Australian Government
Bureau of Meteorology

Severe Tropical Cyclone Ferdinand

22 February – 01 March 2020

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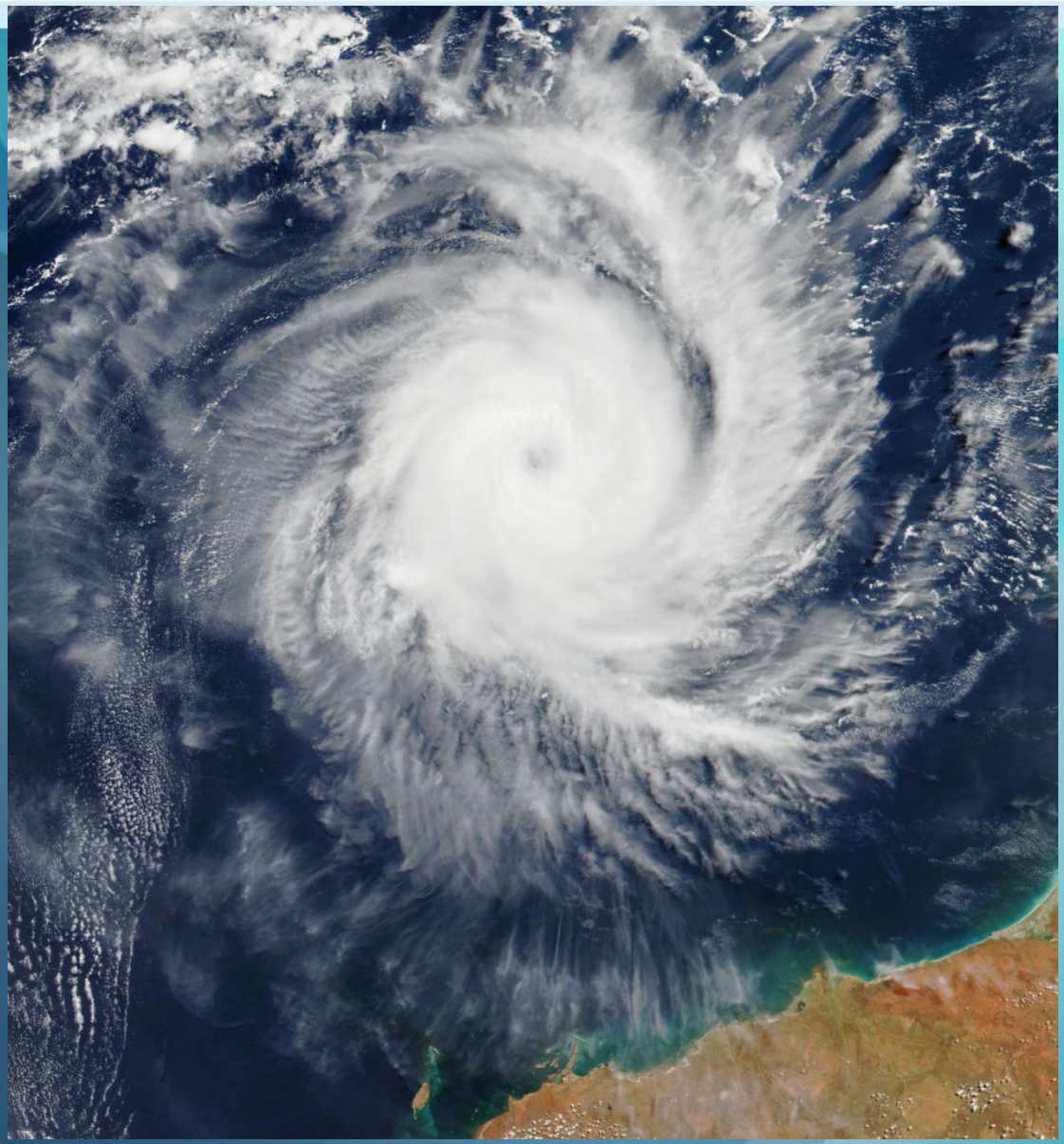

Image courtesy of NOAA-NASA, captured on the Suomi National Polar-orbiting Partnership

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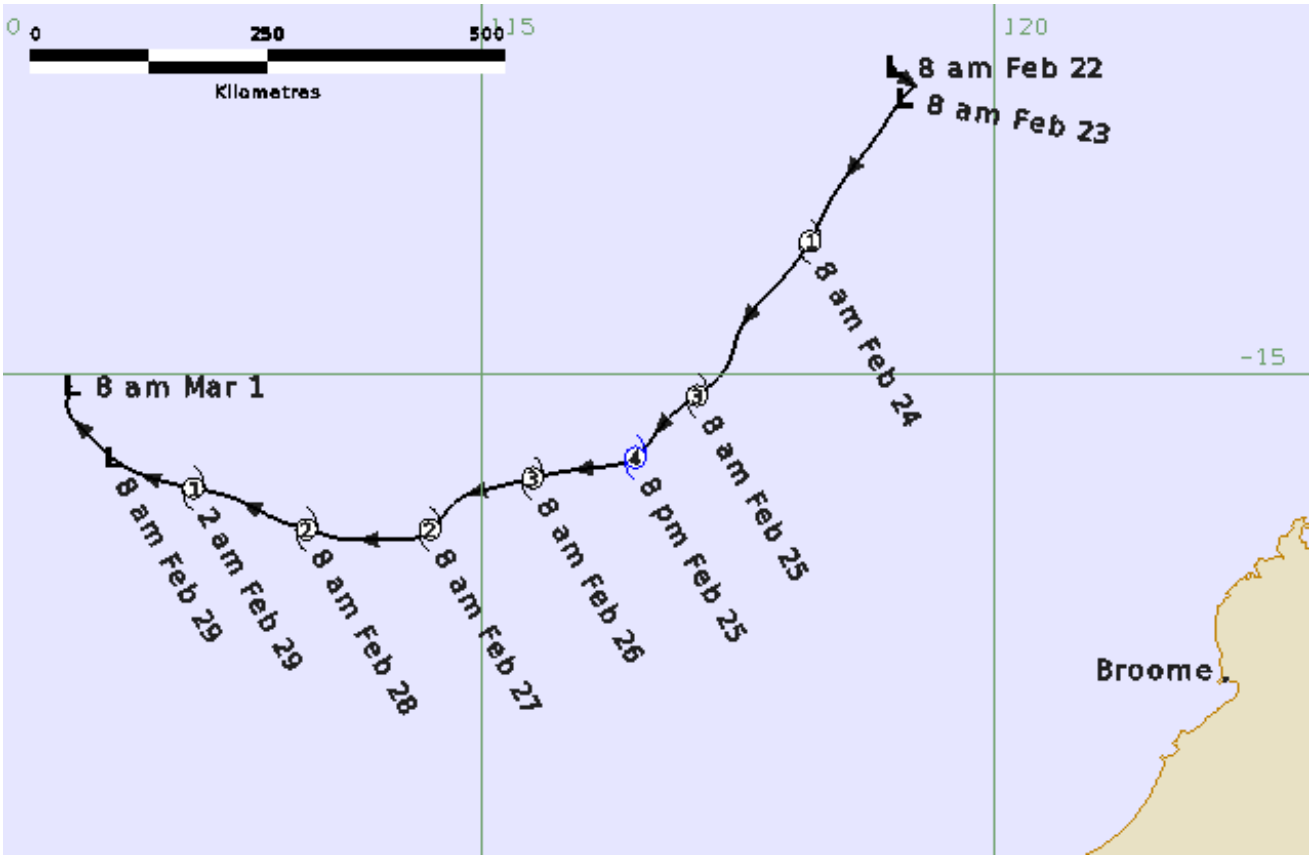
1. Summary

Severe Tropical Cyclone Ferdinand was a tropical cyclone that developed in the Indian Ocean and did not impact mainland Australia or any offshore island communities.

A low formed to the northwest of Broome during 22 February 2020 and moved to the southwest. The low reached tropical cyclone strength at 0000 Universal Time Co-ordinated (UTC) (0800 Australian Western Standard Time (AWST)) 24 February, (AWST=UTC+ 8 hours). Ferdinand continued to intensify rapidly and reached a 10-minute mean peak wind of 95 knots (175 kilometres per hour (km/h)) (category 4) at 1200 UTC 25 February. As environmental conditions became less favourable Ferdinand began to slowly weaken, finally decreasing to below tropical cyclone strength by 0000 UTC 29 February.

FIGURE 1 Best track of Tropical Cyclone Ferdinand 22 February – 1 March 2020 (times in AWST, UTC+8).



2. Meteorological Description

2.1 Intensity analysis

A well-defined monsoon trough developed across northern Australia during the middle of February. Despite there being no Madden-Julian Oscillation present in the Australian longitudes a low became evident in the trough. The low was assigned a Data T number (DT) of 1.0 at 0000 UTC 22 February, developing slowly to reach a DT of 2.0 at 0600 UTC 23 February. Gales are estimated to develop in western quadrants by 1200 UTC 23 February and a DT of 3.0 was assigned at 1800 UTC. An Advanced Scatterometer (ASCAT) pass at 0017 UTC 24 February confirmed gales had extended into eastern quadrants (Figure 2) and Ferdinand had attained tropical cyclone intensity.

Ferdinand continued to slowly develop through the day on 24 February before undergoing very rapid intensification during the 24 hours from 1200 UTC 24 February to 1200 UTC 25 February. Microwave imagery showed greatly increased cold cloud tightly spiralling around the centre and an eye became apparent on visible imagery from early on 25 February. The three-hour average subjective Dvorak intensity estimates increased from 3.0 to a peak of 6.0 at 1100 UTC 25 February however the Final T (FT) number was constrained to 5.5. A plot of subjective and objective intensity estimates is shown in Figure 8. This indicates that objective intensity estimates also increased rapidly. Ferdinand reached a peak 10-minute mean wind of 95 kn (175 km/h) at 1200 UTC 25 February (refer Figure 3).

Subsequent to attaining peak intensity, microwave imagery showed a gradual weakening of Ferdinand between 1200 UTC 25 February and 0000 UTC 26 February as the inner eyewall relaxed and expanded (Figure 4). Objective guidance showed a period of slight strengthening from 0000 UTC 26 February with a secondary peak in intensity occurring at approximately at 0600 UTC (Figure 5). Subjective Dvorak remained steady between 0000 UTC and 0600 UTC 26 February and the best track intensity was maintained at 85 kn (155 km/h).

From 1200 UTC 26 February further rapid weakening occurred with a microwave image at 2031 UTC 26 February (Figure 6) indicating loss of deep convection on the northern side of the system. A more sustained and gradual weakening of the system occurred through 27 and 28 February. The weakening was most likely caused by a change in the vertical wind shear direction. Despite there being little change in the magnitude of the vertical wind shear the change in direction resulted in dry air entrainment into the core of the tropical cyclone. Ferdinand weakened below tropical cyclone intensity at 0000 UTC 29 February with an ASCAT pass at 0129 UTC (Figure 7) showing marginal gales in the western quadrants.

2.2 Structure

Severe Tropical Cyclone Ferdinand was a small system – initially it had radius to gales of 30-50 nautical miles (nm) (56-93 km), and as it intensified only had a maximum radius to gales of 50-60 nm (93-111 km). As Ferdinand weakened, the radius to gales contracted to 30-40 nm (56-74 km). ASCAT passes were the only available source of verification for the extent of gales.

The radius to maximum winds (RMW) was initially 20 nm (37 km), with microwave imagery indicating a contraction to approximately 10 nm (18 km) during the peak intensity from 0600 UTC 25 February through to 0000 UTC 26 February. The RMW increased to 15 nm (28 km) as the inner eye wall weakened during 26 February, before extending to 20 nm (37 km) as the system weakened through until it was below tropical cyclone strength.

2.3 Motion

Severe Tropical Cyclone Ferdinand was steered generally to the southwest by a mid-level high located to the southeast of the tropical cyclone. As Ferdinand weakened, it tracked in a more west and then northwest direction, as the steering flow contracted to lower levels.

FIGURE 2. ASCAT winds at 0017 UTC 24 February overlaid on visible Himawari-8 satellite imagery at 0010 UTC, indicating gales in eastern quadrants.

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

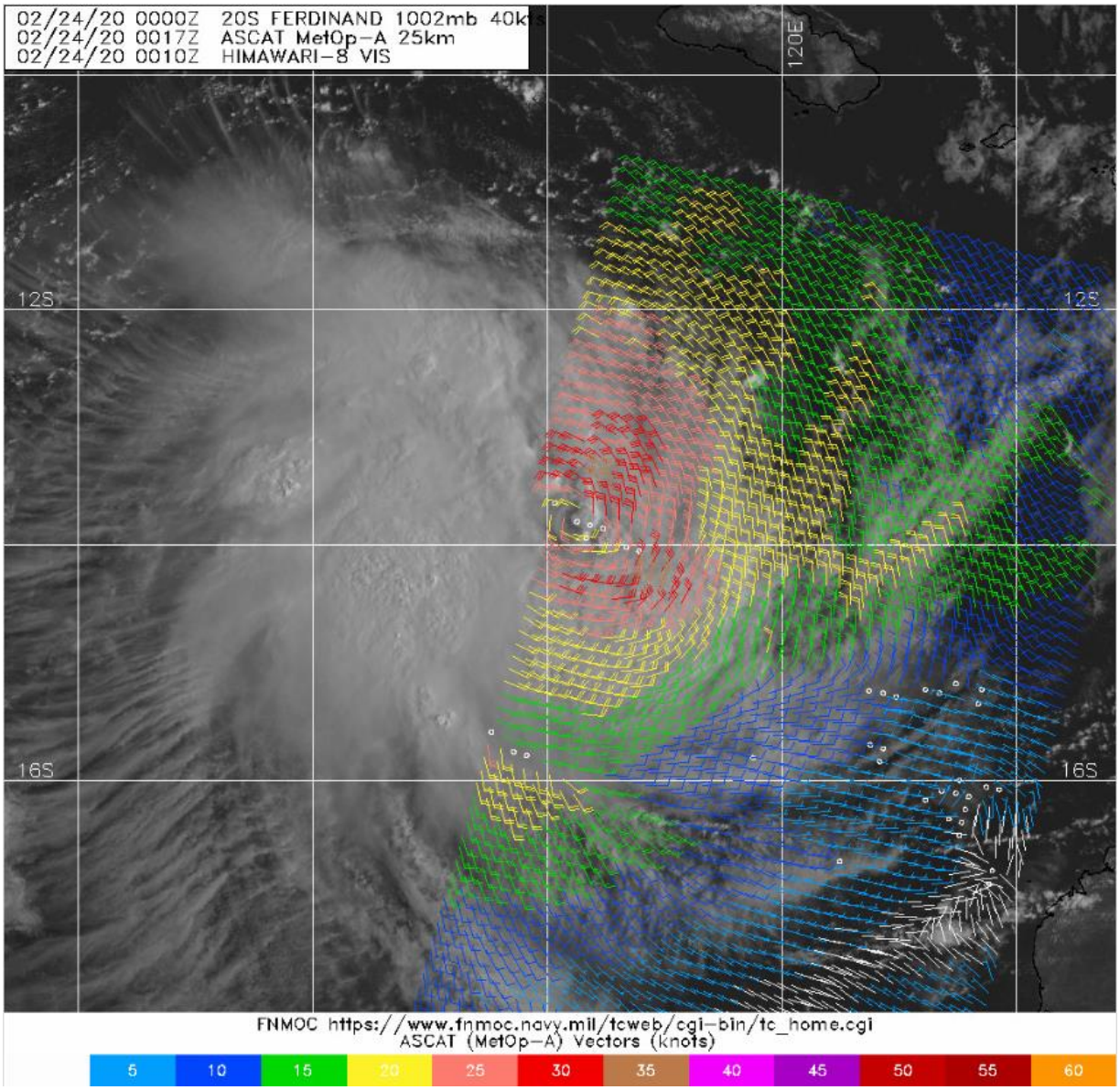


FIGURE 3. SSMIS 91 GHz microwave image at 0929 UTC 25 February, near peak intensity.

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

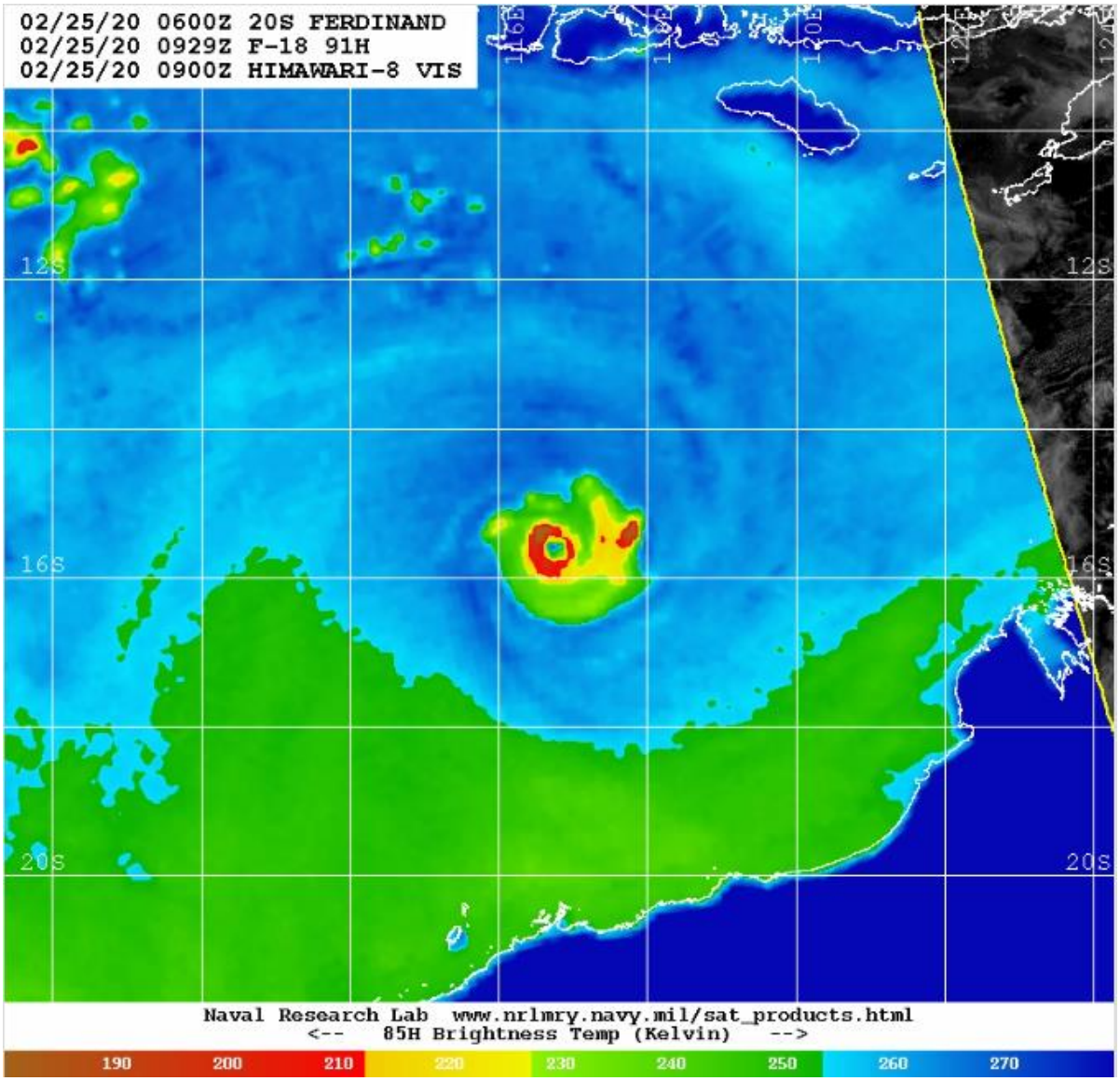


FIGURE 4. SSMIS 91 GHz microwave at 2041 UTC 25 February, with an expanded and relaxed eyewall structure.

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

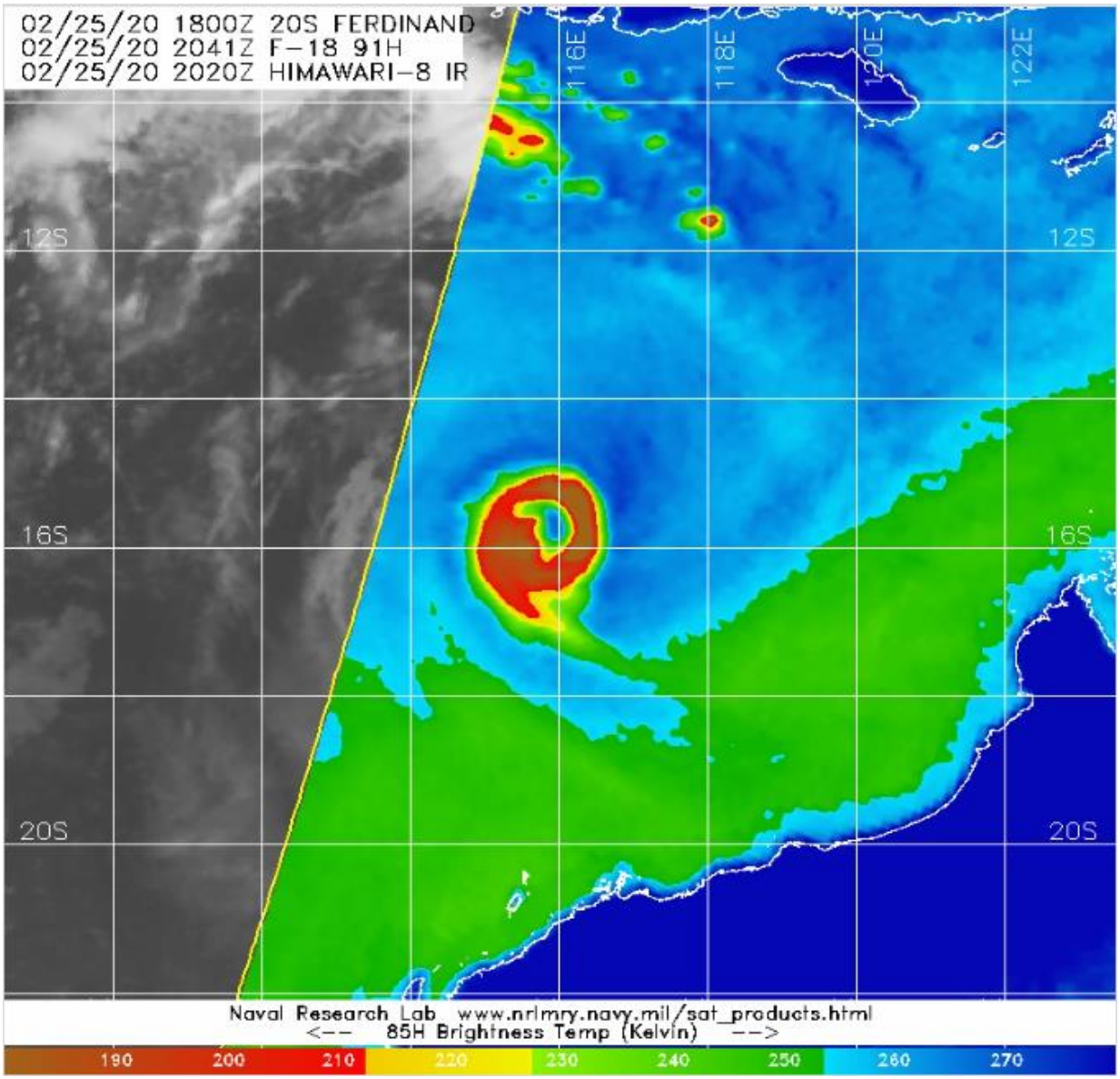


FIGURE 5. Himiwari-8 visible satellite imagery at 0600 UTC 26 February, at the secondary intensity peak.

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

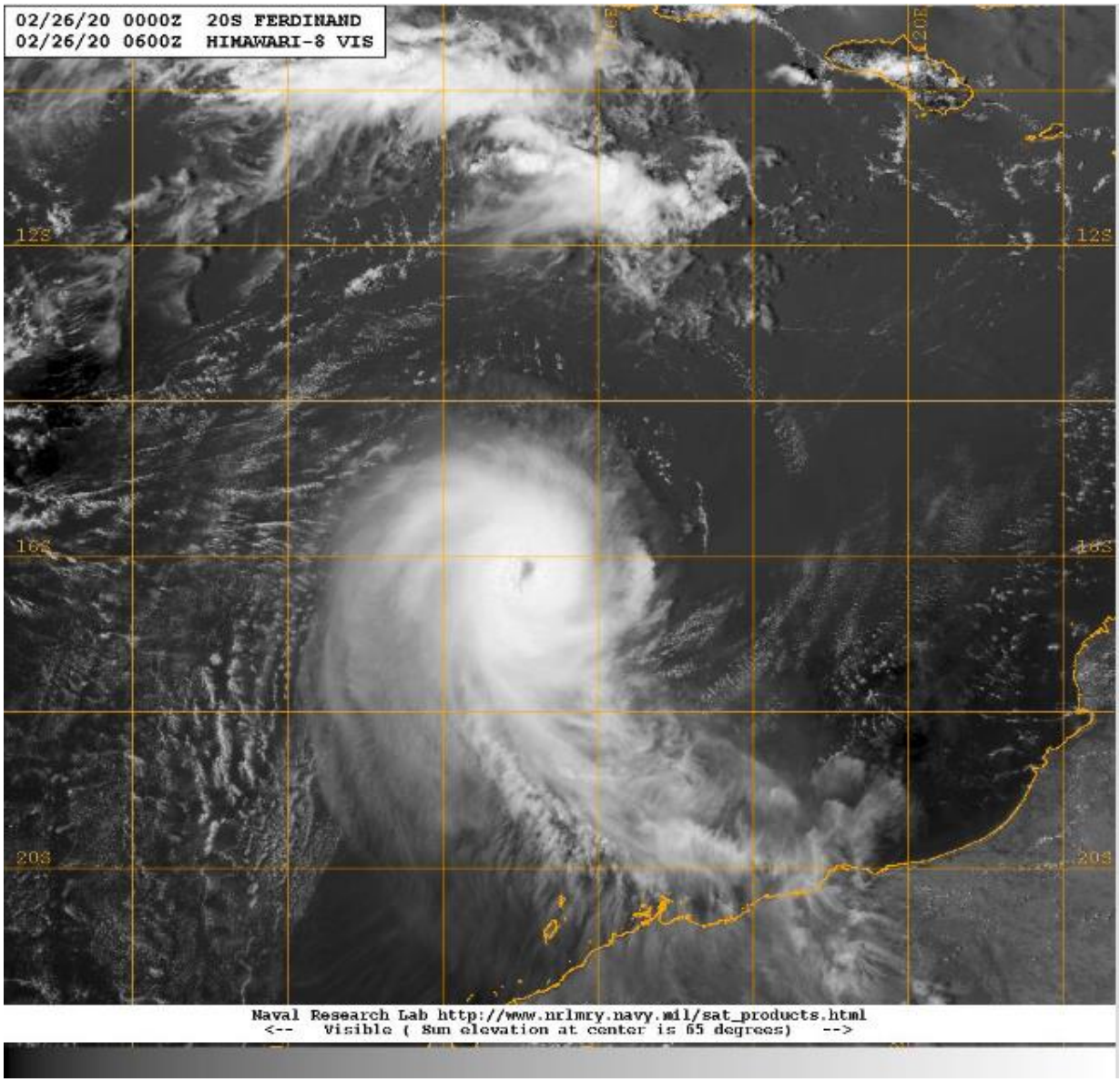


FIGURE 6. SSMIS 91 GHz microwave at 2031 UTC 26 February, showing a marked decrease in deep convection, particularly to the north of the system centre.

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

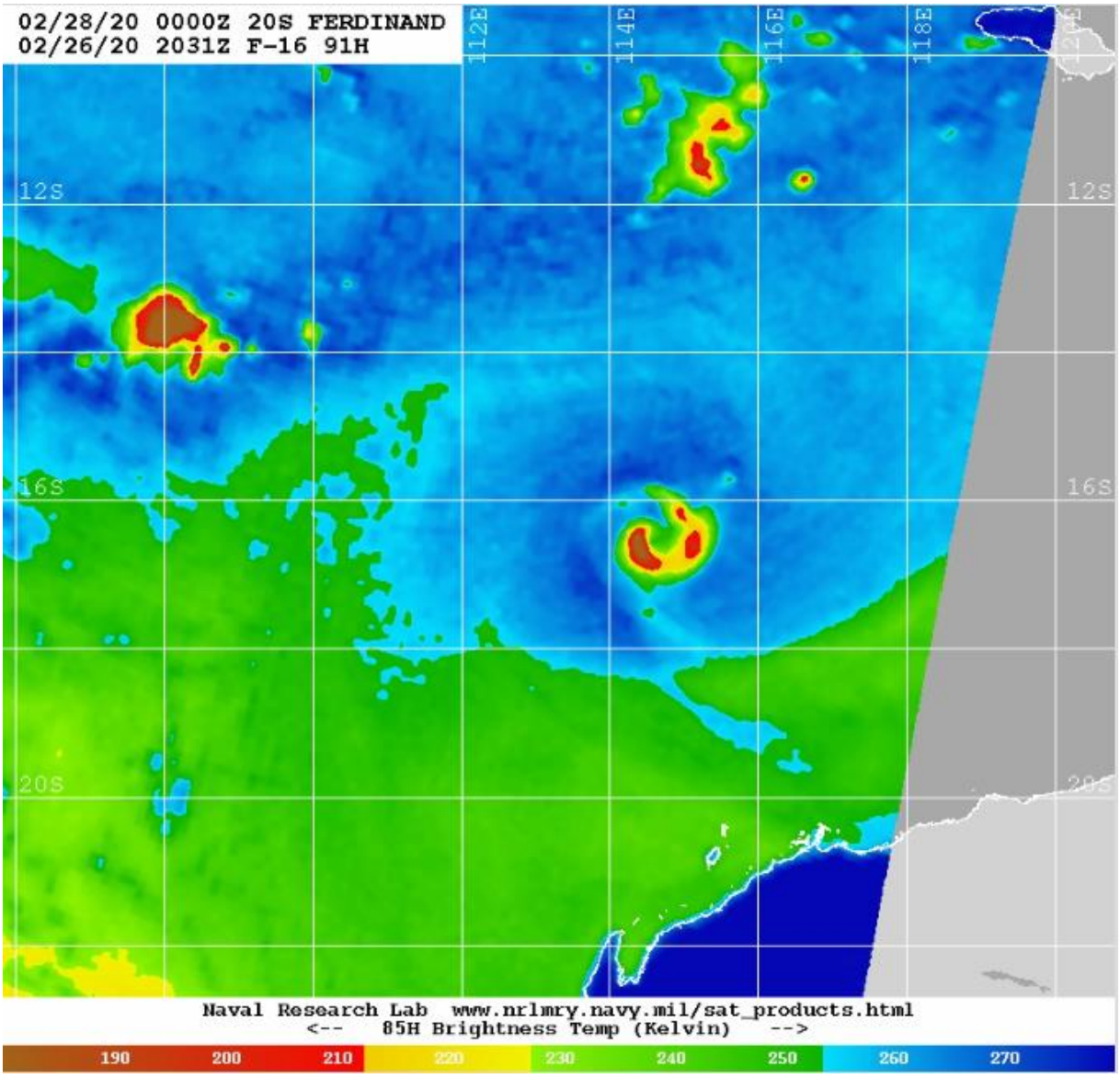


FIGURE 7. ASCAT winds at 0129 UTC 29 February overlaid on Himawari-8 visible satellite imagery at 0120Z, showing marginal gales to the west of the system centre.

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

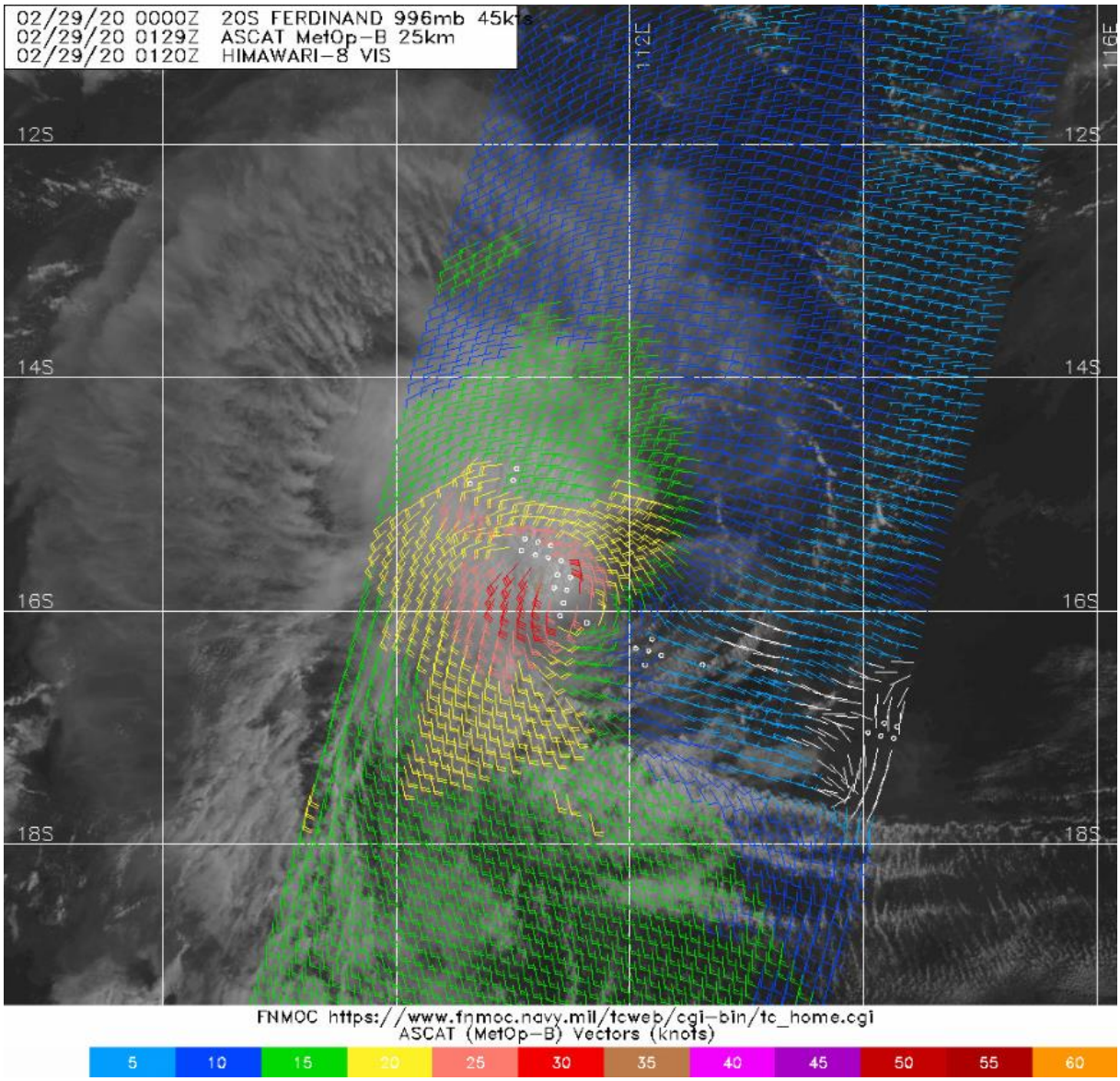
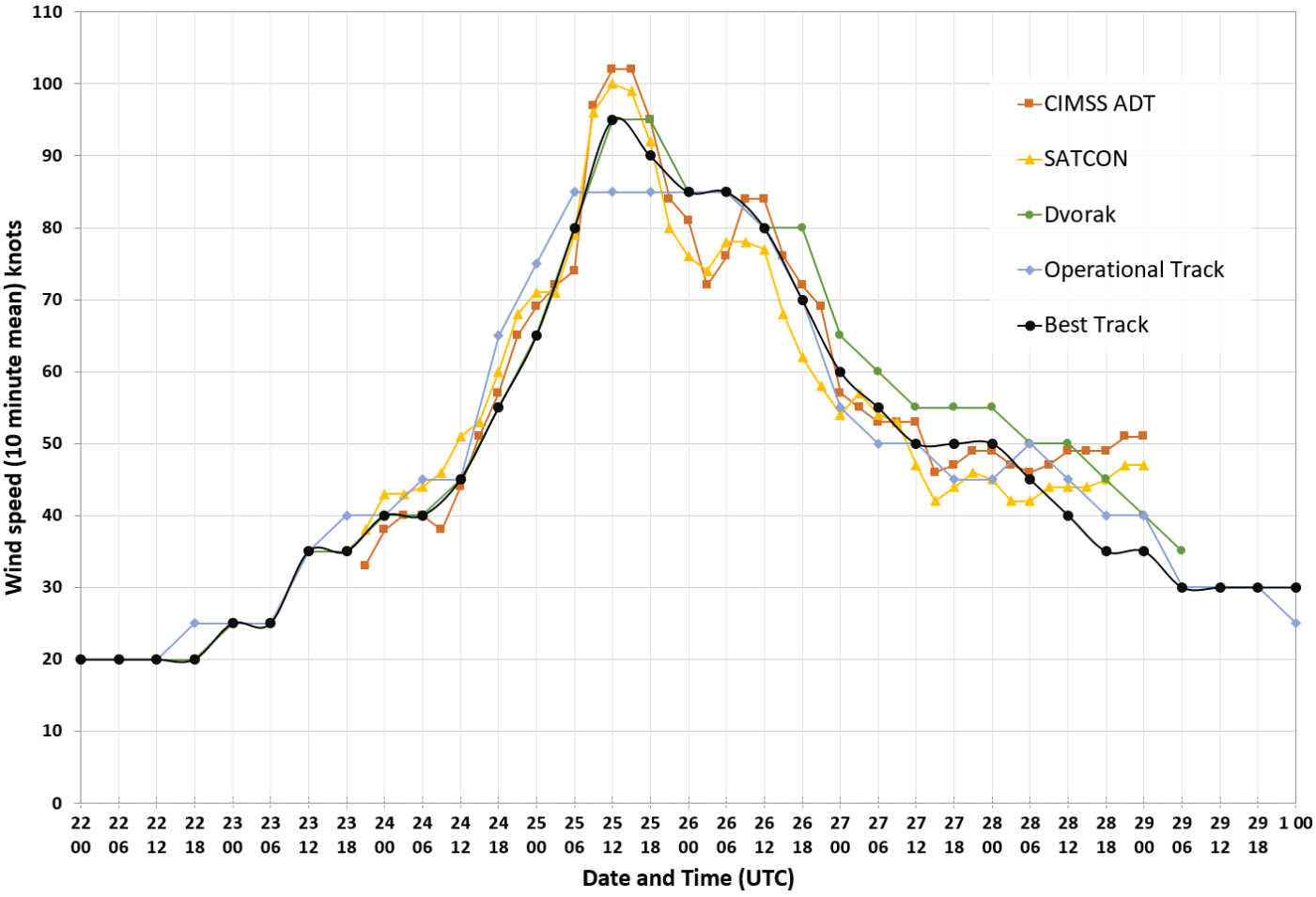


FIGURE 8. Plot of objective and subjective intensity estimates for Severe Tropical Cyclone Ferdinand.



3. Impact

There were no recorded impacts from Ferdinand.

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4. Observations

There were no observations recorded during Ferdinand.

TABLE 1. Best track summary for Severe Tropical Cyclone Ferdinand.

Refer to the Australian Tropical Cyclone database for complete listing of parameters and track. Note: UTC is AWST - 8 hours. *Denotes system has gales but not a tropical cyclone at this time.

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
2020	02	22	00	12.0	119.0	30	20	45	1004			
2020	02	22	06	12.1	119.1	30	20	45	1004			
2020	02	22	12	12.2	119.2	30	20	45	1004			
2020	02	22	18	12.2	119.1	30	20	45	1004			
2020	02	23	00	12.3	119.1	30	25	45	1004			
2020	02	23	06	12.6	118.9	25	25	45	1003			
2020	02	23	12	13.0	118.6	25	35*	50	1000	-/-/50/- *		
2020	02	23	18	13.3	118.4	20	35*	50	998	-/-/50/30 *		
2020	02	24	00	13.7	118.2	20	40	55	995	30/50/50/30		20
2020	02	24	06	14.2	117.8	20	40	55	995	30/50/50/60		20
2020	02	24	12	14.6	117.5	20	45	65	992	40/60/60/40		20
2020	02	24	18	14.9	117.4	15	55	75	985	60	25	20
2020	02	25	00	15.2	117.1	15	65	90	978	60	30	15
2020	02	25	06	15.5	116.7	15	80	110	963	60	30	10
2020	02	25	12	15.8	116.5	10	95	135	951	60	40/30/30/ 40	10
2020	02	25	18	15.9	116.1	10	90	125	954	60/50/60/60	40/30/30/ 40	10
2020	02	26	00	16.0	115.5	20	85	120	959	60/50/60/60	40/30/30/	10

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
											40	
2020	02	26	06	16.1	115.1	20	85	120	959	50/40/50/50	30/20/30/ 30	15
2020	02	26	12	16.2	114.8	20	80	110	963	50/30/40/50	30/20/20/ 30	15
2020	02	26	18	16.4	114.6	20	70	100	971	40	20	15
2020	02	27	00	16.5	114.5	20	60	85	980	40	20	15
2020	02	27	06	16.6	114.3	30	55	75	984	40	20	15
2020	02	27	12	16.6	114.1	25	50	70	988	40	20	15
2020	02	27	18	16.6	113.7	20	50	70	988	40	20	15
2020	02	28	00	16.5	113.3	15	50	70	989	40/30/30/40	15/-/15/15	15
2020	02	28	06	16.4	113.0	10	45	65	991	30/30/30/40		15
2020	02	28	12	16.2	112.6	25	40	55	995	30/30/40/40		15
2020	02	28	18	16.1	112.2	25	35	50	997	25/25/30/30		20
2020	02	29	00	15.8	111.4	20	35*	50	997	-/-/30/30 *		
2020	02	29	06	15.6	111.2	20	30	45	998			
2020	02	29	12	15.5	111.1	20	30	45	998			
2020	02	29	18	15.4	111.0	20	30	45	998			
2020	03	01	00	15.1	111.0	20	30	45	998			

5. Forecast Performance

Official tropical cyclone forecasts were issued from 0000 UTC 23 February until 0600 UTC 29 February. The position accuracy figures were better than the 5-year average at all lead times. Ferdinand was steered westward by the mid-level ridge which was well forecast by model guidance. The intensity accuracy figures were poorer than the 5-year average at 12 hours but thereafter were better at all lead times out to 120 hours. Despite Ferdinand being a small tropical cyclone, the rapid intensification was well forecast leading to smaller than average intensity error figures.

The accuracy figures for Severe Tropical Cyclone Ferdinand are shown in the table below and in Figures 9 a and b.

	00	**06**	**12**	**18**	**24**	**36**	**48**	**72**	**96**	**120**
Position Absolute error (km)	17	28	36	44	55	75	96	135	143	129
Intensity Absolute error (kn)	4.8	7.8	9.1	9.0	7.3	9.8	11.7	9.9	7.7	7.2
Sample Size	25	25	25	25	25	23	21	17	13	9

FIGURE 9 a. Position accuracy figures for Severe Tropical Cyclone Ferdinand

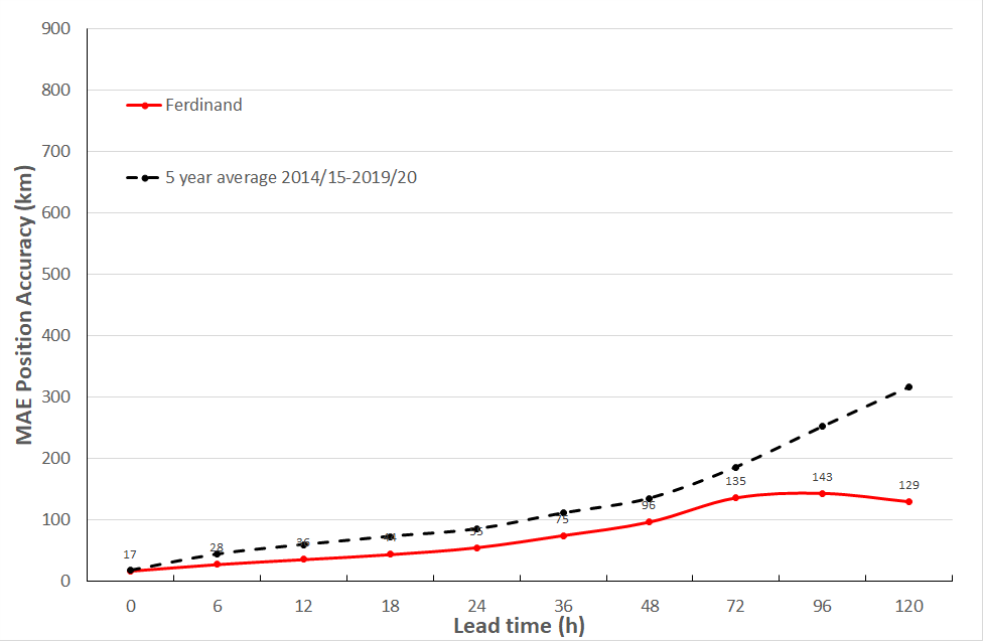

FIGURE 9 b. Intensity accuracy figures for Severe Tropical Cyclone Ferdinand