Australian Government
Bureau of Meteorology

Unnamed Tropical Cyclone 01U

27 July – 1 August 2022

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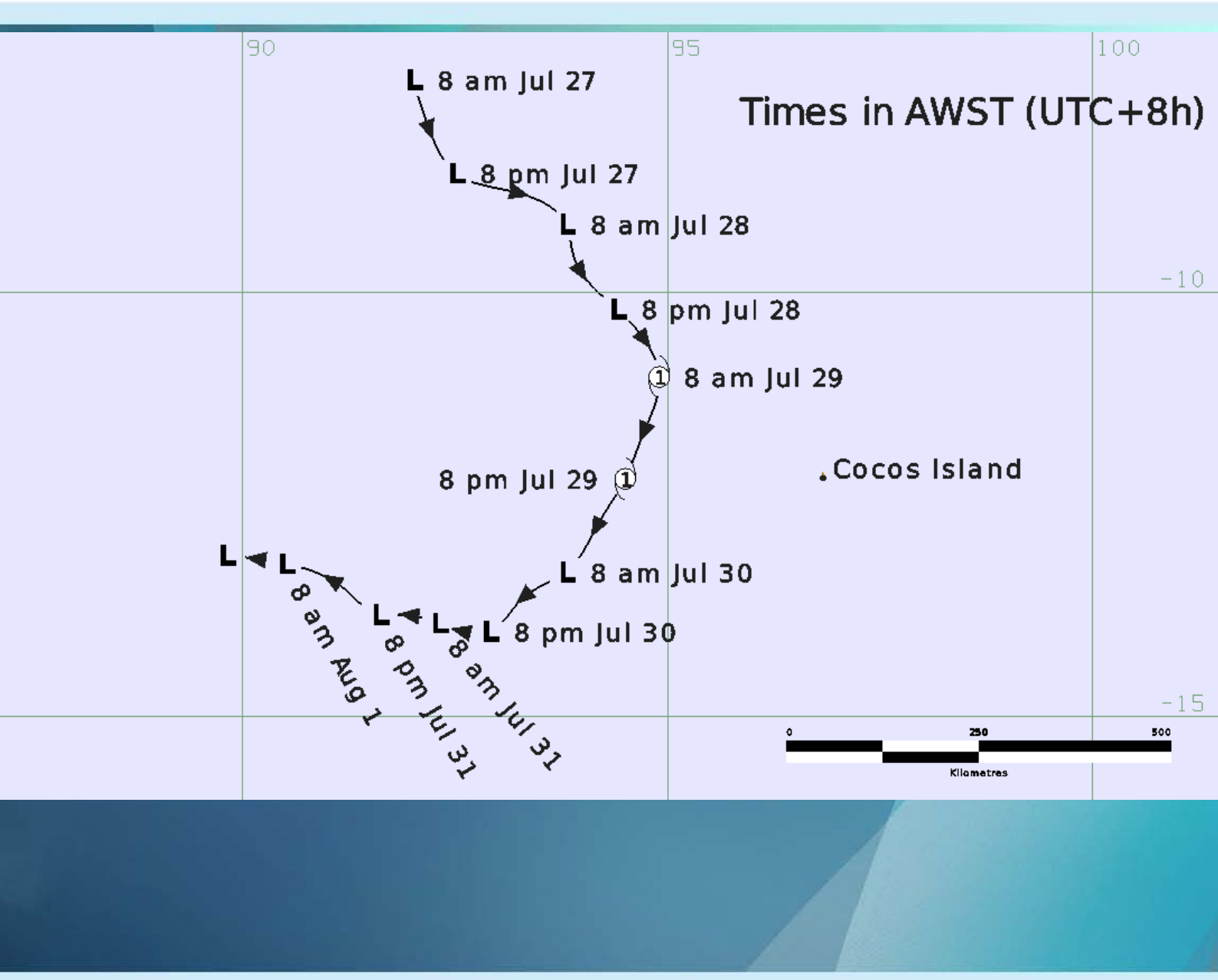

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1. Summary

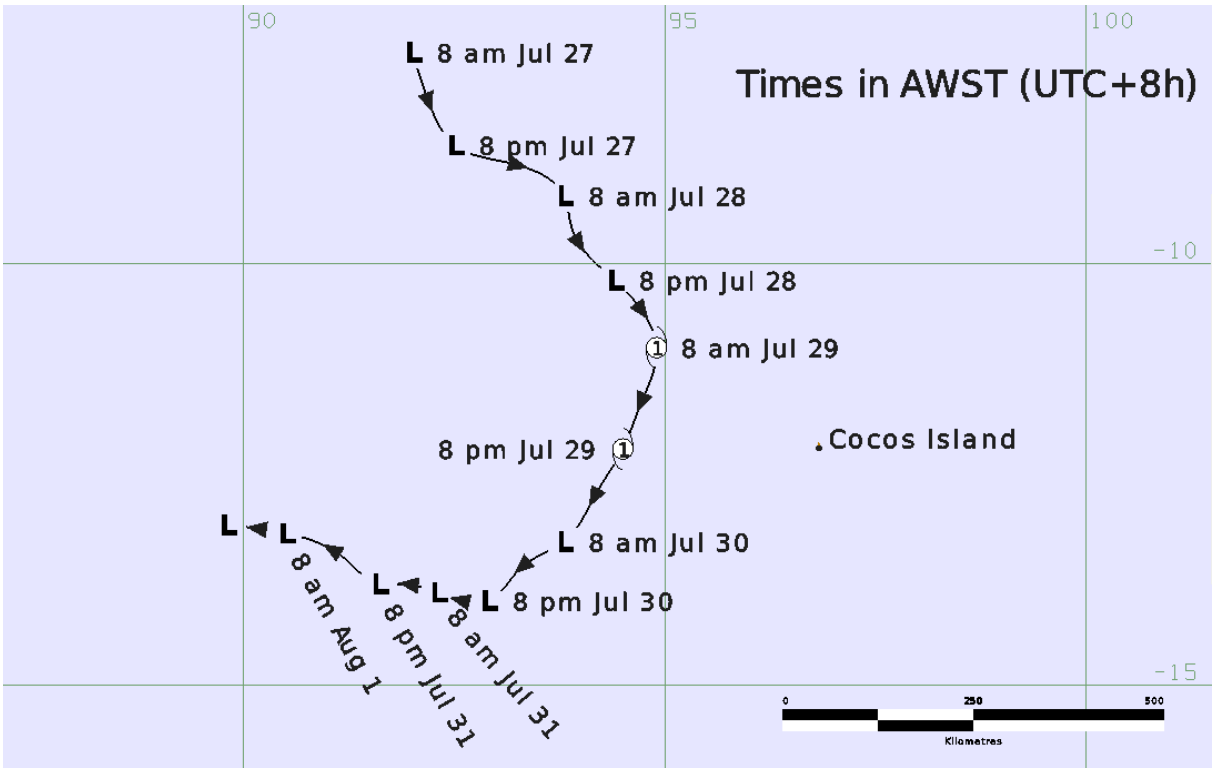
An unusual out of season tropical low in the Indian Ocean briefly reached tropical cyclone intensity on 29 July over open waters.

Gales developed to the south of the centre overnight from 28 to 29 July extending to the northwest quadrant during 29 July sufficient to reach tropical cyclone intensity. Gales continued southwest of the centre on 30 and 31 July even as the circulation weakened.

Ocean wind warnings and track maps were issued for the system but gales were not expected to extend more than halfway around the centre. It was not named in real time on the basis of anticipated weakening. However, upon reanalysis after the event it was determined that it did attain tropical cyclone intensity.

The system passed west of Cocos Island and while it did lead to a period of heavy showers there were no significant impacts on the Islands.

Figure 1. Best track of unnamed Tropical Cyclone 01U July 2022 (times in AWST, UTC +8 hours)



2. Meteorological Description

2.1 Intensity analysis

A tropical low formed in the Indian Ocean on 26 July following an increase in monsoonal storm activity during an MJO event. By 28 July deep convection became more pronounced south of the centre owing to a strong upper-level divergence associated with an upper-level trough. However, strong north to northeasterly wind shear limited deep convection forming elsewhere.

Scatterometry and radiometers on 28 – 29 July provided valuable guidance to estimate the intensity. SMOS at 1138 UTC 28 July and ASCAT-B 1535 UTC 28 July indicated gales albeit well removed some 50 nm southeast from the centre. AMSR2 at 1902 UTC 28 July indicated gales extending to the southwest quadrant, while ASCAT-B at 0241UTC 29 July (see Figure 2); ASCAT-C at 0333 UTC 29 July indicated gales extending also into the northwest quadrant, as shown in Figure 4. As a result of the latter images, tropical cyclone intensity is estimated at 0000 UTC 29 July meeting the requirement for gales to extend more than halfway around the centre. Deep convection remained constrained south of the system as shown on the SSMIS microwave image in Figure 3.

For a period later on 29 July deep convection briefly increased closer to the centre and the SMAP pass at 1140 UTC 29 July in Figure 4 demonstrated gales closer to the centre and a small area of 50 kn. Peak intensity is estimated at this time at 45 kn (category 1), consistent with SATCON objective estimates of 43-47 kn. Subjective Dvorak estimates FT/CI of 2.5 remained at slightly lower intensity as shown in the event intensity comparison in Figure 2.

The HSCAT image at 2350 UTC 29 July showed reduced winds to indicate the system had weakened below tropical cyclone intensity.

During 30 July deep convection shifted to the south then southeast of the centre then dissipated completely during 31 July. However, marginal gales continued during this time in the southwest quadrant assisted by the vigorous southeasterly synoptic flow associated with the sub-tropical ridge to the south.

2.2 Structure

Gales commenced southeast of the centre (110 nm (110 km) radius) late on 28 July but were quite removed from the centre as indicated by SMOS at 1138 UTC and ASCAT 1535 UTC images. A series of scatterometer and radiometry passes on 29 July (e.g. ASCAT at 0241 UTC in Figure 2) confirmed that gales extended from the southeast (130 nm (240 km)) to northwest (60 nm (110km)) quadrants, marginally more than halfway around the centre. During 29 July gales increased to extend to 120 nm (220 km) radius in the southwest but decreased early on 30 July as the system weakened. Gales remained evident in the southwest quadrant varying from 60 to 120 nm (110-220 km) in following days assisted by the southeasterly synoptic flow.

Radius of maximum winds (RMW) estimates was relatively high, initially being 60 nm (110 km) and then 35-40 nm (65-75 km) thereafter. Refer to Table 1 for wind radii estimates.

2.3 Motion

The low was steered to the southeast under the combined influence of a mid-latitude trough to the south and the monsoonal flow north of circulation. The system tracked to the south on 29 July as the upper trough tracked to the east. As a sub-tropical ridge developed south of the centre the circulation began a track to the southwest on 31 July and then to the west.

TABLE 1. Best track summary for unnamed Tropical Cyclone 01U.

Refer to the Australian Tropical Cyclone database for complete listing of parameters.
Note: UTC is AWST - 8 hours.
*Not at tropical cyclone intensity as gales in two or less quadrants.

Year	Month	Day	Hour UTC	Pos. Lat. S	Pos. Long. E	Pos. Acc. nm	Max Wind 10min kn	Max gust kn	Cent. Press. hPa	Rad. of gales (NE/SE/ SW/NW)	Rad. of storm (NE/SE/ SW/NW)	RMW nm
2022	7	27	0000	7.5	92.0	50	15	45	1006	0/0/0/0	0/0/0/0	-
2022	7	27	0600	8.1	92.2	50	15	45	1006	0/0/0/0	0/0/0/0	-
2022	7	27	1200	8.6	92.5	40	20	45	1005	0/0/0/0	0/0/0/0	-
2022	7	27	1800	8.8	93.1	40	25	45	1005	0/0/0/0	0/0/0/0	-
2022	7	28	0000	9.2	93.8	30	25	45	1004	0/0/0/0	0/0/0/0	-
2022	7	28	0600	9.6	93.9	30	25	45	1003	0/0/0/0	0/0/0/0	-
2022	7	28	1200	10.2	94.4	30	35*	50	996	0/110/0/0	0/0/0/0	60
2022	7	28	1800	10.4	94.6	30	35*	50	994	0/110/0/0	0/0/0/0	60
2022	7	29	0000	11.0	94.9	25	40	55	998	0/130/90/60	0/0/0/0	40
2022	7	29	0600	11.7	94.7	25	45	65	996	0/130/120/60	0/0/0/0	40
2022	7	29	1200	12.2	94.5	25	45	65	994	0/150/120/60	0/0/0/0	40
2022	7	29	1800	12.7	94.2	30	40	55	994	0/90/100/60	0/0/0/0	40
2022	7	30	0000	13.3	93.8	20	40*	55	994	0/0/80/0	0/0/0/0	40
2022	7	30	0600	13.6	93.3	25	40*	55	993	0/0/80/0	0/0/0/0	40
2022	7	30	1200	14.0	92.9	15	35*	50	997	0/0/60/0	0/0/0/0	35
2022	7	30	1800	14.0	92.6	15	35*	50	997	0/0/60/0	0/0/0/0	35
2022	7	31	0000	13.9	92.3	15	35*	50	998	0/0/60/0	0/0/0/0	35
2022	7	31	0600	13.8	91.9	10	35*	50	1000	0/0/60/0	0/0/0/0	35
2022	7	31	1200	13.8	91.6	15	35*	50	1000	0/0/80/0	0/0/0/0	40
2022	7	31	1800	13.5	91.2	15	35*	50	1001	0/0/100/0	0/0/0/0	40
2022	8	1	0000	13.2	90.5	15	35*	50	1001	0/0/120/0	0/0/0/0	40
2022	8	1	0600	13.1	89.8	15	35*	50	1001	0/0/120/0	0/0/0/0	40

Figure 2. Advanced Scatterometer ASCAT-B pass at 0241 UTC 29 July 2022.

Image courtesy of NOAA: https://manati.star.nesdis.noaa.gov/datasets/ASCATBData.php

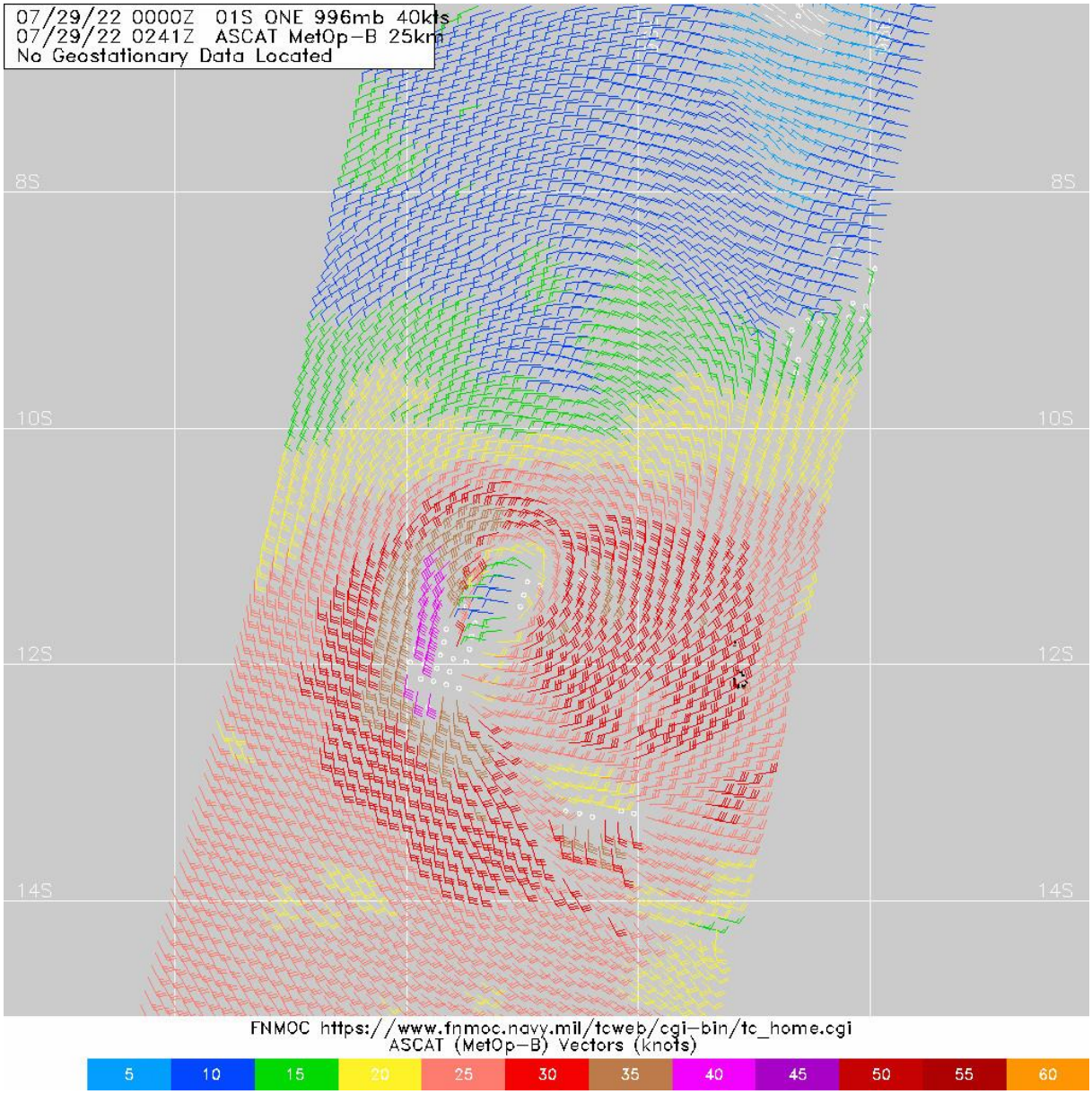


Figure 3. SSMIS Composite microwave image at 0001 UTC 29 July at initial point of tropical cyclone intensity.

Image courtesy of CIRA: https://rammb-data.cira.colostate.edu/tc_realtime/index.asp

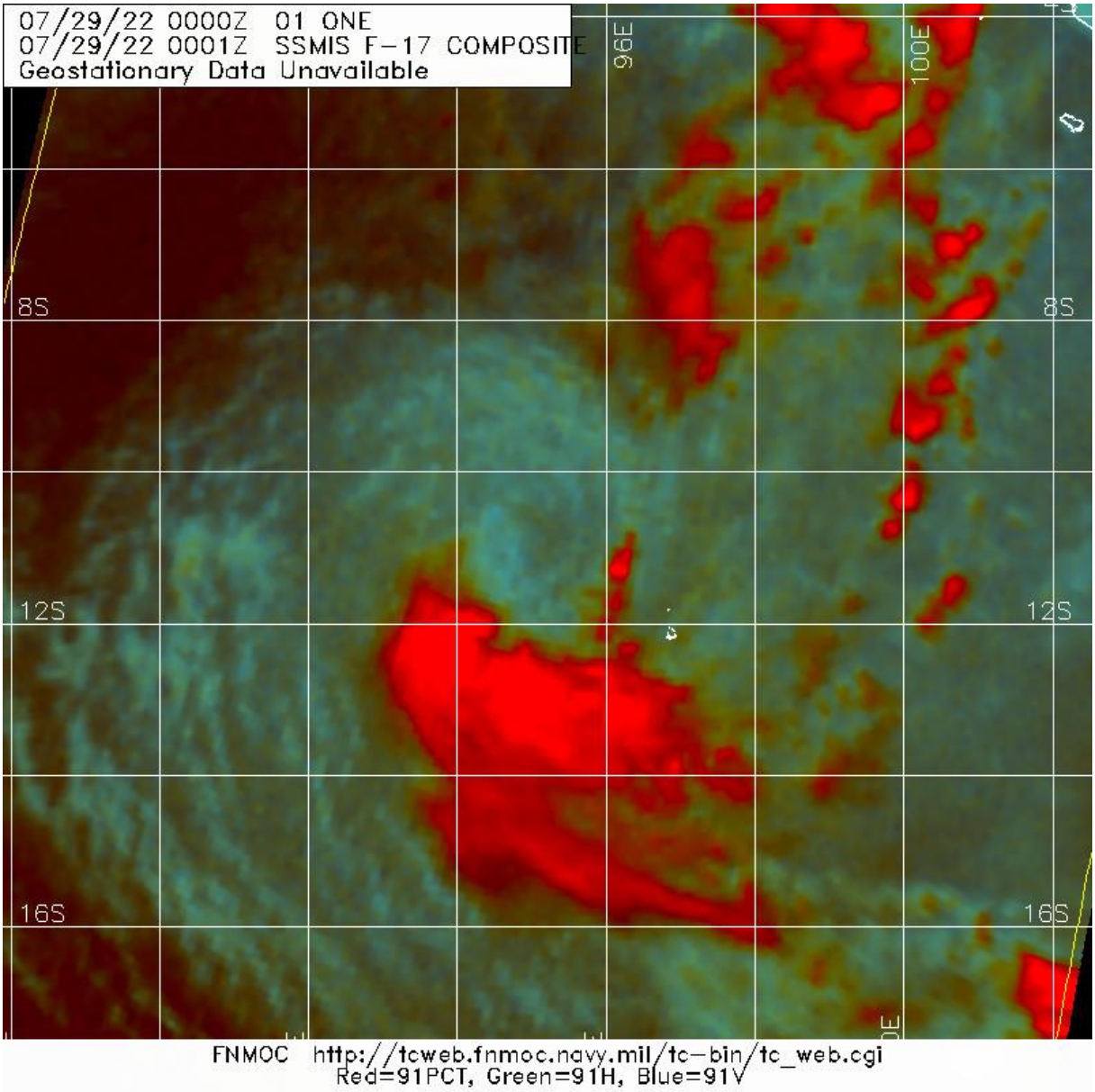


Figure 4. SMAP radiometer pass at 1139 UTC 29 July 2022.

Image courtesy of NRL: https://www.nrlmry.navy.mil/TC.html.

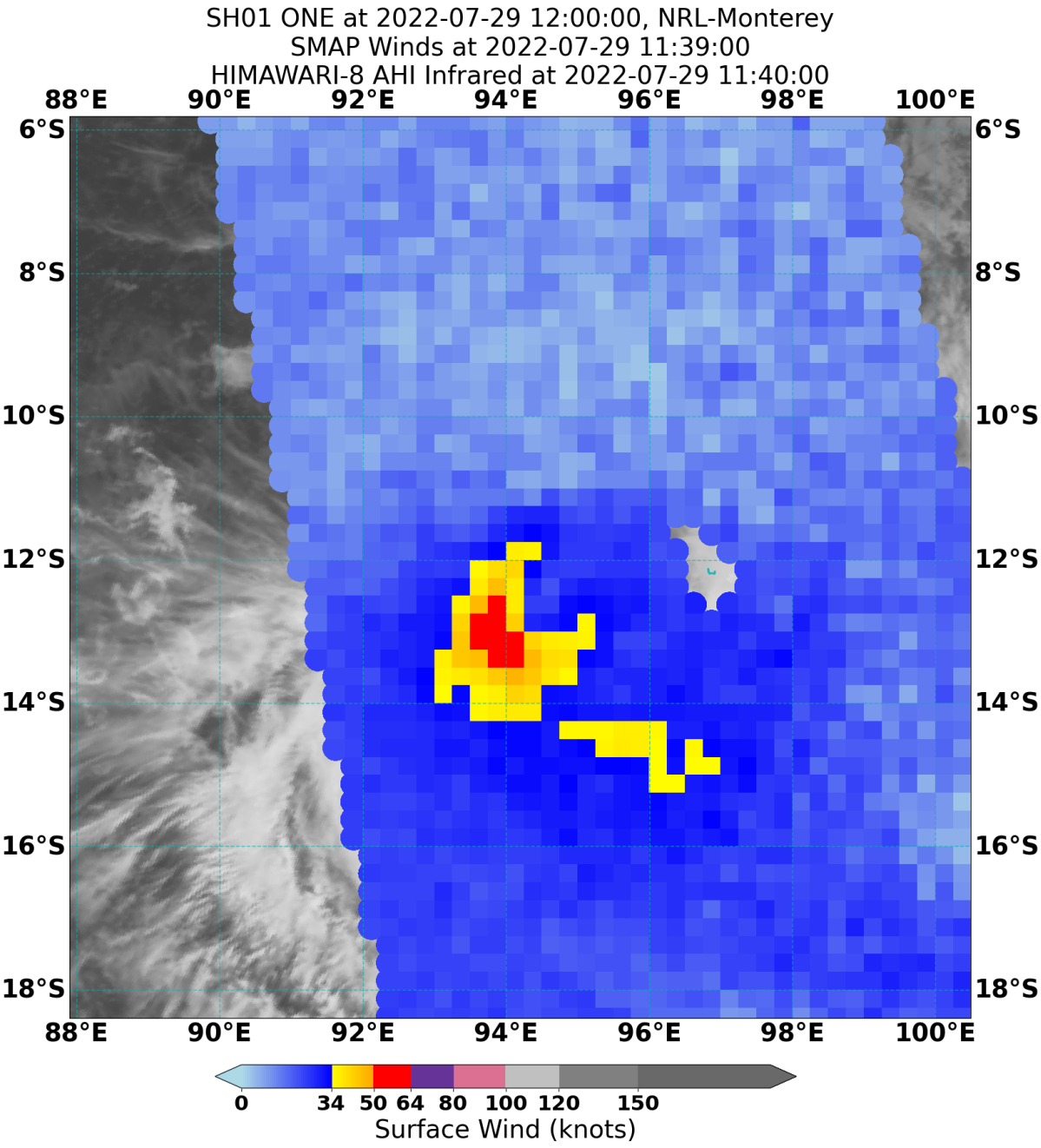
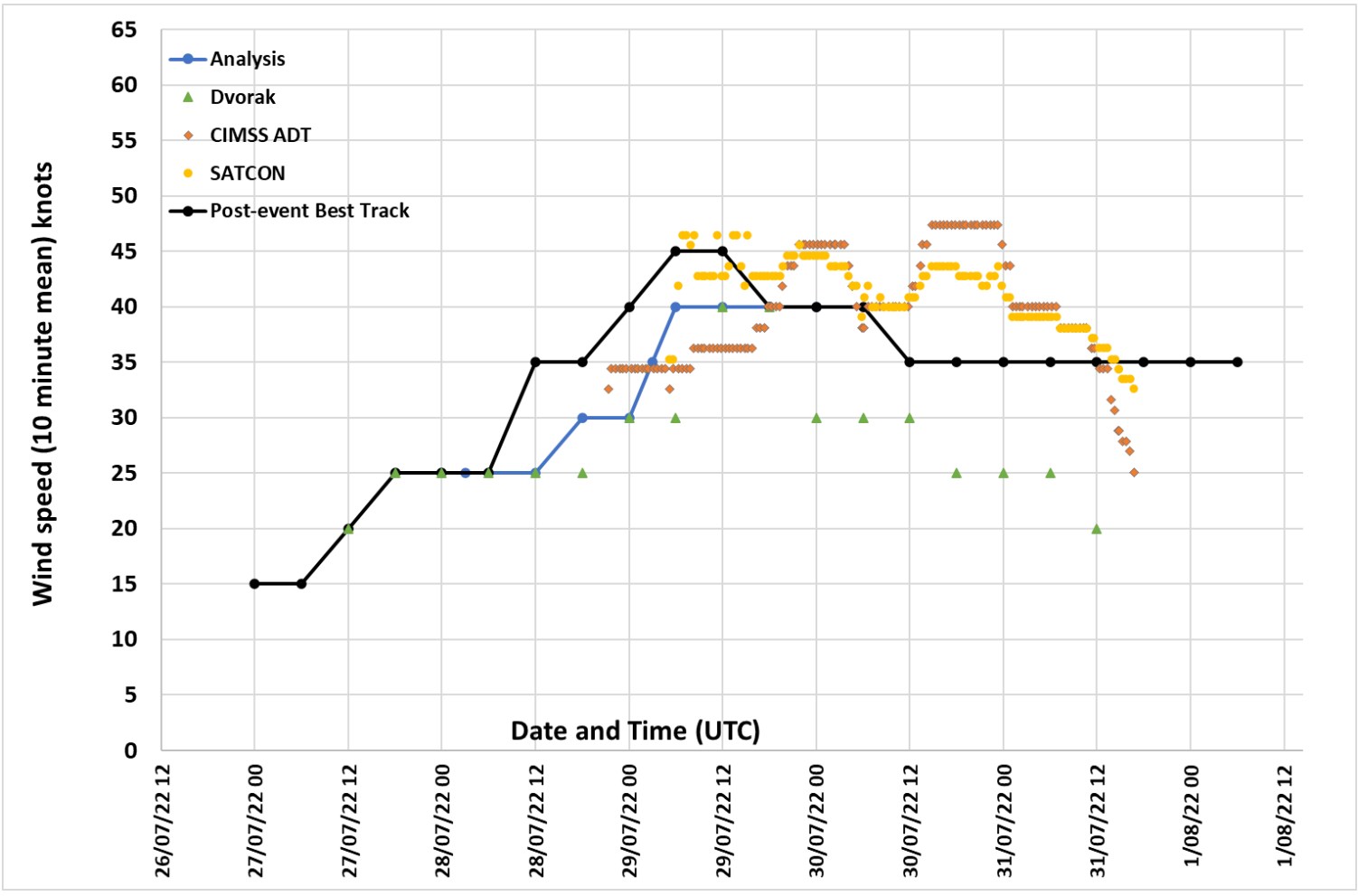


Figure 5. Plot of objective and subjective intensity estimates for 01U.



3. Impact

The system caused no significant impacts to Cocos Islands.

4. Observations

Cocos Islands recorded a period of strong winds early on 29 July but were less than gale-force.

5. Forecast Performance

Ocean wind warnings and official Tropical Cyclone Forecast Track Maps were issued from 13 UTC 28 July to 01 UTC 30 July. Tropical Cyclone Information Bulletins commenced at 0141 UTC 29 July and continued until 0050 UTC 30 July.

The accuracy figures for unnamed Tropical Cyclone 01U in the table below and in Figure 6 show that both the forecast position and intensity errors versus the five-year average out to 72 hour forecast range. The intensity forecasts were better than the five-year average for the forecast range 18 to 72 hours. In the first 6 hours post analysis shows the intensity higher than forecast. Position accuracy figures for 01U unnamed Tropical Cyclone were comparable to the five-year average in the first 18 hours of the forecast. The position accuracy error increased between 24 to 72 hours as the forecasts predicted a track moving to the west earlier than what actually eventuated.

	0	6	12	18	24	36	48	72	96	120
Position Absolute error (km)	31	47	73	98	119	167	227	345		
Intensity Absolute error (kn)	5.0	4.3	3.6	2.9	2.1	2.9	2.9	5.0		
Sample Size	7	7	7	7	7	7	7	4		

FIGURE 6 a. Position accuracy figures for Unnamed Tropical Cyclone 01U.

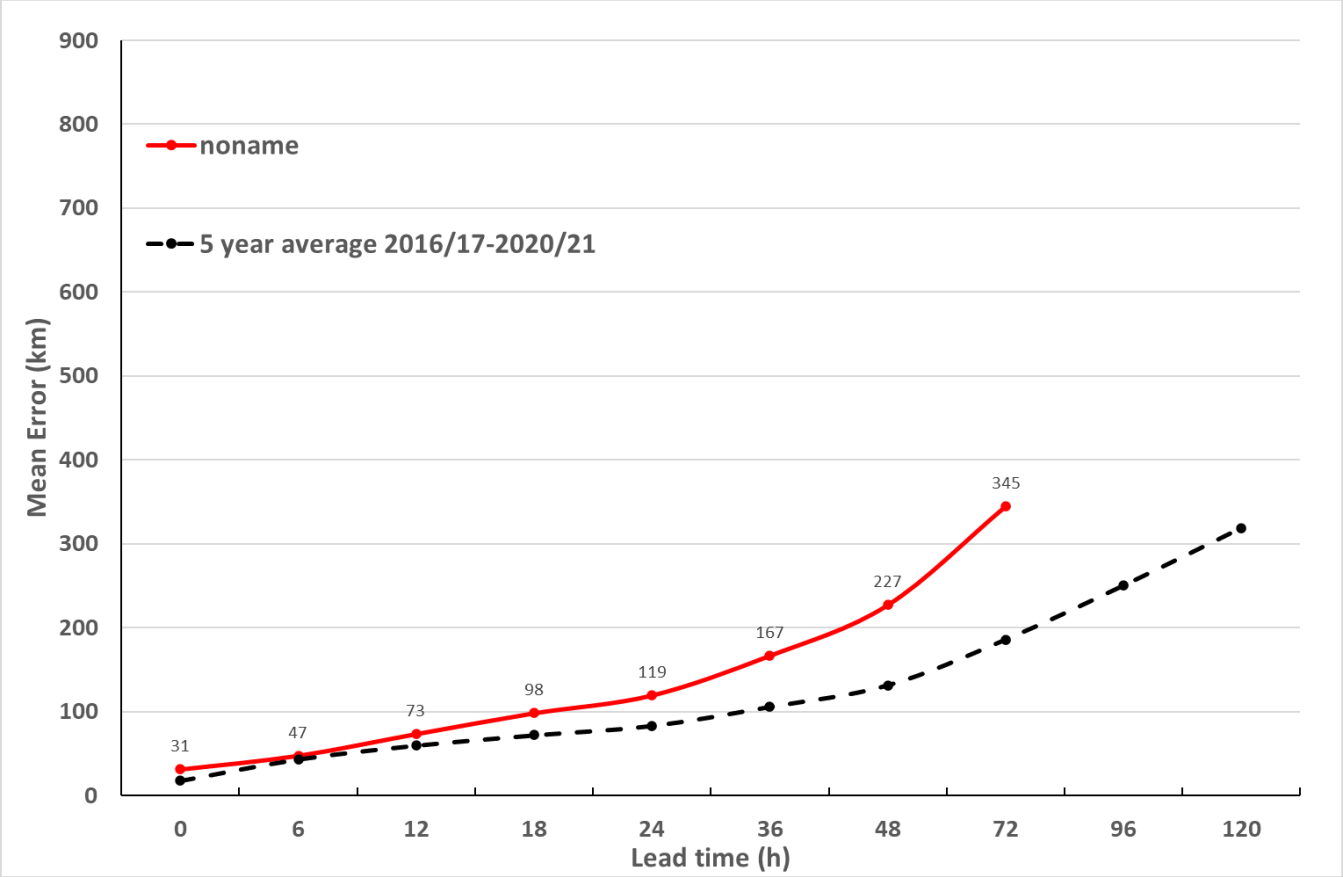
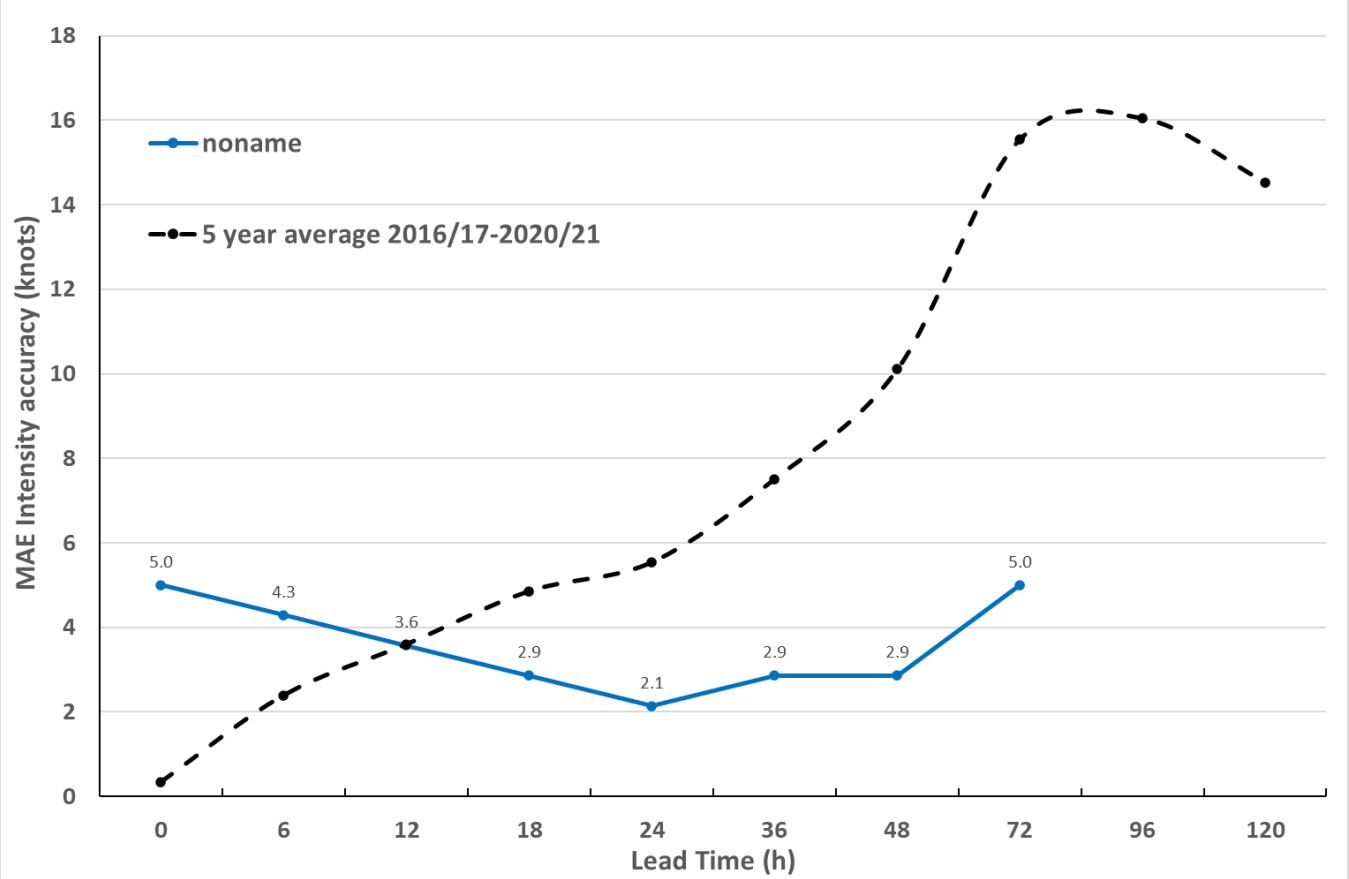


FIGURE 6 b. Intensity accuracy figures for Unnamed Tropical Cyclone 01U



6. Appendix: List of abbreviations

ADT	Advanced Dvorak Technique	km/h	kilometres per hour
ACST	Australian Central Standard Time	kn	knot
AEST	Australian Eastern Standard Time	LLCC	low level cloud centre
AMSR2	Advanced Microwave Scanning Radiometer	MET	Model Expected T-number
ASCAT	Advanced Scatterometer	METOP	Meteorological Operational Satellite
ATMS	Advanced Technology Microwave Sounder	MJO	Madden-Julian Oscillation
AWS	automatic weather station	mm	millimetres
AWST	Australian Western Standard Time	MSLP	mean sea level pressure
C	Celsius	nm	nautical mile
CI	Current intensity	NOAA	National Oceanic and Atmospheric Administration
CIMSS	Cooperative Institute for Meteorological Satellite Studies (USA)	NRL	Navy Research Lab (USA)
CIRA	Cooperative Institute for Research in the Atmosphere (USA)	PAT	Pattern T-number
EIR	Enhanced InfraRed	RH	relative humidity
ERC	eyewall replacement cycle	RMW	radius of maximum winds
FNMOC	Fleet Numerical Meteorology and Oceanography Centre (USA)	RSMC	Regional Specialised Meteorological Centre
FT	Final T-number	SAR	Synthetic Aperture Radar
GCOM	Global Change Observation Mission	SATCON	satellite Consensus
GHz	Gigahertz	SMAP	Soil Moisture Active Passive
GMI	Global Precipitation Measurement Microwave Imager	SMOS	Soil Moisture and Ocean Salinity
h	hour	SSMIS	Special Sensor Microwave Imager/Sounder
hPa	hectopascal	TC	Tropical Cyclone
HSCAT	Hai Yang 2 Scatterometer (HY-2B, HY-2C)	TCWC	Tropical Cyclone Warning Centre
km	kilometres	UTC	Universal Time Co-ordinated