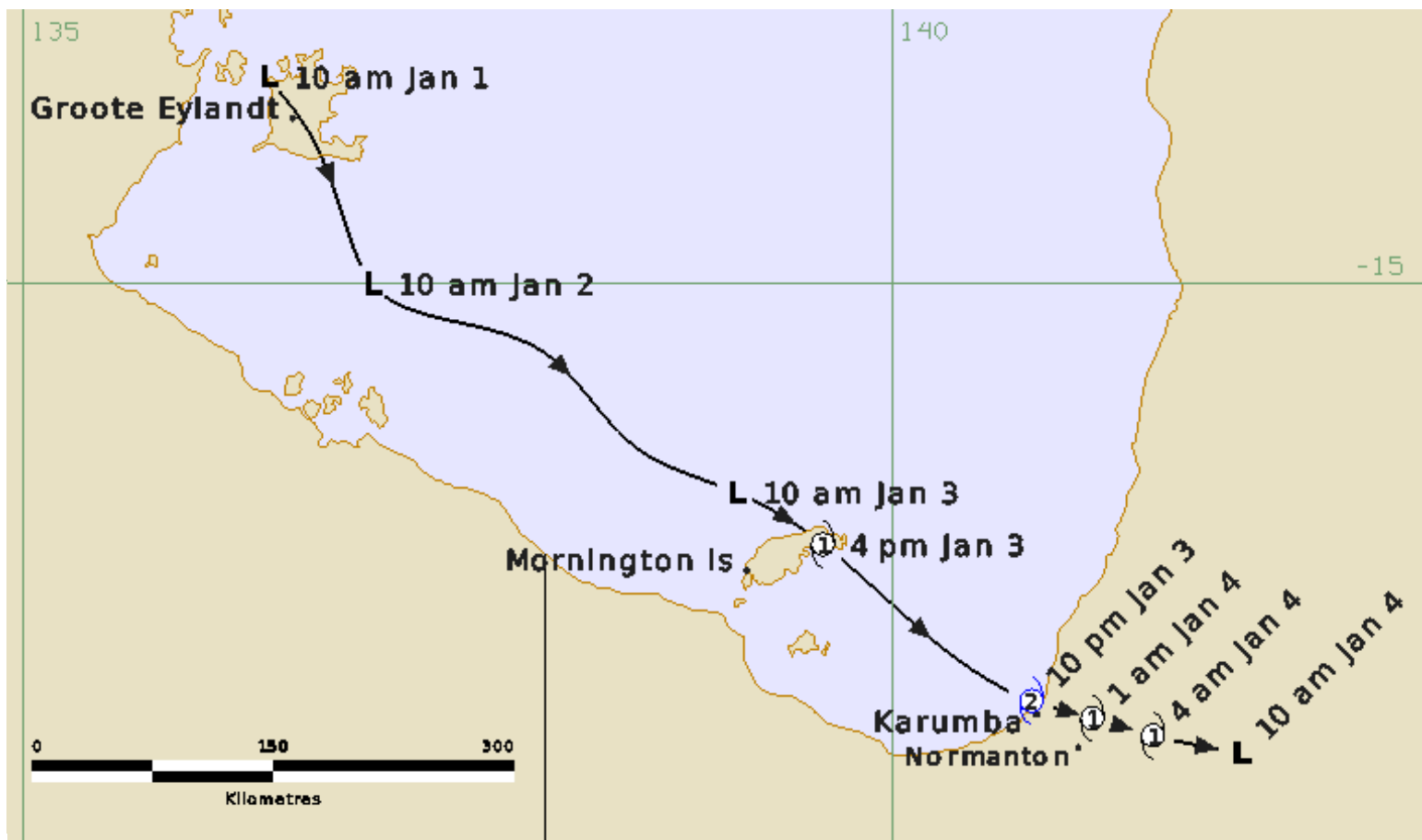




Tropical Cyclone *Imogen*

1-4 January 2021

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1 Summary

Tropical Cyclone *Imogen* was a short-lived cyclone in the Gulf of Carpentaria. A low first formed near Groote Eylandt on 1 January. The low was steered to the southeast and developed into a tropical cyclone at 0600 Universal Time Co-ordinated (UTC) 3 January (1600 Australian Eastern Standard Time (AEST = UTC+10 hours)). *Imogen* reached a peak 10-minute mean wind intensity of 50 knots (kn) (95 kilometres per hour (km/h)) at 1200 UTC 3 January as it crossed the eastern coast of the Gulf of Carpentaria near Karumba. Normanton Airport, which is located about 20 kilometres (km) to the south of the track, recorded a 43 kn (80 km/h) peak 10-minute mean wind speed and a 3-second maximum wind gust of 54 kn (100 km/h) late on 3 January. *Imogen* weakened below tropical cyclone strength by 0000 UTC 4 January as it moved inland.

Some minor damage to vegetation and infrastructure in the region was reported.

FIGURE 1 a. Best track of Tropical Cyclone *Imogen* 1 – 4 January 2021 (times in AEST, UTC+10).

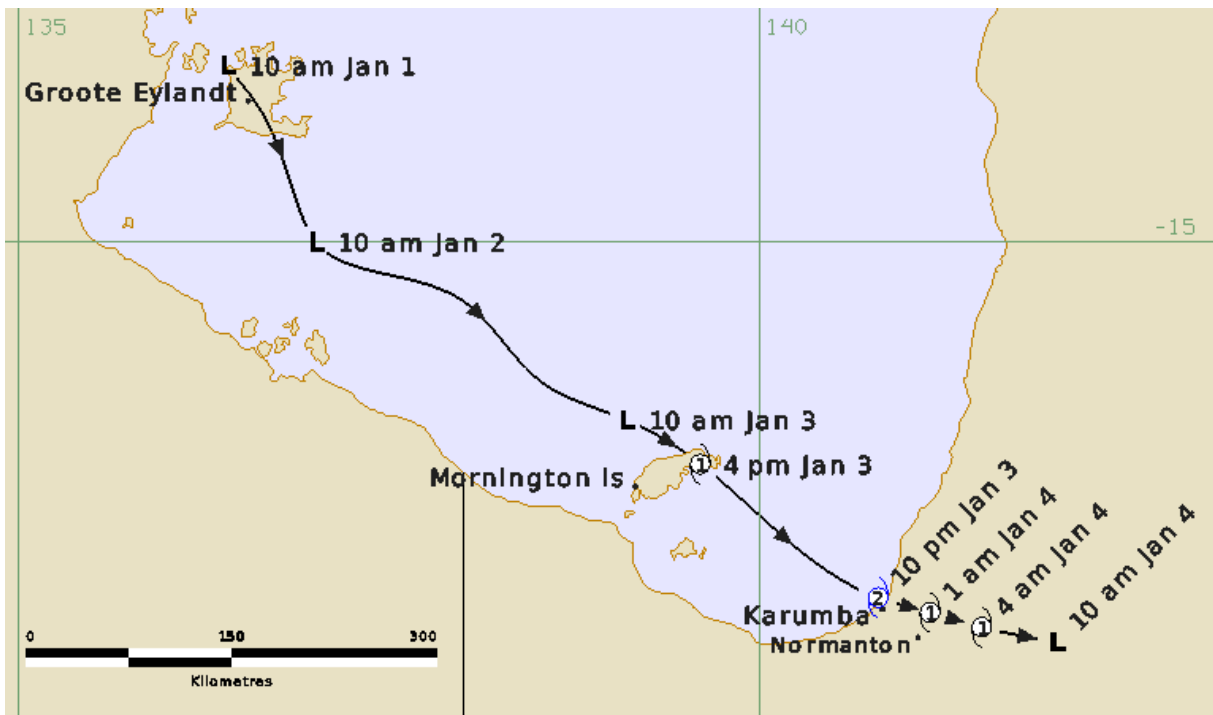
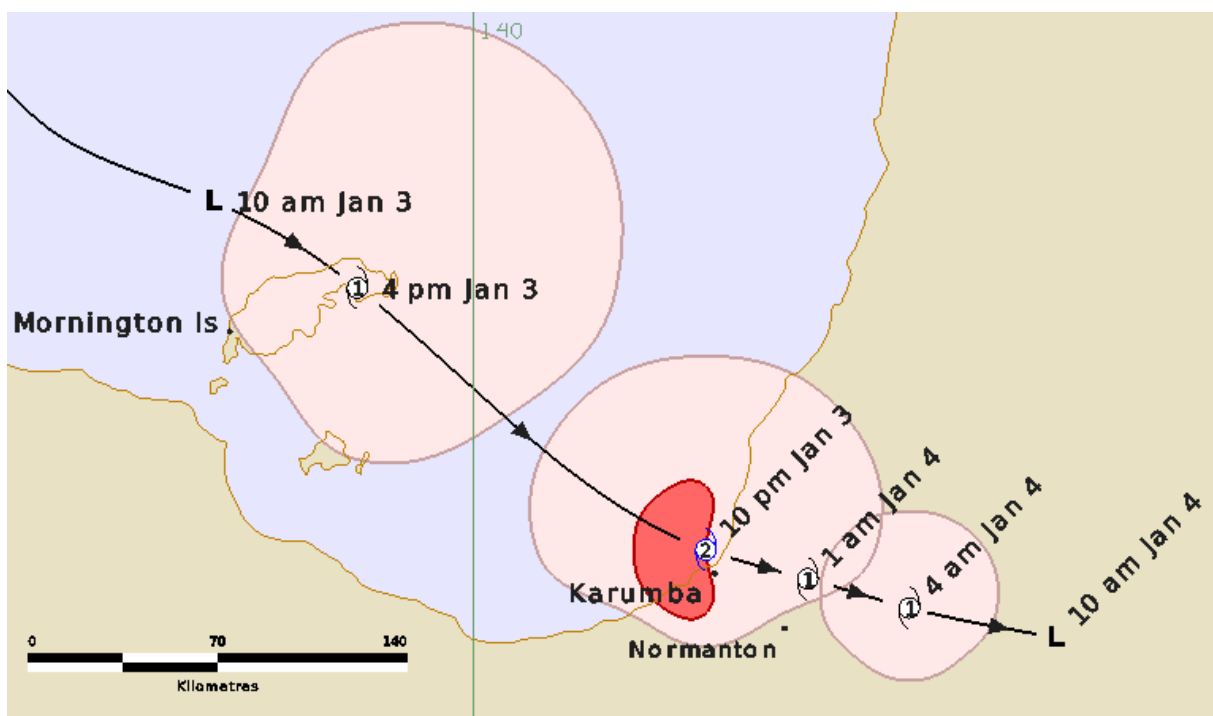


FIGURE 1 b. Best track of Tropical Cyclone *Imogen* at landfall in the Gulf of Carpentaria 2-4 January 2021 (times in AEST, UTC+10).



2 Meteorological Description

2.1 Intensity analysis

During December the Madden-Julian Oscillation (MJO) tracked across northern Australia. As the weak MJO pulse moved into the western Pacific a low became evident near Groote Eylandt on 1 January. The low moved southeast across the Gulf of Carpentaria (GoC) and developed. A Dvorak Data T (DT) number of 1.5 could be assigned at 0600 UTC 2 January. *Imogen* continued to be steered to the southeast and was located near Mornington Island by 3 January. Morning Advanced Scatterometry (ASCAT) passes indicated 25-30 kn (45-55 km/h) winds in all quadrants of the circulation. The circulation was clearly visible on the Mornington Island radar and through the early part of 3 January the circulation appeared to consolidate. Curved banding in satellite imagery improved between 0000 – 0600 UTC 3 January and tropical cyclone strength was reached with a DT of 3.0 attained at this time.

The circulation was small and intensified quickly as it approached the Gulf coast near Karumba. Satellite imagery from 0600 UTC 3 January up to the time *Imogen* crossed the coast showed an increase in curved banding, refer Figure 2, and a three-hour average DT of 3.5 was attained at 0900 UTC 3 January. Microwave imagery reflected this improvement in the cold cloud and an eye was evident on the 0901 UTC 3 January Special Sensor Microwave Imager/Sounder 9SSMIS), refer Figure 3. Radar imagery also supported a complete circulation with intense convective banding on the western side. Once *Imogen* began to cross the coast the satellite signature weakened quickly. Observations were recorded at Normanton Airport which is located about 20 km to the south of the track. These peaked at 43 kn (80 km/h) 10-minute mean wind speed at 1500 UTC 3 January, some three hours after land fall. A 3-second maximum wind gust of 54 kn (100 km/h) was recorded at 1521 UTC 3 January. *Imogen* weakened quickly over land and was downgraded to below tropical cyclone strength by 0000 UTC 4 January.

2.2 Structure

Imogen was a very small tropical cyclone, the radius to maximum winds was 10 nm (18 km). This increased to 15 nm (28 km) as it crossed the coast. Gale radii ranged from 25 nm (46 km) in the southwest quadrant to 60 nm (111 km) in the northeast quadrant initially and then decreased to 15 nm in the eastern quadrants as *Imogen* made landfall. Storm force winds are only estimated in the western quadrants as *Imogen* made landfall with a radii estimated at 15 nm (28 km).

2.3 Motion

In the early stages *Imogen* was steered to the southeast by the strong north-westerly monsoon flow which was present across the GoC, to the northwest of the low. As *Imogen* intensified and became deeper in the atmosphere it was steered by an amplifying mid-level trough to the southwest, this continued the southeast movement.

FIGURE 2. Enhanced infrared image (EIR) at 0600 UTC 3 January (left) and at 0900 UTC (right) showing the improved curvature as *Imogen* intensified, the X marks the centre location.

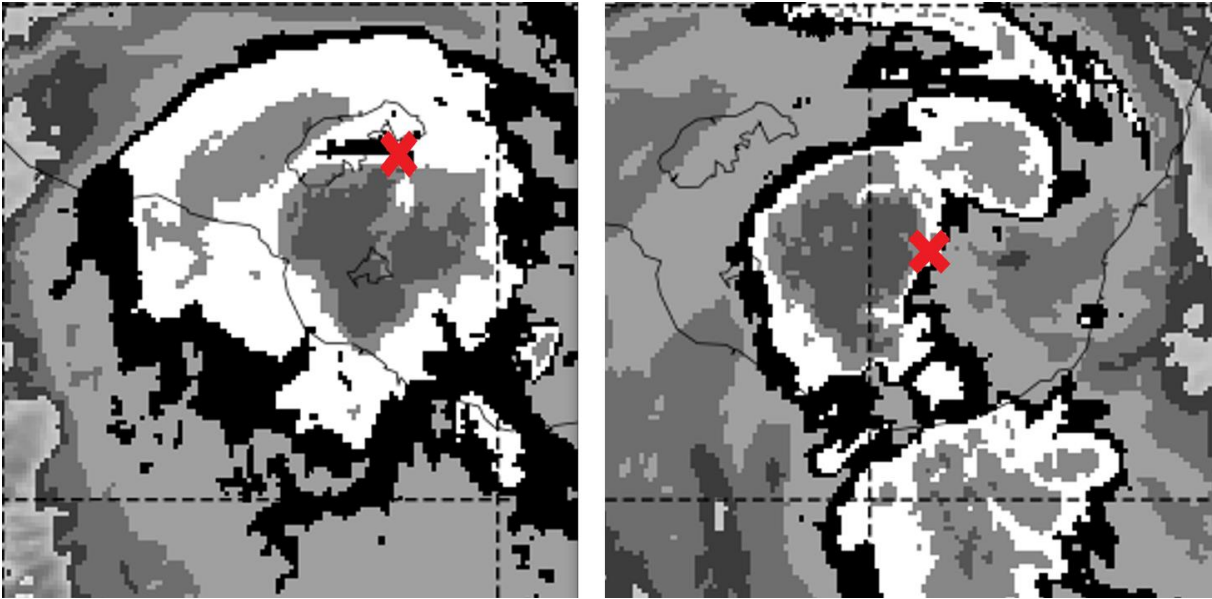
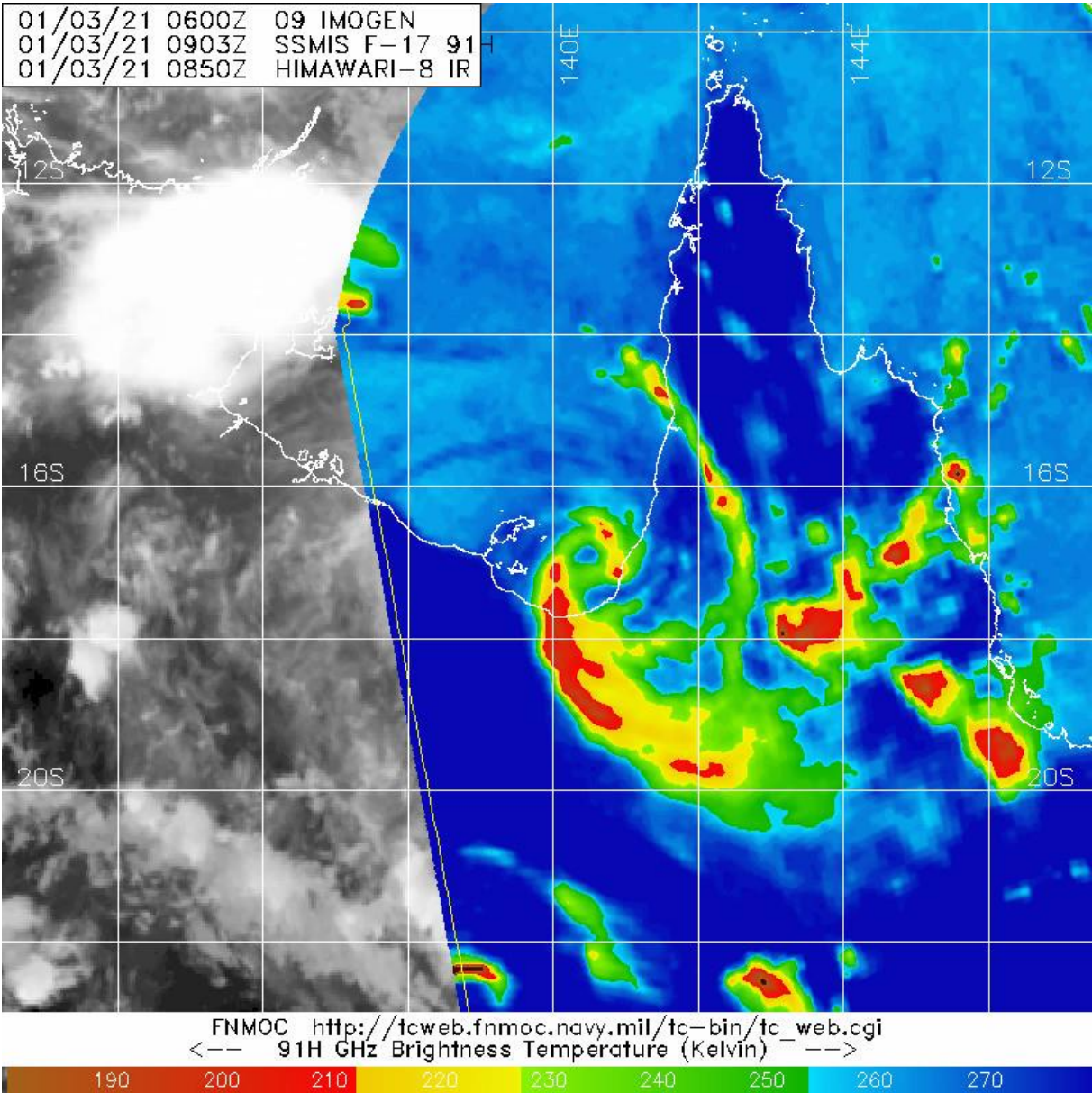


FIGURE 3. SSMIS Microwave at 0901 UTC 1 January, near peak intensity.

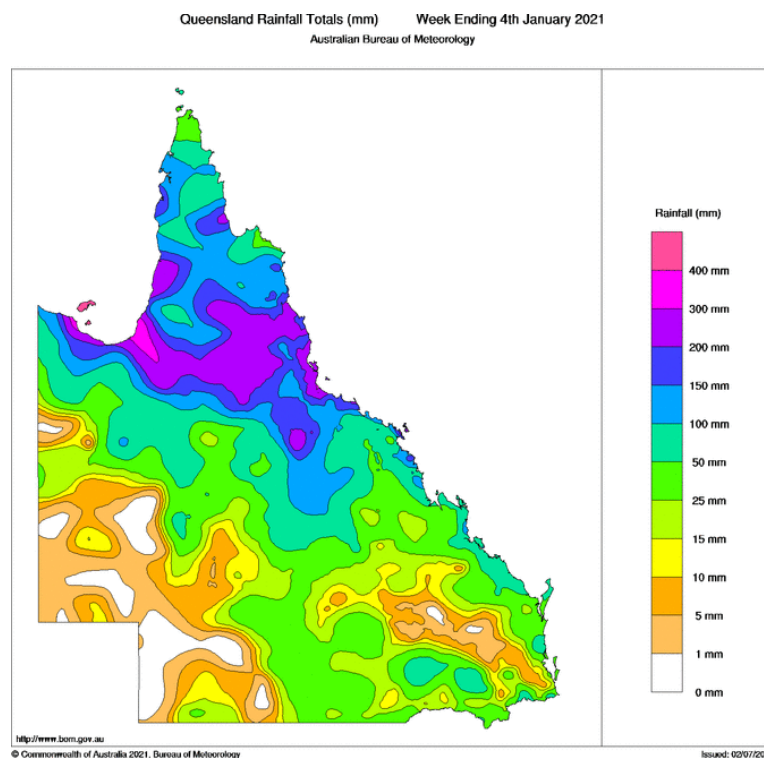
Images courtesy NRL: <https://www.nrlmry.navy.mil/TC.html>



3 Impact

Heavy rainfall and strong gales were reported as well as large waves and abnormally high tides which reached above the Highest Astronomical Tide mark. There was mostly minor damage reported such as fallen trees, downed power lines and superficial damage to buildings in the towns of Karumba and Normanton. Roads to the Gulf country were closed for a period due to flooding. Ergon Energy reported about 1000 customers without power in Normanton and Karumba and another 180 customers on Mornington Island in the wake of the tropical cyclone. Some areas that were only accessible by air were without power for several days.

FIGURE 4. Rainfall for the week ending 4 January 2021



4 Observations

4.1 Wind

Normanton Airport

Gale force winds were recorded between 1450 UTC – 1730 UTC 3 January.

Maximum 10-minute mean wind 43 kn (80 km/h) between 1500 – 1504 UTC 3 January.

Maximum 3-second wind gust 54 kn (100 km/h) at 1521 UTC 3 January.

4.2 Pressure

Normanton Airport

The lowest mean sea level pressure recorded was 989.2 hecto-Pascals (hPa) at 1455 UTC 3 January.

4.3 Rainfall

Weekly rainfall totals exceeded 300 millimetres (mm) near landfall and generally exceeded 200 mm along the track of *Imogen*, refer Figure 4.

Daily rainfall totals to 9 am AEST 3 January:

Sweers Island 162 millimetres (mm)

Daily rainfall totals to 9 am AEST 4 January:

Normanton Airport 262.6 mm

Sweers Island 223 mm

Croydon Township 155.4 mm

TABLE 1. Best track summary for Tropical Cyclone *Imogen* 1 – 4
January 2021.

Refer to the Australian Tropical Cyclone database for complete listing of parameters. Note: UTC is AEST - 10 hours.

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 n mi
2021	01	01	00	13.8	136.4	30	15	45	1004			
2021	01	01	06	14.1	136.6	30	15	45	1003			
2021	01	01	12	14.7	136.9	30	20	45	1002			
2021	01	01	18	14.9	136.9	40	20	45	1000			
2021	01	02	00	15.0	137.0	40	20	45	1000			
2021	01	02	06	15.2	137.4	40	25	45	1000			
2021	01	02	12	15.4	138.0	30	25	45	1000			
2021	01	02	18	15.9	138.5	15	30	45	996			
2021	01	03	00	16.2	139.1	15	30	45	994			
2021	01	03	06	16.5	139.6	10	35	50	990	60/45/25/30		10
2021	01	03	12	17.4	140.8	10	50	70	985	40/20/25/50	0/0/15/15	10
2021	01	03	18	17.6	141.5	20	40	55	990	20/15/15/20		15
2021	01	04	00	17.7	142.0	20	30	45	998			

5 Forecast Performance

Official tropical cyclone forecasts were issued from 0100 UTC 2 January to 0100 UTC 4 January. The position accuracy figures were equal to or better than the 5-year average. The intensity accuracy varied over lead times with some larger than the 5-year average and some less than the 5-year average, this is not surprising given the rapid intensification in an area close to land fall. However, all figures at lead times greater than 18 hours should be treated with caution as there are less than 6 members in the sample size and at 48 hours this decreased to only 1 sample.

The accuracy figures for Tropical Cyclone are shown in the table below and in Figures 5 a and b.

	00	06	12	18	24	36	48
Position Absolute error (km)	14	38	47	65	86	163	165
Intensity Absolute error (kn)	2	5	3	5	7	12	10
Sample Size	8	8	7	6	5*	3*	1*

*Sample size less than 6

FIGURE 5 a. Position accuracy figures for Tropical Cyclone *Imogen*.

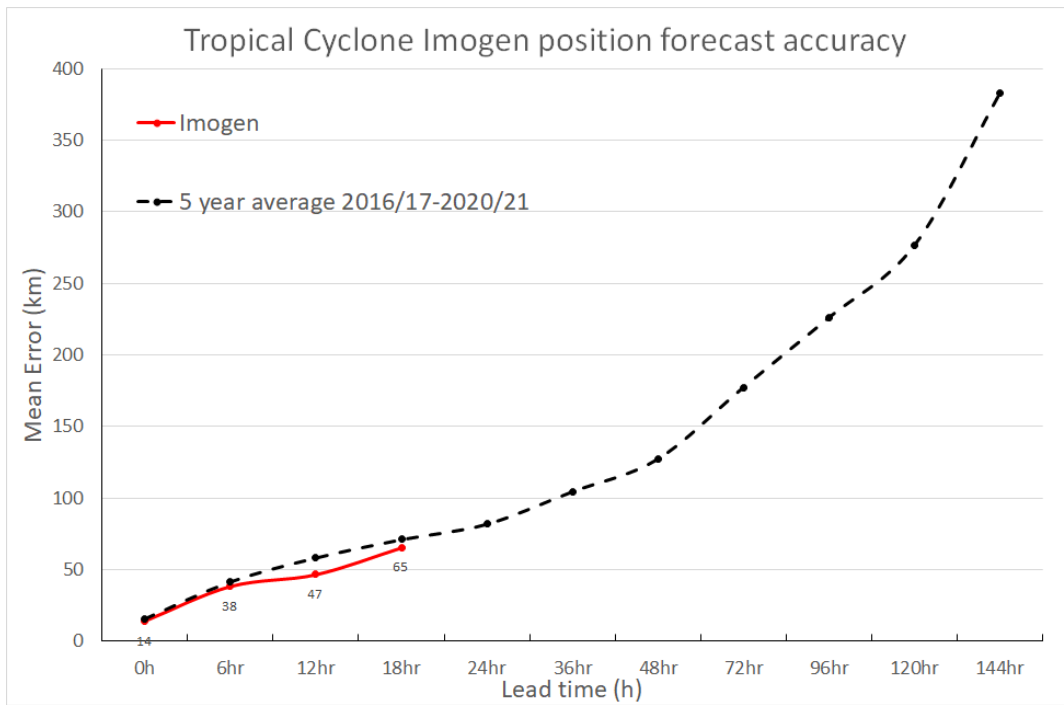


FIGURE 5 b. Intensity accuracy figures for Tropical Cyclone *Imogen*.

