E	35	18	99	178	242	302				-5	-20	-20	-25	-30			
01030912	2	21.0S	40.5E	55	6	36	67	84	96				0	5	5	-5	-20			
01031000	3	22.8S	40.7E	60	5	16	33	92	115				0	-5	-10	-30	-45			
01031012	4	24.4S	40.6E	70	5	19	68	147	50				-5	-10	-25	-40	-40			
01031100	5	25.9S	40.5E	75	12	72	91	33	291				-5	-25	-45	-50	-20			
01031112	6	27.3S	40.2E	85	5	12	19	101					-20	-35	-40	-20				
01031200	7	29.3S	41.0E	90	0	95	277						-15	-30	-10					
01031212	8	34.5S	43.7E	85	0	169							-15	-5						
01031300	9	42.2S	50.8E	55	0								0							
			AVERAGE		6	65	105	117	171				7	17	22	28	31			
			BIAS										-7	-16	-21	-28	-31			
			# CASES		9	8	7	6	5				9	8	7	6	5			

Statistics for JTWC on TC 16S

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01040212		13.0S	87.5E	20																
01040218	1	13.3S	86.5E	25	5	41	59	82	146				10	20	30	40	45			
01040306	2	14.1S	84.0E	30	26	80	117	99	132	385			5	10	20	30	45	50		
01040318	3	15.2S	82.0E	35	8	55	126	237	350	526			0	10	20	25	30	30		
01040406	4	15.5S	79.5E	35	28	87	198	333	462	657			0	5	15	25	30	35		
01040418	5	14.7S	77.4E	35	13	95	210	310	398				0	10	20	25	30			
01040506	6	12.8S	76.9E	30	13	103	215	309	441				5	10	15	20	25			
01040518	7	11.4S	77.7E	25	13	114							0	0						
01040600		10.9S	78.2E	25																
01040606		10.7S	78.6E	25																
01040612		10.6S	79.1E	25																
01040618		10.6S	79.6E	25																
01040700		10.7S	80.0E	25																
01040706		11.3S	81.4E	25																
			AVERAGE		16	82	154	228	322	523			3	9	20	28	34	38		
			BIAS										3	9	20	28	34	38		
			# CASES		7	7	6	6	6	3			7	7	6	6	6	3		

Statistics for JTWC on TC 17S Walter

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01040206		9.8S	107.7E	25																
01040212		10.0S	106.6E	25																
01040218		10.0S	105.3E	30																
01040300	1	10.0S	104.0E	40	8	71	101	103	96				-5	-5	0	0	-5			
01040312	2	10.0S	102.4E	55	13	32	47	29	6				0	0	0	0	10			

Statistics for JTWC on TC 17S Walter

01040400	3	10.1S	100.6E	65	0	13	24	66	117				0	-10	-10	0	15			
01040412	4	10.5S	98.7E	75	23	30	66	100	111				0	-5	5	15	20			
01040500	5	11.2S	97.1E	85	21	41	72	106	141				5	20	30	35	25			
01040512	6	12.1S	96.1E	85	11	43	85	156	282				-5	0	0	5	10			
01040600	7	12.7S	95.3E	80	26	38	21	115					-10	-10	-10	-5				
01040612	8	13.5S	94.6E	75	29	104	195						-10	-10	-5					
01040700	9	15.1S	95.0E	70	0	75							-5	5						
01040712	10	17.9S	95.3E	60	5								-10							
			AVERAGE		14	50	76	96	126				5	7	8	9	14			
			BIAS										-4	-2	1	7	13			
			# CASES		10	9	8	7	6				10	9	8	7	6			

Statistics for JTWC on TC 18S Evariste

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01040300		9.4S	60.7E	30																
01040306		9.8S	61.1E	30																
01040312		10.1S	61.5E	30																
01040318	1	10.6S	62.2E	30	16	130	126	127	174				0	0	-10	-20	-30			
01040406	2	12.0S	63.4E	35	18	102	131	137	149				0	-10	-25	-35	-30			
01040418	3	13.0S	62.4E	45	6	34	54	82	120				0	-5	-10	-10	-10			
01040506	4	13.6S	61.5E	60	11	35	98	137	244				0	-10	-5	0	0			
01040518	5	14.9S	61.1E	75	0	26	64	161	54				0	0	0	0	15			
01040606	6	16.2S	61.0E	75	0	18	130	46	101				0	10	10	15	25			
01040706	7	21.7S	62.5E	55	30	143	217						0	15	20					
01040712	8	22.9S	61.7E	45	12	174	291						0	0	10					
01040718	9	23.0S	61.0E	40	33	223							0	5						
01040800	10	23.5S	61.0E	40	42	287							0	10						
01040806	11	24.3S	62.1E	30	16								0							
01040812		26.1S	63.7E	25																
			AVERAGE		17	117	139	115	140				0	7	11	13	18			
			BIAS										0	2	-1	-8	-5			
			# CASES		11	10	8	6	6				11	10	8	6	6			

Statistics for JTWC on TC 19P Sose

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01040318		11.8S	171.5E	25																
01040400		11.9S	170.5E	25																
01040406		12.2S	169.5E	25																
01040412		12.5S	168.8E	25																
01040418		12.9S	168.2E	25																
01040500		13.2S	167.7E	25																
01040506		13.4S	167.2E	25																
01040512		13.4S	166.7E	25																
01040518	1	13.4S	166.1E	35	46	39	87	175	247				0	0	-5	-10	-10			
01040606	2	13.8S	165.3E	40	11	60	152	223	284				0	-5	-15	-15	-10			
01040618	3	14.5S	165.6E	50	34	93	139	209	307				0	-5	-10	-10	-5			
01040706	4	15.8S	166.7E	60	8	78	144	189	250				5	5	10	20	25			
01040718	5	17.8S	167.4E	65	17	26	6	29	42				5	5	15	25	30			

Statistics for JTWC on TC 19P Sose

01040806	6	19.5S	168.3E	65	23	68	117	118	155				-5	5	20	20	25			
01040818	7	20.6S	169.5E	60	8	30	20	53	60				-5	0	5	15	20			
01040906	8	22.0S	170.5E	55	0	30	34	30	26				-5	0	10	10	15			
01040918	9	23.2S	170.1E	50	11	22	54	72					0	5	10	10				
01041006	10	24.5S	170.0E	40	5	45	92						0	0	5					
01041018	11	25.5S	170.1E	35	12	53							0	0						
01041106	12	26.4S	169.5E	30	0								0							
			AVERAGE		15	49	85	122	171				2	3	11	15	18			
			BIAS										0	1	5	7	11			
			# CASES		12	11	10	9	8				12	11	10	9	8			

Statistics for JTWC on TC 20S Alistair

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01041600		8.3S	135.4E	25																
01041606	1	8.6S	134.5E	30	5	36	73	111	188				0	0	0	-5	-5			
01041618	2	9.5S	132.6E	35	21	65	118	201	282				0	0	0	0	0			
01041706	3	10.6S	130.4E	40	0	13	42	89	139				-5	-5	-5	-10	-15			
01041718	4	11.8S	128.1E	45	42	88	125	152	166	167			-5	-5	-10	-10	10	35		
01041800	5	12.6S	126.9E	50	16	38	121	158	164	144			-5	-10	-15	-5	10	35		
01041806	6	13.4S	125.6E	50	8	13	25	38	60	64			5	-5	0	10	30	40		
01041812	7	14.2S	124.4E	55	8	12	17	60	77	75			5	5	15	20	35	45		
01041818	8	15.0S	123.2E	60	0	17	36	69	34	117			0	0	15	30	40	55		
01041900	9	15.9S	122.1E	65	5	29	87	128	131	199			0	5	15	25	25	35		
01041906	10	16.5S	121.0E	65	18	54	96	138	186	192			0	5	10	10	10	10		
01041912	11	17.0S	119.7E	60	45	79	153	175	190	204			0	0	5	5	5	10		
01041918	12	17.6S	118.0E	55	47	120	142	200	274				0	0	-5	-5	0			
01042000	13	18.0S	116.4E	55	18	45	74	134	156				-5	0	-5	-5	0			
01042006	14	18.4S	114.8E	45	0	18	41	25	34				0	-5	-5	0	5			
01042012	15	18.8S	113.7E	45	13	38	37	39	45				0	0	0	5	5			
01042018	16	19.4S	112.8E	40	11	38	74	131					0	5	10	5				
01042100	17	20.0S	111.8E	40	8	53	91	144					0	0	5	5				
01042106	18	20.5S	110.7E	35	0	38	69	110					0	5	0	0				
01042112	19	21.1S	110.0E	35	0	58	123						0	5	0					
01042118		21.4S	109.6E	25																
01042200		21.9S	109.2E	25																
01042206		22.5S	109.0E	25																
01042212		23.1S	109.2E	25																
01042218		23.6S	109.5E	25																
01042300		24.1S	109.7E	25																
01042306		24.2S	110.3E	25																
01042312		24.0S	111.8E	25																
			AVERAGE		14	45	81	117	142	145			2	3	6	9	13	33		
			BIAS										-1	0	2	4	10	33		
			# CASES		19	19	19	18	15	8			19	19	19	18	15	8		

Statistics for JTWC on TC 21S

	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
01062012		30.0S	34.2E	25																

Statistics for JTWC on TC 21S

01062018		28.8S	33.9E	30												
01062100		27.4S	33.9E	45												
01062106		26.6S	34.7E	65												
01062112		26.3S	35.4E	60												
01062118	1	26.0S	36.3E	55	0	52	71	71					-10	10	5	10
01062206	2	25.9S	38.9E	35	5	21	102						0	10	15	
01062218	3	25.5S	41.0E	35	0	19							0	5		
01062306	4	24.6S	41.9E	25	0								0			
			AVERAGE		1	31	86	71					3	8	10	10
			BIAS										-3	8	10	10
			# CASES		4	3	2	1					4	3	2	1

6. APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

6.1 SATOPS FIX STATISTICS FOR NORTHWEST PACIFIC OCEAN (Herron, J.C. and Barlow, S.J., NPMOC/JTWC)

The JTWC Satellite Operations Section (SATOPS) has developed metrics to evaluate internal satellite reconnaissance support to the Typhoon Duty Officer (TDO). Metrics have also been developed for the evaluation of all satellite reconnaissance centers, which support the JTWC tropical cyclone forecasting effort.

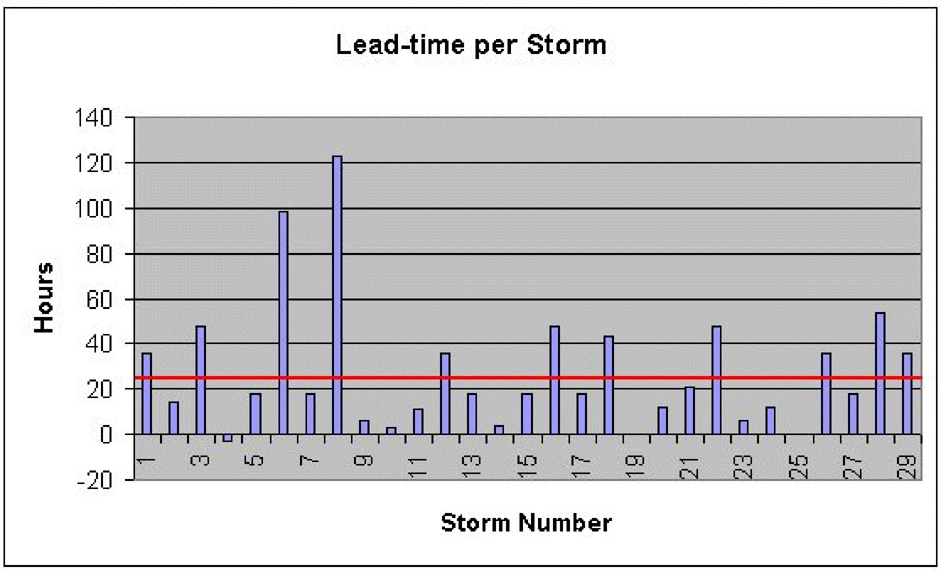


Fig 6-1. JTWC/SATOPS lead-time per storm. The lead-time is calculated using the delta between the initial storm fix and the initial warning time.

A key SATOPS process metric is the amount of lead-time SATOPS provides the TDO in relation to the time of the first warning issued on a storm. A 24-hour lead-time has been determined as the appropriate lead-time necessary for the TDO to issue the Tropical Cyclone Formation Alert and the first warning. Figure 6-1 shows the lead-time provided for tropical storms 01W-29W. The figure clearly shows that 62% of the storms (18) did not meet the 24-hour lead-time criteria; despite the fact that JTWC SATOPS provided approximately 30-hours average lead-time. These numbers are misleading on an individual level, especially when, on occasion, the on-coming satellite analyst was "caught" with a system when satellite imagery indicated that the previous shift could have already begun fixing. Also, these numbers do not take into account that several storms developed more rapidly than T1.0 per day. Some individuals were very proactive and identified systems in very early stages, although others struggled and need to be a little more proactive interrogating systems earlier in their development. To remedy this, SATOPS has developed an internal suspect area fix checklist (see Fig 6-2) for early classification and interrogation assistance.

Suspect Area Fix Checklist

Primary Considerations: (Ideally looking to meet 3 of 5 criteria but item 4 may weigh more heavily)

☐ 1. Are there curved lines or bands indicating a center of curvature within a small area?

☐ 2. Is there a center, which is defined by, or appears near dense overcast clouds?

☐ 3. Have convective clouds persisted for at least 12 hours?

☐ 4. Does the environment favor further development?

*** Under Ridge? ☐ SSTs ≥ 27C? ☐ Low Shear (5-10kt)? ☐ No Land Interaction?

☐ 5. What model or models are favored by the TDO? ______________________

*** Do these models indicate further development? Yes No

Secondary Considerations:

☐ 6. Is there a well-defined, reliable LLCC on QUIKSCAT or Microwave?

☐ 7. Is there a definite synoptic center? Min SLP: _____ Trend: ↑ or ↓

☐ 8. Other Agency Fixes? KGWC ________ KWBC ________

*** Consider calling KGWC to request they start fixing on the system.

*** Consider making a recommendation for upgrade to the TDO.

Fig 6-2. JTWC/SATOPS Suspect Area Fix Checklist.

JTWC SATOPS also needs to be compared to the Air Force Weather Agency and NOAA/NESDIS Satellite Applications Branch since these are the outside support agencies for the TDO. This statistic is accurate for JTWC however; there are several factors that must be considered when looking at other fix sites. One consideration is that the other units do not disseminate their fixes to JTWCs TDO until the storm is classifiable (KGWC T1.0 and KWBC T2.0). The lead-time provided by the other sites could increase substantially by implementing several changes in their dissemination procedures. The other sites could begin disseminating position fixes that are not yet classifiable under Dvorak rules, or with the implementation of a T0.0 intensity. The results of this lead-time study support the dissemination of fixes immediately, rather than waiting until a storm is Dvorak classifiable which is the current procedure. This change would result in increased support to the TDO and thus result in an improved the warning process.

Using the data provided in this paper, it can be asserted that changes in the dissemination process could further increase the TDOs forecasting abilities by providing satellite data to support the warning process more rapidly. If the satellite network were to make changes in the dissemination procedures (i.e. early dissemination of fix data), the typhoon warning could be issued quicker, resulting in better lead-time provided to its customers.

6.2 CONSENSUS FORECASTING AND AN ANALYSIS OF THE SYSTEMATIC APPROACH TO TROPICAL CYCLONE FORECASTING AID (SAFA) at the JOINT TYPHOON WARNING CENTER (Cantrell, C.E., NPMOC/JTWC)

The concept of reducing tropical cyclone forecast errors by using a linear combination of independent forecasts or objective aids in an operational setting has been in practice at the Joint Typhoon Warning Center (JTWC) for more than two decades. One of the first consensus forecasts was HPAC (half persistence and half climatology) which, when applied to the track forecasting problem during the late 1970s and early 1980s, performed about as well as any individual objective aid (Tsui 1984). Other consensus approaches such as Tsui (1984), Leslie and Fraedrich (1990), Mundell (1993), and Mundell and Rupp (1995) have also been used with varying degrees of success. In 1998, a consensus was introduced for the western North Pacific that consistently outperformed the individual objective aids and even the JTWC forecast (Goerss 2000; Sampson 2002).

Beginning in 1994 the development of a forecast process had begun that was designed to aid the Typhoon Duty Officer (TDO) in the classification of the current synoptic situation, in a review of dynamical model fields and in the identification of systematic model errors. This process, entitled the Systematic Approach to Tropical Cyclone Forecasting Aid (SAFA), was developed by Dr. Les Carr III and Dr. Russell L. Elsberry, Naval Post Graduate School, Monterey, California, and James E. Peak, Computer Sciences Corporation, Monterey, California to facilitate the systematic production, review and use of the Non-Selective Consensus (NCON) and Selective Consensus (SCON) forecast aids. (Carr and Elsberry 1994; Carr and Elsberry 2000; Peak et al. 2000).

The NCON is similar in concept to previous consensus approaches and is defined as a simple numerical consensus of available dynamic model vortex tracks for each warning. The five models considered for the NCON are the Navy Operational Global Atmospheric Prediction System (NOGAPS), Geophysical Fluid Dynamics Laboratory Hurricane Prediction System - Navy version (GFDN), U.K. Met Office global model (EGRR), Japan Global Spectral Model (JGSM), and the Japan Typhoon Model (JTYM).

The SCON is intended as a refinement to the NCON. If the TDO determines, after a thorough field review, that one or more of the models contain an error they have the option of removing that model(s) from the NCON thus creating an SCON.

The Joint Typhoon Warning Center (JTWC) completed the second year of operational testing of Module Two (Model Traits) of the SAFA during the 2001 Tropical Cyclone (TC) season.

An evaluation and comparison of JTWC and NCON for the 2000 and 2001 Northwestern Pacific (NWPAC) TC forecast season is presented in Table 6-1. This table shows a homogeneous comparison of the 24, 48 and 72-hour track errors (in nm) for the JTWC official forecast and NCON. For this comparison NCON is defined as being a consensus of two or more of the models described in the preceding paragraph. During the 2000 season NCON achieved a 5.1%, 6.6%, and 4.0% improvement over the corresponding JTWC errors at 24, 48, and 72-hours respectively (Table 6-1). By contrast, during the 2001 NWPAC season JTWC was able to match NCONs performance at 24 hours, and improve on NCON by 8.3% and 9.0% at 48 and 72-hours respectively.

Table 6-1 Homogeneous comparison of JTWC and NCON forecast track errors (FTE) in nautical miles for the 2000 and 2001 western North Pacific season. Number of cases indicated in parenthesis after the JTWC track errors.

	JTWC Forecast Track Error (nm)		NCON Forecast Track Error (nm)	
	2000	2001	2000	2001
24 hours	79 (549)	72 (602)	75	72
48 hours	136 (423)	121 (478)	127	132
72 hours	203 (330)	181 (366)	195	199

A more detailed analysis, that categorizes track errors according to the number of models in the NCON ensemble, of a homogeneous comparison of the 72-hour track errors of JTWC and NCON for the 2000 and 2001 NWPAC season is shown in Table 6-2. Findings indicated that JTWC added value over NCON at 72 hours when NCON consisted of two and three models for both the 2000 and 2001 season. For the four and five model categories JTWC was unable to add value over NCON during the 2000 season, however, results from the 2001 season showed JTWC was able to improve over NCON in the four and five model categories by 5.0% and 5.5% respectively. Finally, the analyses showed NCON improved over JTWC during the 2000 season by 4% when all cases with 2 or more models are considered. In contrast, JTWC posted a 9% improvement over NCON during the 2001 season.

Table 6-2 also highlights the general fact that as the number of models available for NCON increases, the NCON track error decreases; especially once the fourth model is added.

Table 6-2 Homogeneous comparison of JTWC and NCON forecast position errors (nm) at the 72 hour forecast period categorized by the number of models available for NCON. Number of cases shown in parenthesis after the year.

	2 Models		3 Models		4 Models		5 Models		Cases with 1 Model	
	2000 (37)	2001 (34)	2000 (60)	2001 (56)	2000 (97)	2001 (72)	2000 (136)	2001 (204)	2000 (330)	2001 (366)
JTWC	248	192	226	198	186	189	194	172	203	181
NCON	292	225	242	245	165	199	170	182	195	199

In order to determine an explanation for JTWCs ability to add value over NCON in the four, five and all model cases during the 2001 season versus JTWCs inability to accomplish this same result during the 2000 season, the development and use of SCONs is considered. An analyses, that categorizes track errors according to the number of models in the NCON ensemble, of a homogeneous comparison of the 72-hour track errors of JTWC, NCON and SCON for the 2000 and 2001 NWPAC season is shown in Table 6-3.

Table 6-3 Homogeneous comparison of JTWC, NCON and SCON forecast position errors (nm) at the 72 hour forecast period categorized by the number of models available for NCON. Number of cases shown in parenthesis after the year.

	2 Models		3 Models		4 Models		5 Models		Cases with 1 Model	
	2000 (30)	2001 (32)	2000 (58)	2001 (53)	2000 (97)	2001 (69)	2000 (133)	2001 (203)	2000 (318)	2001 (357)
JTWC	237	185	226	202	186	190	191	172	200	181
NCON	287	224	242	250	165	201	167	181	191	199
SCON	301	224	243	229	186	197	193	183	210	196

Findings in Table 6-3 indicated that SCON was unable to improve on NCON in all categories during the 2000 NWPAC season. However, during the 2001 NWPAC season, SCON was able to match or improve over NCON in all categories except the five model category.

An analysis of the SCONs was conducted to determine the frequency in which they were being created and what percentage of SCONs added value over NCON and what percentage did not (see Table 6-4). One indication of the poor performance of SCON during the 2000 TC season is the frequency in which it was created. SCONs were created in 55% of the total cases during 2000. In a review of systematic model errors for NOGAPS and GFDN during the 1997 NWPAC season Carr and Elsberry (2000a,b) found that only 33 to 35 percent of these dynamic model TC track forecasts were contaminated by systematic model errors. Therefore the creation of SCONs in 55% of the cases during the 2000 season was excessive. This important lesson learned led to a 36.3% reduction in the number of SCONs created during the 2001 season as compared to the 2000 season with SCONs being created only 20% of the time during 2001.

Table 6-4 Evaluation of Non-Selective Consensus (NCON) and Selective Consensus (SCON) for the 2000 and 2001 Northwest Pacific Tropical Cyclone Season

Number of Models in NCON	Sample Size		Number of SCONs created		Number of SCONs that Added value to NCON		Mean improvement of SCON vs NCON (nm)		Number of SCONs that subtracted value from NCON		Mean degradation of SCON vs NCON (nm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
2	30	32	5	0	2	0	121	0	3	0	215	0
3	58	53	26	7	14	6	104	197	12	1	125	55
4	97	69	50	15	15	8	64	132	35	7	89	109
5	133	203	94	50	36	26	50	60	58	24	90	77
T	318	357	175	72	67	40	67	94	108	32	97	84

Not only were SCONs being created too frequently during the 2000 season, they were also being created in such a way that they subtracted more value from NCON than they added. Of the 175 SCONs created during the 2000 season only 67 (38%) added value by an average of 67 nm with 108 (62%) subtracting value by an average of 97 nm.

Similar analysis from the 2001 season indicated that 40 (55.5%) SCONs added value over NCON by an average of 94 nm while 32 (44.5%) subtracted value over NCON by 84nm.

Another important finding is the performance of NCON when four and five models are available for the consensus. During the 2000 season SCONs were created 50 (52%) and 94 times (71%) for the four and five model categories respectively (Table 6-4). This led to NCON outperforming SCON by 11% and 13.5% in the four and five model categories.

Conversely SCONs were only created 15 (21.7%) and 50 (24.6%) times for the four and five model categories during the 2001 season. As a result SCON was able to add value in the mean over NCON by 2% in the four-model category. However, SCON was still unable to add value over NCON in the five-model category, with NCON showing a 1% improvement over SCON.

The reduction in the frequency of SCONs created, SCONs being created in such a way that they add value over NCON, and the finding that an NCON containing 5 models is difficult to improve on played key roles in the reduction of JTWC forecast track errors during the 2001 NWPAC TC season.

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6.3 THE JOINT TYPHOON WARNING CENTER TROPICAL CYCLONE BEST-TRACKS, 1945-2000 (Chu, J. and Sampson, C.R., Naval Research Laboratory, Levine, A.S., University of Hawaii, and Fukada, E., JTWC)

This report documents efforts to resolve discrepancies associated within the JTWC tropical cylone best-track archives. Corrections were limited to years for which supporting documentation was found: 1950-2000 for the western North Pacific, 1971-2000 for the North Indian Ocean and 1985-2000 for the Southern Hemisphere. The authors rate the 1985-2000 best-tracks to be of high quality and urge users to use older data with caution. The modified best-tracks are posted on JTWC Tropical Cyclone Best Track Data Site at https://metoc.npmoc.navy.mil/jtwc/best_tracks/.