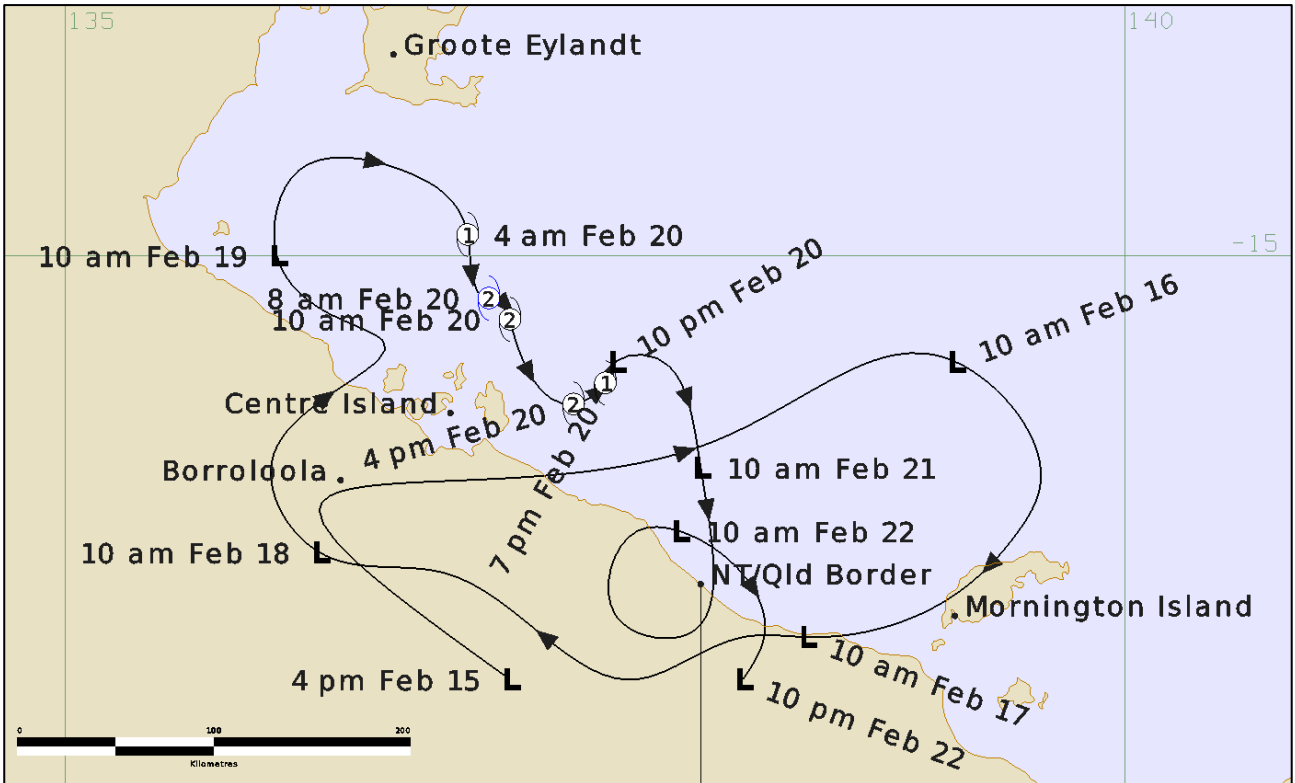


Tropical Cyclone Alfred

15-22 February 2017

Angeline Prasad and Linda Paterson

Tropical Cyclone Environmental Prediction Services



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Contact details:

Tropical Cyclone Team Lead

Severe Weather Environmental Prediction Services

Bureau of Meteorology

PO Box 1370, West Perth WA 6872

Email: tcwc@bom.gov.au



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Cover image: Track of Tropical Cyclone Alfred



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1. Summary

Alfred was a Category 2 tropical cyclone that developed in the Gulf of Carpentaria before moving inland near the Northern Territory and Queensland border and weakening.

A low developed over inland eastern Northern Territory and drifted in a loop for several days over the southern Gulf of Carpentaria coast. The low moved offshore north of Borroloola and developed into a tropical cyclone at 0600 UTC 19 February (UTC=CST+9.5 hours). Alfred reached a peak 10-minute mean wind intensity of 50 kn (95 km/h) at 0000 UTC 20 February before quickly weakening to below tropical cyclone strength by 1200 UTC 20 February. The remnant low crossed the coast near the Northern Territory and Queensland border during 22 February and dissipated over land.

Gale-force winds felled trees in Alyangula on Groote Eylandt, at Borroloola and in nearby communities. Gales were observed at Alyangula with a peak mean wind of 38 kn (71 km/h) recorded at 1340 UTC 19 February. Peak wind gusts of 61 kn (113 km/h) and 47 kn (87 km/h) were recorded at Centre Island and Mornington Island, respectively.

The McArthur River exceeded minor flood level in the Borroloola area, peaking at 12.29m around midnight on Monday 20th. Roads and bridges were cut by floodwaters and several outstations in the area were isolated. Several houses were inundated at King Ash Bay fishing village. Five-day rainfall totals recorded to 22nd February were 862 mm at Sweers Is, 486mm at Centre Island, 412mm at Burketown, 366mm at Mornington Island and 314mm at Borroloola.

Abnormally high tides, up to 1m above predicted levels, were observed about the southeast Gulf of Carpentaria.

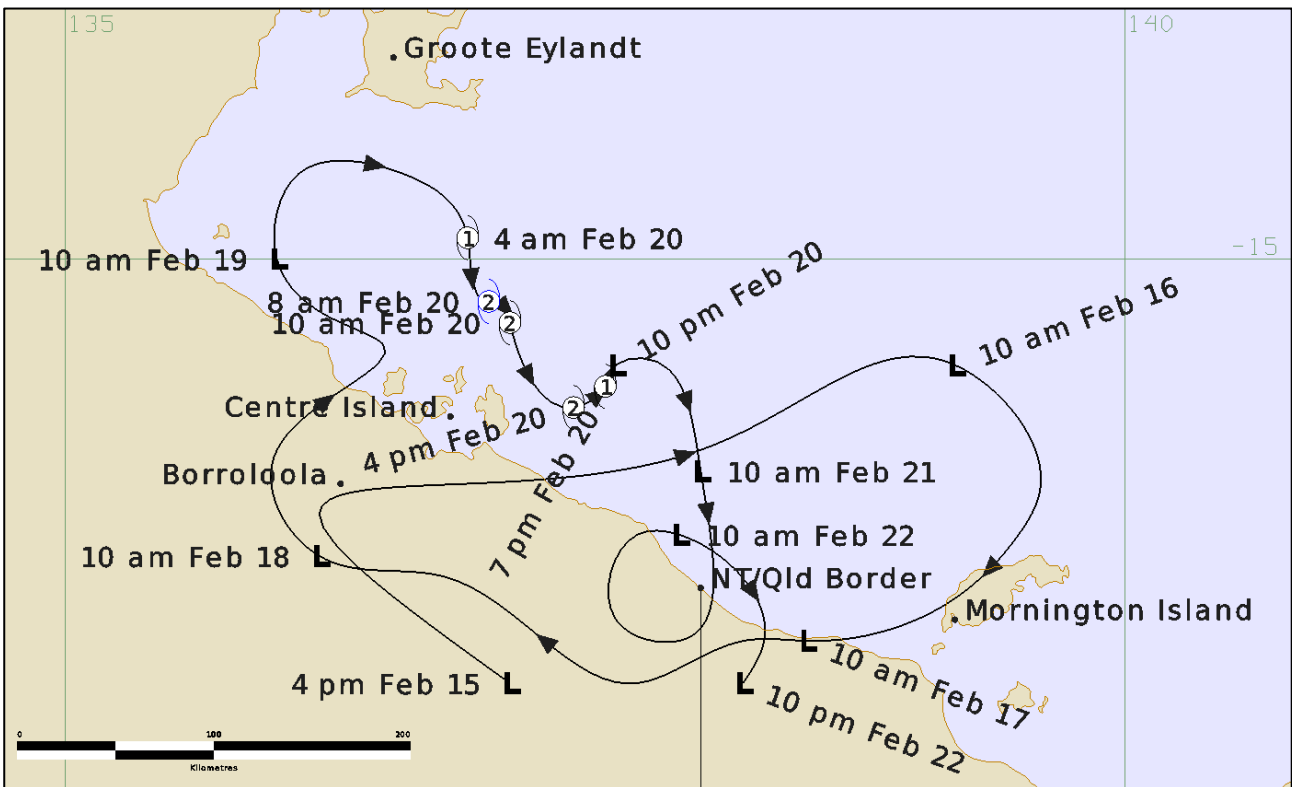


Figure 1. Best track of Tropical Cyclone Alfred (times in CST, UTC +9.5 hours).

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Table 1. Best track summary for Tropical Cyclone Alfred 15-22 February 2017.

[UTC=CST-9.5h] * Not at tropical cyclone intensity as gales less than halfway around centre.

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
2017	2	15	0600	17.0	137.1	40	15	45	1002	0/0/0/0	0/0/0/0	-
2017	2	15	1200	16.2	136.2	30	15	45	1003	0/0/0/0	0/0/0/0	-
2017	2	15	1800	15.9	138.0	45	15	45	1002	0/0/0/0	0/0/0/0	-
2017	2	16	0000	15.5	139.2	20	25	45	1002	0/0/0/0	0/0/0/0	-
2017	2	16	0600	16.1	139.6	10	25	45	1001	0/0/0/0	0/0/0/0	-
2017	2	16	1200	16.3	139.5	8	30	45	999	0/0/0/0	0/0/0/0	-
2017	2	16	1800	16.6	139.2	3	35*	50	994	0/10/0/0	0/0/0/0	-
2017	2	17	0000	16.8	138.5	10	30	45	996	0/0/0/0	0/0/0/0	-
2017	2	17	0600	16.8	138.2	10	25	45	999	0/0/0/0	0/0/0/0	-
2017	2	17	1200	17.0	137.7	20	25	45	1002	0/0/0/0	0/0/0/0	-
2017	2	17	1800	16.5	136.8	20	25	45	1002	0/0/0/0	0/0/0/0	-
2017	2	18	0000	16.4	136.2	20	20	45	1004	0/0/0/0	0/0/0/0	-
2017	2	18	0600	15.9	136.0	25	20	45	1001	0/0/0/0	0/0/0/0	-
2017	2	18	1200	15.4	136.5	30	25	45	1003	0/0/0/0	0/0/0/0	-
2017	2	18	1800	15.3	136.3	30	25	45	1001	0/0/0/0	0/0/0/0	-
2017	2	19	0000	15.0	136.0	30	30	45	1000	0/0/0/0	0/0/0/0	-
2017	2	19	0600	14.6	136.1	30	35*	50	996	0/80/0/0	0/0/0/0	-
2017	2	19	1200	14.6	136.6	30	40*	55	995	0/0/50/50	0/0/0/0	-
2017	2	19	1800	14.9	136.9	30	40	55	993	35/35/50/50	0/0/0/0	20
2017	2	19	2100	15.2	137.0	30	45	65	990	35/35/50/50	0/0/0/0	20
2017	2	19	2200	15.2	137.0	30	50	70	987	35/35/50/50	20/20/20/20	20
2017	2	19	2300	15.2	137.1	30	50	70	987	35/35/50/50	20/20/20/20	20
2017	2	20	0000	15.3	137.1	25	50	70	987	35/35/50/50	0/0/20/20	20
2017	2	20	0600	15.7	137.4	40	50	70	987	35/50/40/50	0/0/20/20	20
2017	2	20	0900	15.6	137.6	40	40	55	991	0/65/40/50	0/0/0/0	20
2017	2	20	1200	15.5	137.6	25	35	50	996	0/65/40/0	0/0/0/0	15
2017	2	20	1800	15.5	137.7	30	30	45	999	0/0/0/0	0/0/0/0	-
2017	2	21	0000	16.0	138.0	20	30	45	1003	0/0/0/0	0/0/0/0	-
2017	2	21	0600	16.8	137.9	20	30	45	1004	0/0/0/0	0/0/0/0	-
2017	2	21	1200	16.7	137.6	20	30	45	1004	0/0/0/0	0/0/0/0	-
2017	2	21	1800	16.3	137.7	20	30	45	1004	0/0/0/0	0/0/0/0	-
2017	2	22	0000	16.3	137.9	20	25	45	1006	0/0/0/0	0/0/0/0	-
2017	2	22	0600	16.8	138.3	20	25	45	1005	0/0/0/0	0/0/0/0	-
2017	2	22	1200	17.0	138.2	40	25	45	1007	0/0/0/0	0/0/0/0	-



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2. Meteorological description

2.1 Intensity analysis

An active monsoon trough combined with the tail end of a Madden-Julian Oscillation over eastern parts of Australia produced a low over land near the Northern Territory and Queensland border on 15 February. The low spent several days moving over land and water over the southern Gulf of Carpentaria. A Dvorak T number of 1.0 was assigned on the 15 February and satellite and microwave imagery showed a well-developed system with curved banding around a low-level centre over subsequent days, refer Figure 2.

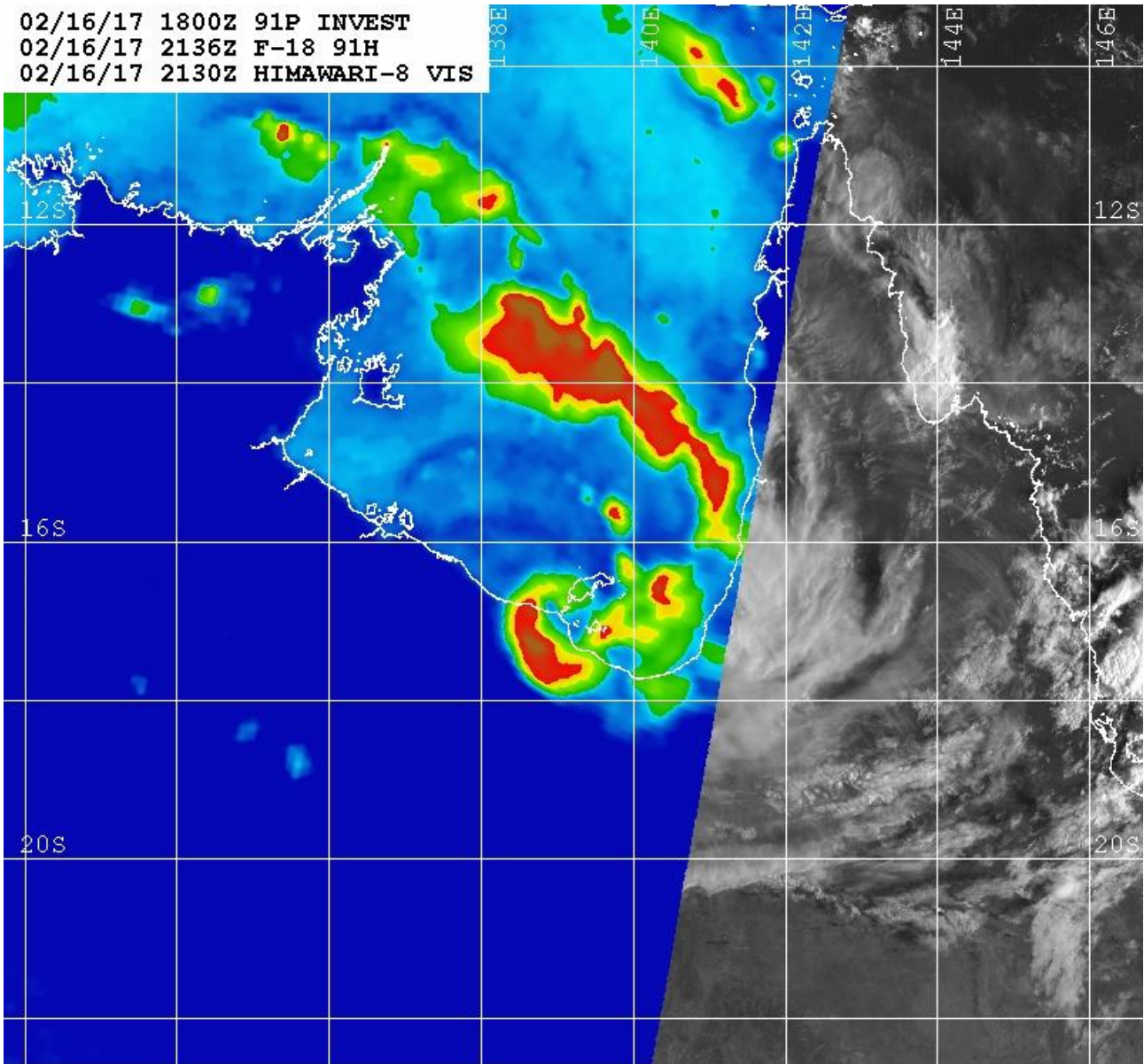
The low moved inland and weakened before it again moved offshore south of Groote Eylandt on 19 February and began to intensify. Alfred reached tropical cyclone intensity at 1800 UTC 19 February. Microwave imagery showed intense deep convection in the western quadrants. Observations from Centre Island recorded long periods of gale force winds and a peak 10-minute mean wind of 47 kn (87 km/h) at 2349 UTC 19 February. At this time the Dvorak T number had reached 3.5. Intensity was based on Dvorak and surface observations and Alfred reached a 10-minute mean wind peak intensity of 50 kn (95 km/h) at 0000 UTC 20 February (refer Figure 3) before beginning to weaken. Alfred lost all cold convection during 20 February and an ASCAT pass at 1207 UTC 20 February showed gales in the southern quadrants only, refer Figure 4. Alfred had weakened below tropical cyclone strength by 1200 UTC 20 February and the remaining weak low moved south. It eventually crossed the Gulf of Carpentaria coast near the Northern Territory and Queensland border and dissipated inland.

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02/16/17 1800Z 91P INVEST
02/16/17 2136Z F-18 91H
02/16/17 2130Z HIMAWARI-8 VIS



Naval Research Lab www.nrlmry.navy.mil/sat_products.html
<-- 85H Brightness Temp (Kelvin) -->



Figure 2. A SSMIS 91 GHz microwave image at 2126 UTC 16 February which showed deep convection wrapped around a low level centre.

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

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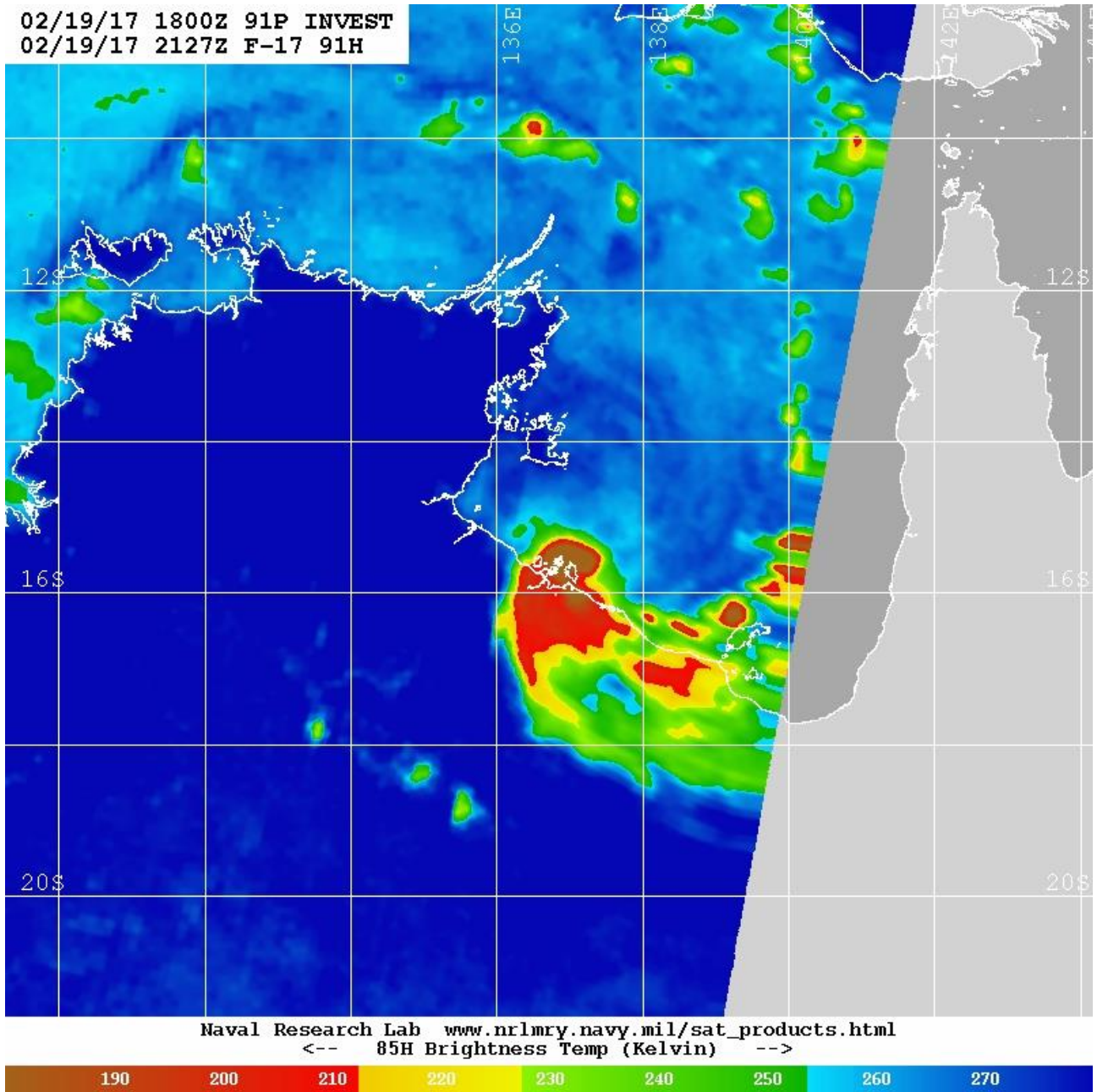


Figure 3. A SSMIS 91 GHz microwave pass just before Alfred reached peak intensity. Image courtesy NRL: <https://www.nrlmry.navy.mil/TC.html>

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02/20/17 1800Z 06P ALFRED
02/20/17 1207Z METOP-A ASCAT
02/20/17 1210Z HIMAWARI-8 IR

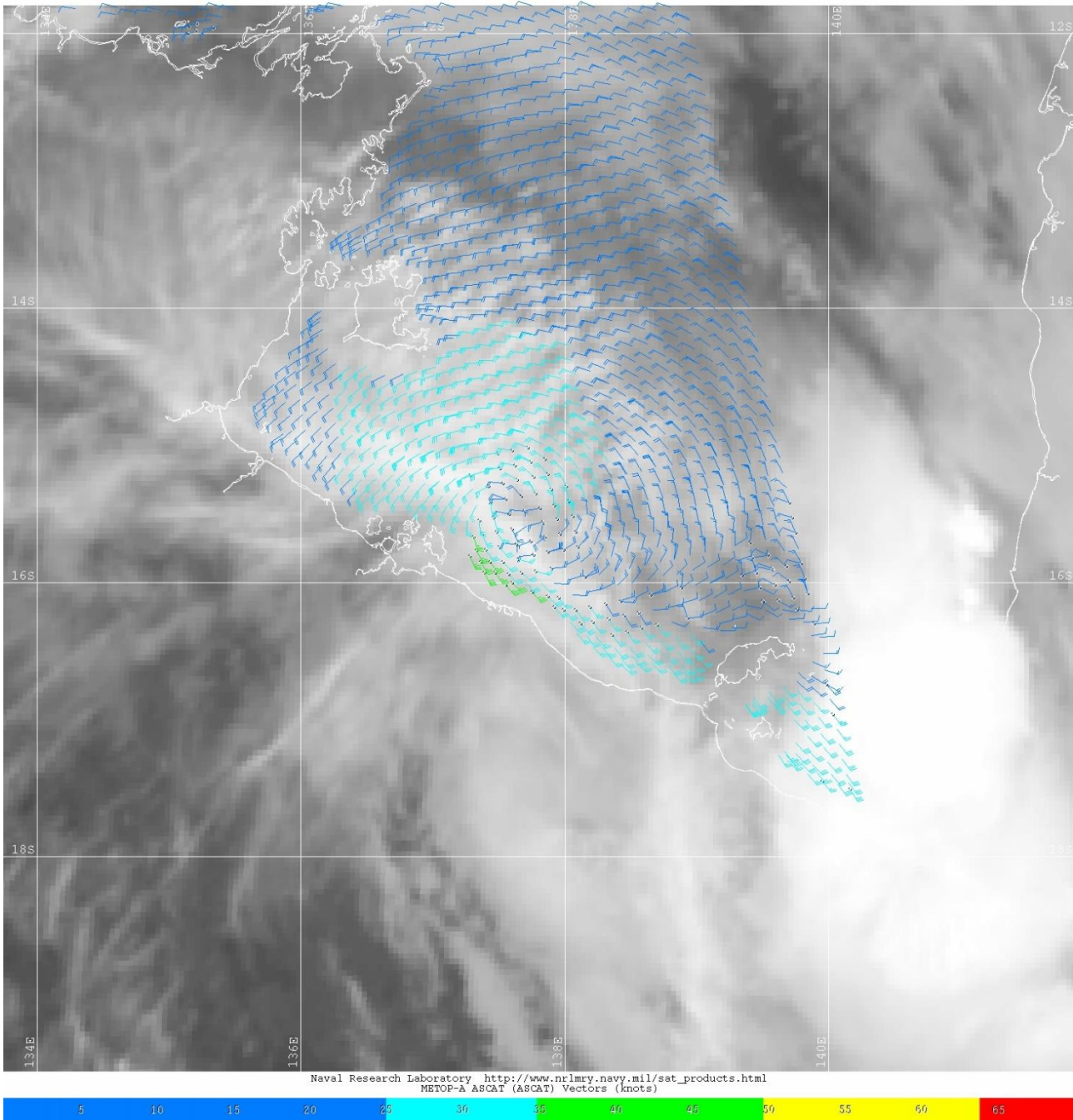


Figure 4. A 1207 UTC 20 February ASCAT pass that showed gales in the southern quadrants. Image courtesy NRL: <https://www.nrlmry.navy.mil/TC.html>

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2.1 Structure

Alfred was a small tropical cyclone with gale radii that ranged mostly between 35 nm and 65 nm (65-120 km) at different times. The largest gale radii were predominantly in the western quadrants. The storm radius was estimated at 20 nm (35 km).

2.2 Motion

Alfred was in a weak steering pattern between a mid-level ridge and an upper trough which produced a looping and meandering track.

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3. Impact

Gale-force winds felled trees in Alyangula on Groote Eylandt, at Borroloola and in nearby communities.

The McArthur River exceeded minor flood level in the Borroloola area, peaking at 12.29m around midnight on Monday 20th. Roads and bridges were cut by floodwaters and several outstations in the area were isolated. Several houses were inundated at King Ash Bay fishing village.

No other impacts were reported.

4. Observations

4.1. Wind

Centre Island AWS reported gale force winds between 1922-1924, 1928-1944, 1948, 1954-2107 and 2126 UTC 19 February and 0433 UTC 20 February, 0524-0832 UTC 20 February. A peak 10-minute mean wind of 46.8 kn (87 km/h) was recorded at 2349 UTC 19 February and a peak 3-second gust of 61 kn (113 km/h) at 0340 UC 20 February.

Alyangula recorded a peak 10-minute mean wind of 38 kn (71 km/h) at 1340 UTC 19 February. A peak wind gust 47 kn (87 km/h) was recorded Mornington Island.

4.2. Pressure

A minimum mean sea level pressure (MSLP) of 996.9 hPa was recorded at Centre Island at 0340 UTC 20 February.

4.3. Rainfall

Five-day rainfall totals recorded to 22nd February were 862 mm at Sweers Is, 486mm at Centre Island, 412mm at Burketown, 366mm at Mornington Island and 314mm at Borroloola.

4.4. Storm Surge

Abnormally high tides, up to 1m above predicted levels, were observed about the southeast Gulf of Carpentaria.

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5. Forecast performance

Tropical Cyclone Advises were issue between 1800 UTC 17 February and 1800 UTC 21 February. The forecast performance for Alfred was better than the 5-year mean for position error.

The accuracy figures for Alfred are below in Table 2 and also shown in Figure 5.

Table 3. Verification statistics for Alfred. * Note, verification is performed using the Official Forecast Tracks at the standard times of 00UTC, 06UTC,12UTC and 18UTC.

	0	6	12	18	24	36	48	72	96	120
Position										
Absolute error (km)	27	51	70	79	87	115	141	161	199	197
Intensity										
Absolute error (kn)	4.1	5.6	5.2	5.0	5.2	5.5	8.8	7.4	9.0	6.8
Sample Size	16	16	16	16	16	16	16	12	8	4

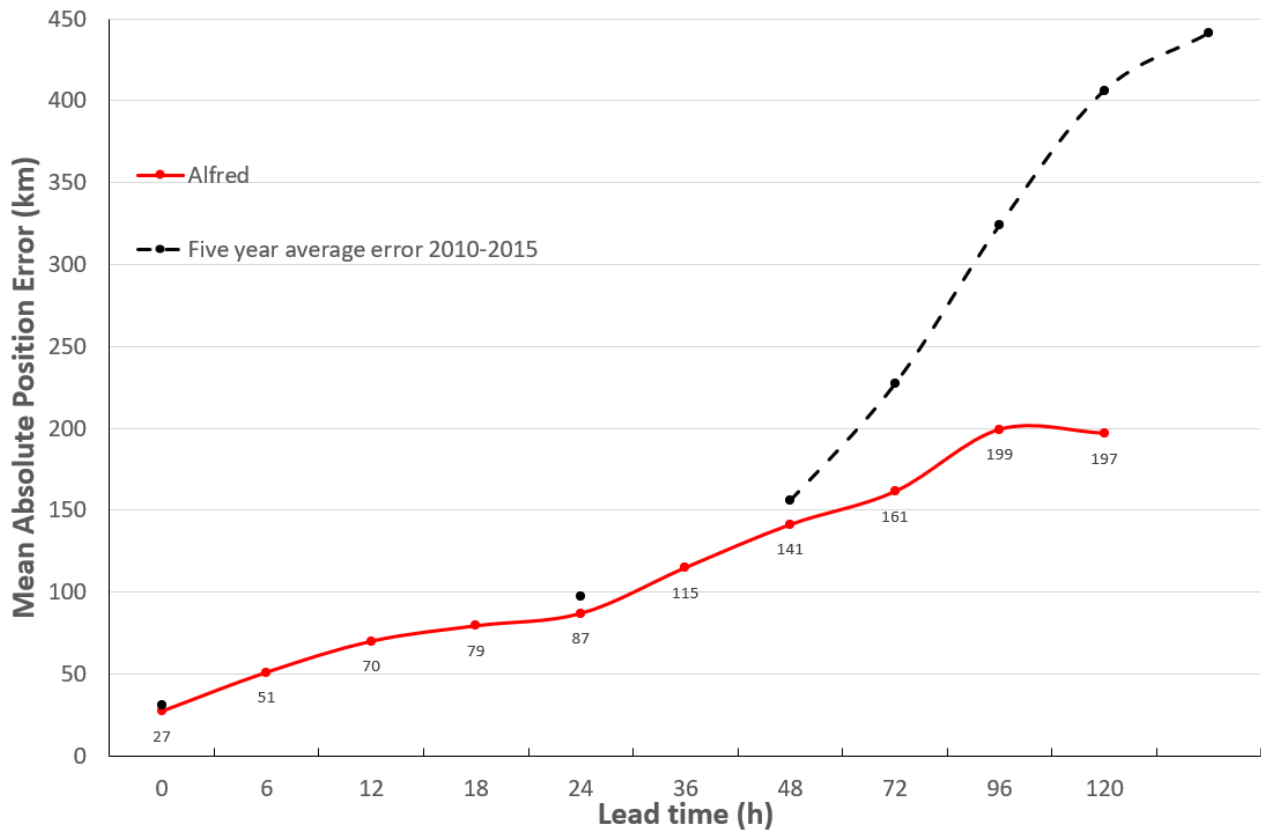


Figure 5 Position accuracy figures for Alfred.

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6. Appendix: List of abbreviations

Abbreviation	Term
ADT	Advanced Dvorak Technique
ACST	Australian Central Standard Time
AEST	Australian Eastern Standard Time
AMSR2	Advanced Microwave Scanning Radiometer
ASCAT	Advanced Scatterometer
ATMS	Advanced Technology Microwave Sounder
AWS	automatic weather station
AWST	Australian Western Standard Time
°C	Celsius
CI	Current intensity
CIMSS	Cooperative Institute for Meteorological Satellite Studies (USA)
CIRA	Cooperative Institute for Research in the Atmosphere (USA)
D-MINT	Deep learning - Multispectral Intensity of TCs (formerly known as DMN)
D-PRINT	Deep learning - IR Intensity of TCs (formerly known as OPEN-AIIR)
EIR	Enhanced InfraRed
ERC	eyewall replacement cycle
FNMOCC	Fleet Numerical Meteorology and Oceanography Centre (USA)
FT	Final T-number
GCOM	Global Change Observation Mission
GHz	Gigahertz
GMI	Global Precipitation Measurement Microwave Imager
h	hour
hPa	hectopascal
HSCAT	Hai Yang 2 Scatterometer (HY-2B, HY-2C)
km	kilometres
km/h	kilometres per hour
kn	knot



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LLCC	LLCC
MET	Model Expected T-number
METOP	Meteorological Operational Satellite
MJO	Madden-Julian Oscillation
mm	millimetres
MSLP	mean sea level pressure
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NRL	Navy Research Lab (USA)
OPEN-AiIR	Ordered Pattern Encoding AI Infrared
PAT	Pattern T-number
RCM	RadarSat Constellation Mission – Synthetic Aperture Radar
RH	relative humidity
RMW	radius of maximum winds
RSMC	Regional Specialised Meteorological Centre
SAR	Synthetic Aperture Radar
SATC	CIMSS Advanced Dvorak Technique
SATCON	Satellite Consensus
SEN1	Sentinel-1A – Synthetic Aperture Radar
SMAP	Soil Moisture Active Passive
SMOS	Soil Moisture and Ocean Salinity
SSMIS	Special Sensor Microwave Imager/Sounder
TC	Tropical Cyclone
TCWC	Tropical Cyclone Warning Centre
UTC	Universal Time Co-ordinated