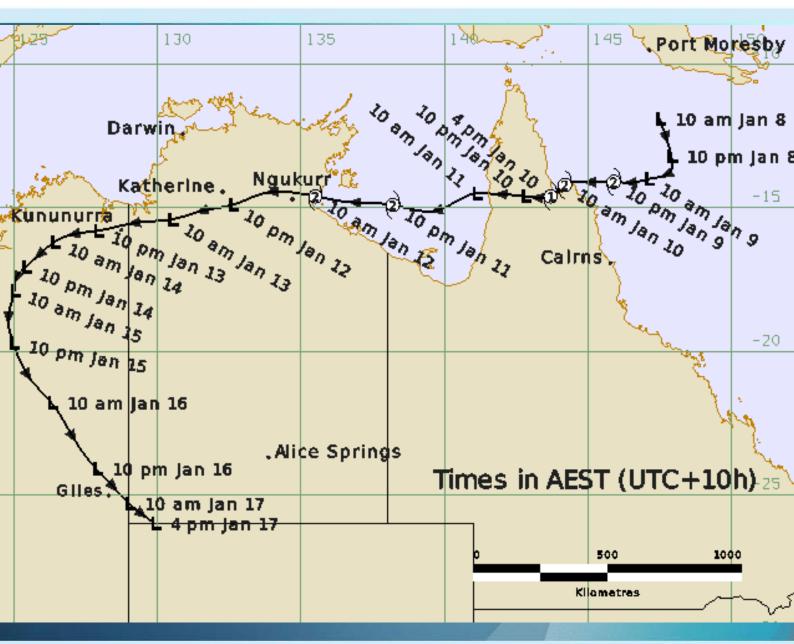


Tropical Cyclone *Tiffany*

08 - 17 January 2022

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1 Summary

Tropical Cyclone (TC) *Tiffany* was a small cyclone that had category two impacts on both the far north Queensland coast and then the Northern Territory (NT) coast in the western Gulf of Carpentaria.

A tropical low formed in the northern Coral Sea on 8 January. The low developed quickly reaching category 1 cyclone strength in the afternoon of 9 January over waters to the northeast of Cooktown. Tropical Cyclone *Tiffany* intensified further during 9 January reaching category 2 intensity in the evening while moving west towards the far north Queensland coast.

Tiffany reached Cape York Peninsula near Cape Melville north of Cairns early on 10 January at category 2 intensity, before crossing the coast later in the day at category 1 intensity. Tiffany moved westwards over Cape York Peninsula and weakened below tropical cyclone intensity during evening of 10 January. The cyclone brought up to 170 millimetres (mm) of rainfall across the Daintree and Mossman river catchments in the 24 hours to 9 am Tuesday 11 Jan, and across the Cape York Peninsula near the track.

The system emerged over the Gulf of Carpentaria near Pormpuraaw during the morning of 11 January and re-intensified to category 2 intensity later that day whilst tracking west over the Gulf of Carpentaria.

Tropical Cyclone *Tiffany* crossed the NT coast near Port Roper on the morning of Wednesday 12 January as a category 2 system. Ngukurr, east of Katherine, recorded a 91 kilometres per hour (km/h) wind gust and a pressure of 987.8 hectoPascals (hPa) as it passed by. High winds brought down trees in the path of *Tiffany* in the NT as far inland as Katherine.

Tiffany weakened into a rain-bearing depression as it tracked to the west across the NT. Heavy rainfall near the Katherine region led to major_flooding in the Waterhouse River, at Beswick Bridge and minor flooding for the Katherine River.

The remnants of the low moved slowly across the Kimberley region of Western Australia (WA) on 14 and 15 January. Ex-TC *Tiffany* then turned southeast and brought heavy rainfall to inland WA, the southern half of the NT and into South Australia (SA). Flooding made roads impassable, including the Stuart Highway linking South Australia to the NT, and the National Highway linking South Australia to WA isolating many towns and communities. Sections of both the Ghan and Indian Pacific railway were washed away and took several weeks to repair. This caused significant freight delays resulting in shortages for food and goods.

Tropical Cyclone *Tiffany* was the fourth tropical cyclone in the Australian region for the 2021/22 season.

FIGURE 1 a. Best track of Tropical Cyclone *Tiffany* 8 - 17 January 2022 (times in AEST, UTC+10 hours).

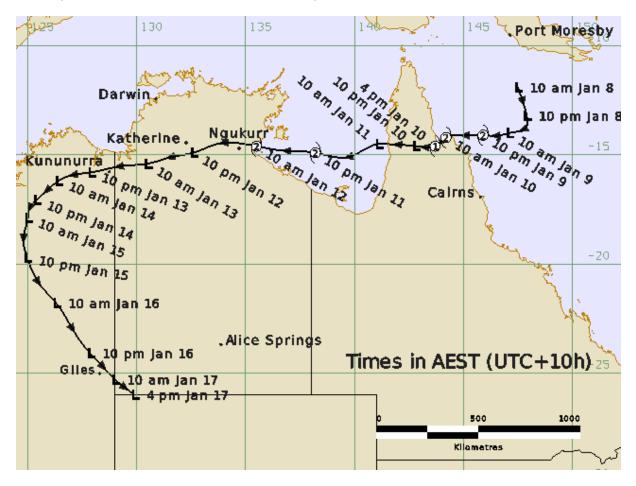
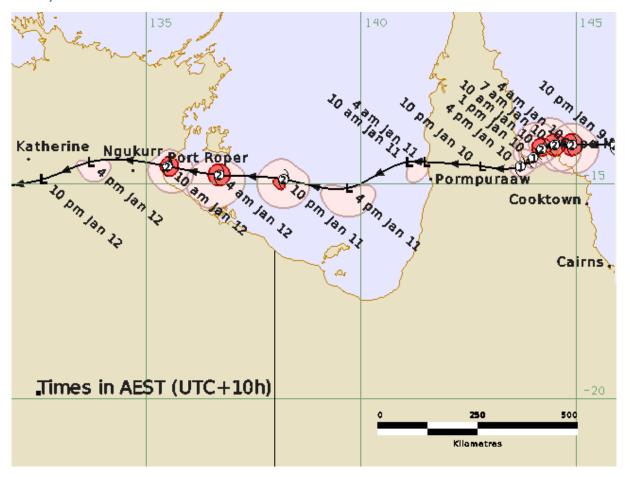


FIGURE 1 b. Enlarged best track of Tropical Cyclone *Tiffany* 9 - 12 January 2022 with wind radii included (times in AEST, UTC+10 hours).



2 Meteorological Description

2.1 Intensity analysis

A low developed in the northern Coral Sea on 8 January moving initially to the south as shown on the track in Figures 1a and 1b. Deep convection became more organised overnight into 9 January despite ongoing moderate easterly vertical wind shear. Other environmental influences were generally conducive for further development – sea surface temperatures being above 29 degrees Celsius (°C); strong poleward upper-level outflow and high moisture feeding into the circulation.

A small but well-defined low-level circulation (LLCC) became evident on microwave imagery during 9 January as shown on the Advanced Microwave Scanning Radiometer 2 (AMSR2) microwave imagery at 0410 Universal Time Coordinated (UTC) 9 January (UTC=Australian Eastern Standard Time (AEST) - 10 hours) in Figure 2. Tropical cyclone intensity is estimated at 0600 UTC 9 January. The Soil Moisture and Ocean Salinity (SMOS) radiometer pass at 0805 UTC 9 January 2022 in Figure 3 showed winds of 50 knots (kn, 90 km/h) near the centre. This suggested ongoing intensification despite persistent moderate easterly wind shear.

The Special Sensor Microwave Imager/Sounder (SSMIS) pass at 1904 UTC 9 January in Figure 4 showed an eye near Cape Melville on the north Queensland coast north of Cooktown. Peak 10-minute wind intensity is estimated at 55 kn (100 km/h) (Category 2) around this time.

Tiffany rapidly weakened as it moved over Princess Charlotte Bay from 0000 UTC (1000 AEST) 10 January due to wind shear and land interactions and crossed at Category 1 intensity (35 kn) at 0600 UTC.

Tiffany weakened further as it traversed Cape York Peninsula but then redeveloped as it moved over the open waters of the Gulf of Carpentaria during 11 January. Figure 5 illustrates the development with the appearance of a strong convective band on the SSMIS at 0725 UTC 11 January to an emerging eye-like structure at 2109 UTC just ahead of landfall. Landfall intensity is estimated at Category 2, 50 kn (90 km/h) near Port Roper. Tiffany then passed over Ngukurr where a pressure of 987.8 hPa was recorded, supporting the Category 2 estimated intensity. While mean winds are estimated to have reduced as Tiffany tracked inland, damaging gusts are likely to have continued as supported by reports of trees being blown down as the circulation passed near Katherine some 12-15 hours following landfall.

The circulation tracked further to the west on 12-13 January before taking a southerly track later on 14 January and then to the southeast by 16 January in response to an approaching mid-latitude trough from the west.

The intensity plot in Figure 6 indicates the estimated intensity is generally consistent with objective aids and slightly higher than the operational estimates. The Satellite Consensus (SATCON) objective aids are erroneously high on 10-11 January as *Tiffany* crossed over Cape York Peninsula and during its redevelopment phase in the Gulf of Carpentaria.

2.2 Structure

The absence of either a strong monsoonal flow to the north or east southeasterly flow to the south resulted in the circulation being small throughout its lifetime. Moderate easterly vertical wind shear resulted in deep convection primarily to the west of the centre in the developing stages. The radius of gales over open waters were only about 40 nautical miles (nm, 75 km/h) to the south and 25-30 nm (40-55 km/h) to the north throughout based upon scatterometry and radiometer (e.g. SMOS in Figure 3). The steady westward track contributed to this asymmetry. Figure 1b shows the wind radii at six-hourly intervals from 9-12 January.

The radius of maximum winds was estimated initially at 15 nm (28 km) initially decreasing to 10 nm (18 km) during its stronger stages.

2.3 Motion

Tiffany tracked westwards from the Coral Sea across Cape York Peninsula through the Gulf of Carpentaria and over the Top End of the NT. The westward track was due to the influence of a mid-level ridge to the south. The remnants of *Tiffany* continued to track west through the Kimberley of WA before turning to the southeast into central Australia.

FIGURE 2. AMSR2 89 GHz microwave image at 0405 UTC 9 January 2022.

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

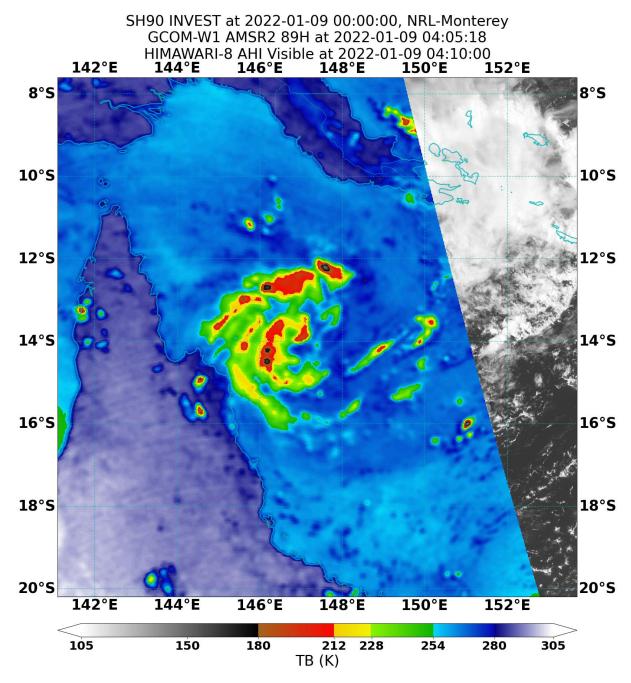


FIGURE 3. SMOS radiometer pass at 0805 UTC 9 January 2022 showing winds of 50 kn near the centre.

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

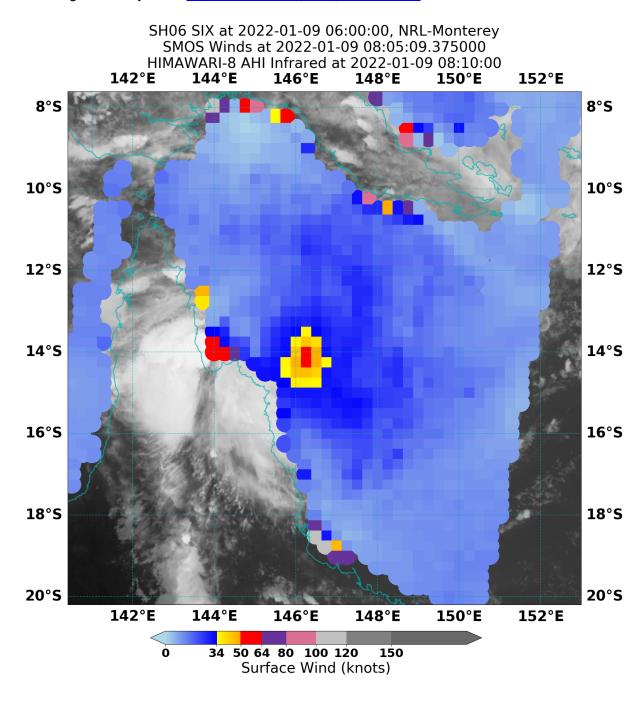


Figure 4. SSMIS 89 GHz microwave image at 1904 UTC 9 January near peak intensity ahead of landfall on the north Queensland coast.



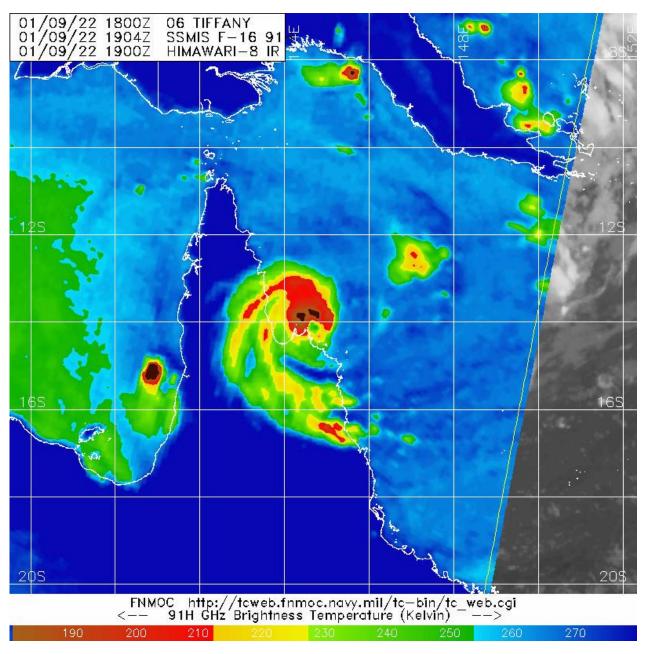


Figure 5. SSMIS 89 GHz microwave images: left at 0725 UTC 9 January and right 2109 UTC 9 January, near landfall.

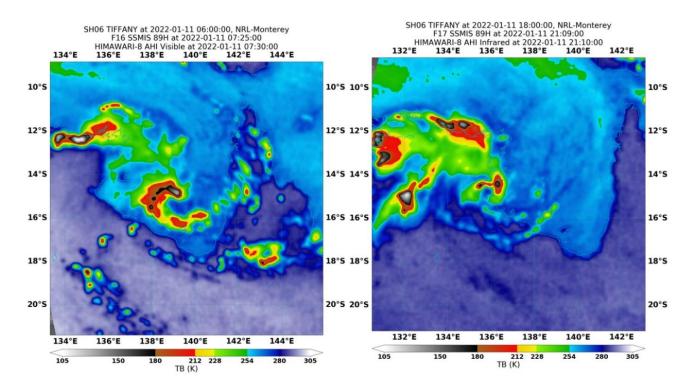
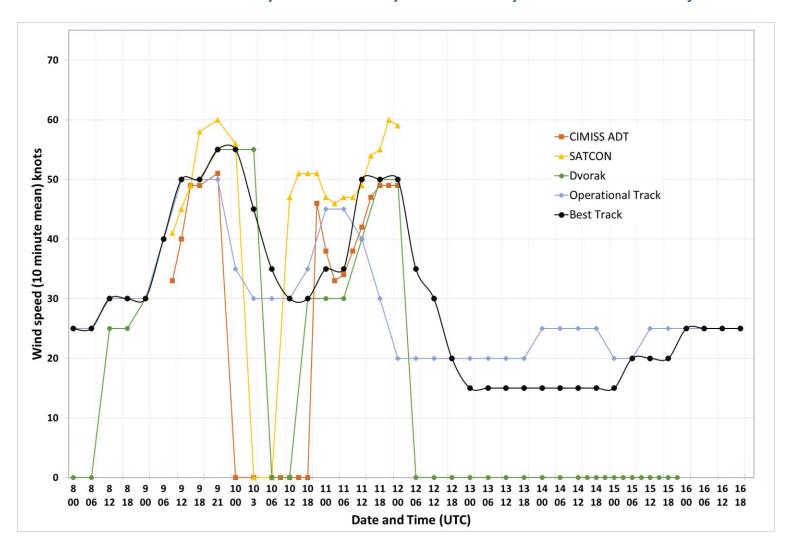


FIGURE 6. Plot of objective and subjective intensity estimates for *Tiffany*.



3 Impact

The main impact of *Tiffany* on mainland Australia was flooding across NT, SA and adjacent WA.

In the Northern Territory there was major flooding in the Waterhouse River at Beswick Bridge and minor flooding on the Katherine River.

Flooding cut roads including the Stuart Highway linking South Australia to the NT, and the National Highway linking South Australia to WA isolating many towns and communities. Sections of both the Ghan and Indian Pacific railway were washed away and took several weeks to repair. This caused significant freight delays resulting in shortages for food and goods.

High winds brought down trees in the path of *Tiffany* in the NT on 10 and 11 January, extending as far inland as Katherine.

4 Observations

There were no observing sites measuring winds or pressures in the path of *Tiffany* in the Coral Sea or over Queensland.

Wind

Centre Island: recorded brief periods of gale-force winds between 1500 and 1830 UTC 11 January (0030 to 0400 ACST 12 January), peaking at 35 kn (65 km/h) at 1530 UTC (0100 ACST 12 January).

Ngukurr (NT): recorded a maximum wind gust of 49 kn (91 km/h) at 0122 UTC (1052 ACST) 12 January.

Pressure

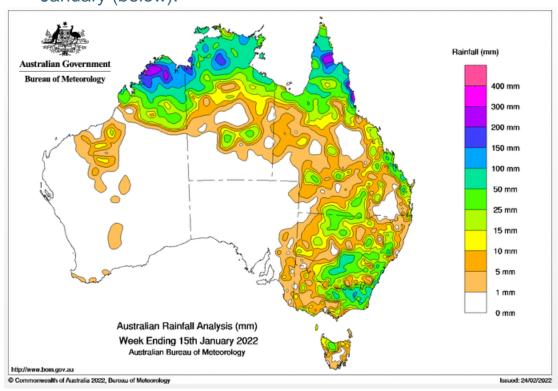
Ngukurr (NT) recorded a lowest pressure of 987.8 hPa as *Tiffany* passed over at 0122 UTC (1052 CST) 12 January.

Rainfall

The weekly rainfall analysis to 15 January is shown in Figure 6. Notable daily rainfall totals (24 hours to 9 am) associated with *Tiffany* during the period 10-16 January included:

- 10 January (Qld): Coen 105 mm, Lizard Island 110.0 mm,
- 11 January (Qld: Southwell Station 164.2 mm; Whyanbeel Valley 170.4 mm, Innisfail Wharf 138 mm.
- 12 January (NT): Groote Eylandt 81.4 mm, Milingimbi Airport 127.0 mm;
- 13 January (NT): Maranboy Hill 155.2 mm, Upper Seventeen Mile Creek 121.6 mm, Katherine Council 108.0 mm;
- 14 January: NT Wadeye 106.6 mm, Legune 105 mm; WA -, Ellenbrae 155.4 mm, El Questro 117.4 mm, Doongan 109.0 mm;
- 15 January (WA) Charnley River 116.6 mm, Mt House 113.0 mm, Theda 105 mm, Country Downs 111.6 mm;
- 16 January (WA): Charnley River 148.4 mm, Mt Hart 131.5 mm, Napier Downs 111.0 mm;
- 3-day totals: Maranboy Hill 264.0 mm and Nitmiluk Ridge 206.0 mm (Katherine region),
- 7-day totals: Keep River 275 mm, Port Keats Airport 238mm, Walungurru 77 mm and Yulara Airport 45 mm (western NT)

FIGURE 6. Weekly rainfall analysis week ending 15 January (top) and 22 January (below).



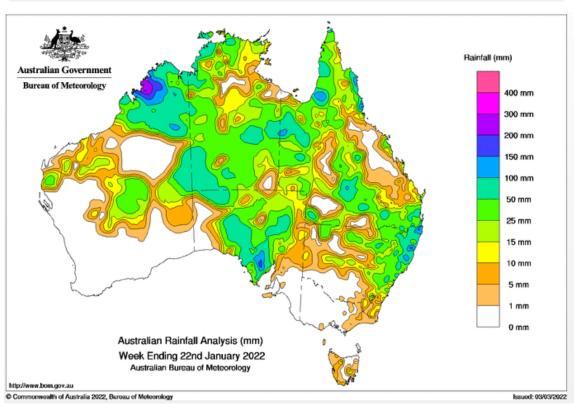


TABLE 1. Best track summary for Tropical Cyclone *Tiffany* 8-17 January 2022.

Refer to the Australian Tropical Cyclone database for complete listing of parameters and track from 8-17 January. Note: UTC is AEST - 10 hours. * not at tropical cyclone intensity.

Year	Month		Hour	Pos.	Pos.		Max Wind			Rad. of gales	Rad. of storm	RMW
		,	UTC	Lat.	Long.	Acc.	10min		Press.	(NE/SE/	(NE/SE/	nm
				S	E	nm	kn	kn	hPa	SW/NW)	SW/NW)	
2022	1	8	0000	11.9	147.5	40	25	45	1005	0/0/0/0	0/0/0/0	-
2022	1	8	0600	12.8	147.8	30	25	45	1004	0/0/0/0	0/0/0/0	-
2022	1	8	1200	13.2	147.9	25	30	45	1004	0/0/0/0	0/0/0/0	-
2022	1	8	1800	13.7	147.9	25	30	45	1002	0/0/0/0	0/0/0/0	-
2022	1	9	0000	14.0	147.1	25	30	45	1000	0/0/0/0	0/0/0/0	-
2022	1	9	0600	14.1	146.7	20	40	55	995	30/40/40/30	0/0/0/0	15
2022	1	9	1200	14.1	145.9	20	50	70	992	30/40/40/30	15/15/15/15	15
2022	1	9	1800	14.1	144.9	15	50	70	990	30/40/40/30	15/15/15/15	10
2022	1	9	2100	14.1	144.5	15	55	75	991	30/40/30/40	15/15/15/15	10
2022	1	10	0000	14.2	144.2	15	55	75	992	30/20/20/40	15/10/10/15	10
2022	1	10	0300	14.4	144.0	10	45	65	993	30/15/15/30	0/0/0/0	10
2022	1	10	0600	14.6	143.7	10	35	50	994	25/15/15/0	0/0/0/0	10
2022	1	10	1200	14.6	142.8	20	30	45	1003	0/0/0/0	0/0/0/0	-
2022	1	10	1800	14.5	141.5	15	30	45	1002	0/0/0/0	0/0/0/0	-
2022	1	11	0000	14.5	141.1	10	35*	50	1000	0/30/0/0	0/0/0/0	-
2022	1	11	0600	15.1	139.7	20	35*	50	998	0/40/40/0	0/0/0/0	-
2022	1	11	1200	14.9	138.2	15	50	70	995	25/40/40/30	0/0/15/0	12
2022	1	11	1800	14.8	136.7	20	50	70	992	25/40/50/30	15/15/15/15	10
2022	1	12	0000	14.6	135.5	20	50	70	988	25/40/30/20	15/15/10/10	10
2022	1	12	0600	14.5	133.7	15	35*	55	992	0/30/20/0	0/0/0/0	-
2022	1	12	1200	14.9	132.6	20	30	50	998	0/0/0/0	0/0/0/0	-
2022	1	12	1800	15.1	131.6	20	20	45	1000	0/0/0/0	0/0/0/0	-
2022	1	13	0000	15.4	130.5	20	15	45	1002	0/0/0/0	0/0/0/0	-
2022	1	13	0600	15.5	129.4	20	15	45	1000	0/0/0/0	0/0/0/0	-
2022	1	13	1200	15.8	127.9	20	15	45	1000	0/0/0/0	0/0/0/0	-
2022	1	13	1800	16.0	126.8	20	15	45	1000	0/0/0/0	0/0/0/0	-
2022	1	14	0000	16.2	126.4	20	15	45	1000	0/0/0/0	0/0/0/0	-
2022	1	14	0600	16.8	125.7	20	15	45	999	0/0/0/0	0/0/0/0	-
2022	1	14	1200	17.1	125.4	30	15	45	998	0/0/0/0	0/0/0/0	-
2022	1	14	1800	17.4	125.1	30	15	45	998	0/0/0/0	0/0/0/0	-
2022	1	15	0000	17.9	125.0	20	15	45	997	0/0/0/0	0/0/0/0	-
2022	1	15	0600	18.8	124.8	20	20	45	997	0/0/0/0	0/0/0/0	-
2022	1	15	1200	19.7	125.0	30	20	45	998	0/0/0/0	0/0/0/0	-
2022	1	15	1800	21.0	125.6	30	20	45	998	0/0/0/0	0/0/0/0	-
2022	1	16	0000	21.8	126.3	25	25	45	992	0/0/0/0	0/0/0/0	-
2022	1	16	0600	23.3	127.3	25	25	45	992	0/0/0/0	0/0/0/0	-
2022	1	16	1200	24.1	127.9	30	25	45	992	0/0/0/0	0/0/0/0	-
2022	1	16	1800	24.7	128.4	30	25	45	992	0/0/0/0	0/0/0/0	-
2022	1	17	0000	25.3	129.0	20	30	45	992	0/0/0/0	0/0/0/0	-
2022	1	17	0600	26.0	129.9	20	30	45	992	0/0/0/0	0/0/0/0	-

5 Forecast Performance

Official tropical cyclone forecasts were issued from 8-12 January. Ocean wind warnings commenced at 0000 UTC 9 January for the Coral Sea and transitioned into the Gulf of Carpentaria until 0300 UTC 12 January when *Tiffany* moved over land in the eastern Top End. The tropical cyclone advices commenced 0600 UTC 8 January and were cancelled at 0300 UTC 12 January when there was confidence that the system had weakened below tropical cyclone intensity.

The first tropical cyclone watch for Queensland was issued 0600 UTC 8 January 48 hours ahead of *Tiffany* making landfall over Cape York. The first tropical cyclone watch for the Northern Territory was issued 0000 UTC 10 January 48 hours ahead of *Tiffany* making landfall near Port Roper on the east coast of the Northern Territory.

The accuracy figures for Tropical Cyclone *Tiffany* below and in Figure 7 show the forecast position and intensity errors against the five-year average out to 120 hour forecast range. The intensity forecast errors were significantly above the five-year average for the 0-36 hour forecast range. Initially the model guidance tracked the system slower over Cape York and through the Gulf of Carpentaria and then recurved to the southeast under the influence of an approaching upper trough. However, the mid-level steering ridge to the south ended up being the dominate force and moved *Tiffany* quickly westwards. This meant that *Tiffany* spent less time in a conducive environment (over water) for development, consequently the forecast intensity was too high. Some forecast intensity errors occurred during the early stages of development, in the Coral Sea, as *Tiffany* developed quicker than forecast. The intensity errors for the 48-120 hour forecast range were comparable to the five year average.

The track position errors were only slightly above the five-average in the first 24 hours of the forecast, however the position errors increased significantly between the 36-120 hour forecast range. The large positional errors in the 36-120 hours forecast range were due to the mid-level steering ridge moving *Tiffany* faster to the west than what was indicated by the influence of the mid-level ridge to the south. The forecasts were biased to the model guidance that moved *Tiffany* slower and back to the southeast due to the expected influence of the approaching upper trough.

	0	6	12	18	24	36	48	72	96	120
Position Absolute error (km)	21	50	71	92	115	168	244	422	626	829
Intensity Absolute error (kn)	2.2	4.7	5.9	7.8	11.1	9.2	10.9	15.0	15.9	16.3
Sample Size	16	16	16	16	16	16	16	16	16	16

FIGURE 7 a. Position accuracy figures for Tropical Cyclone *Tiffany*.

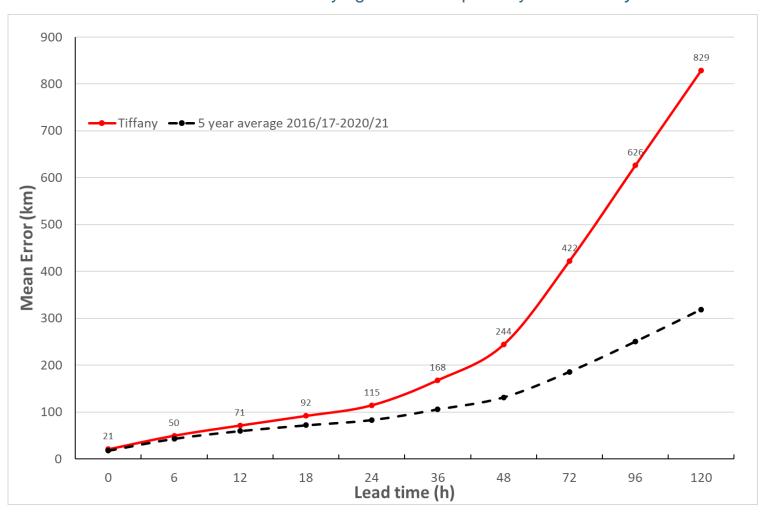


FIGURE 7 b. Intensity accuracy figures for Tropical Cyclone *Tiffany*.

