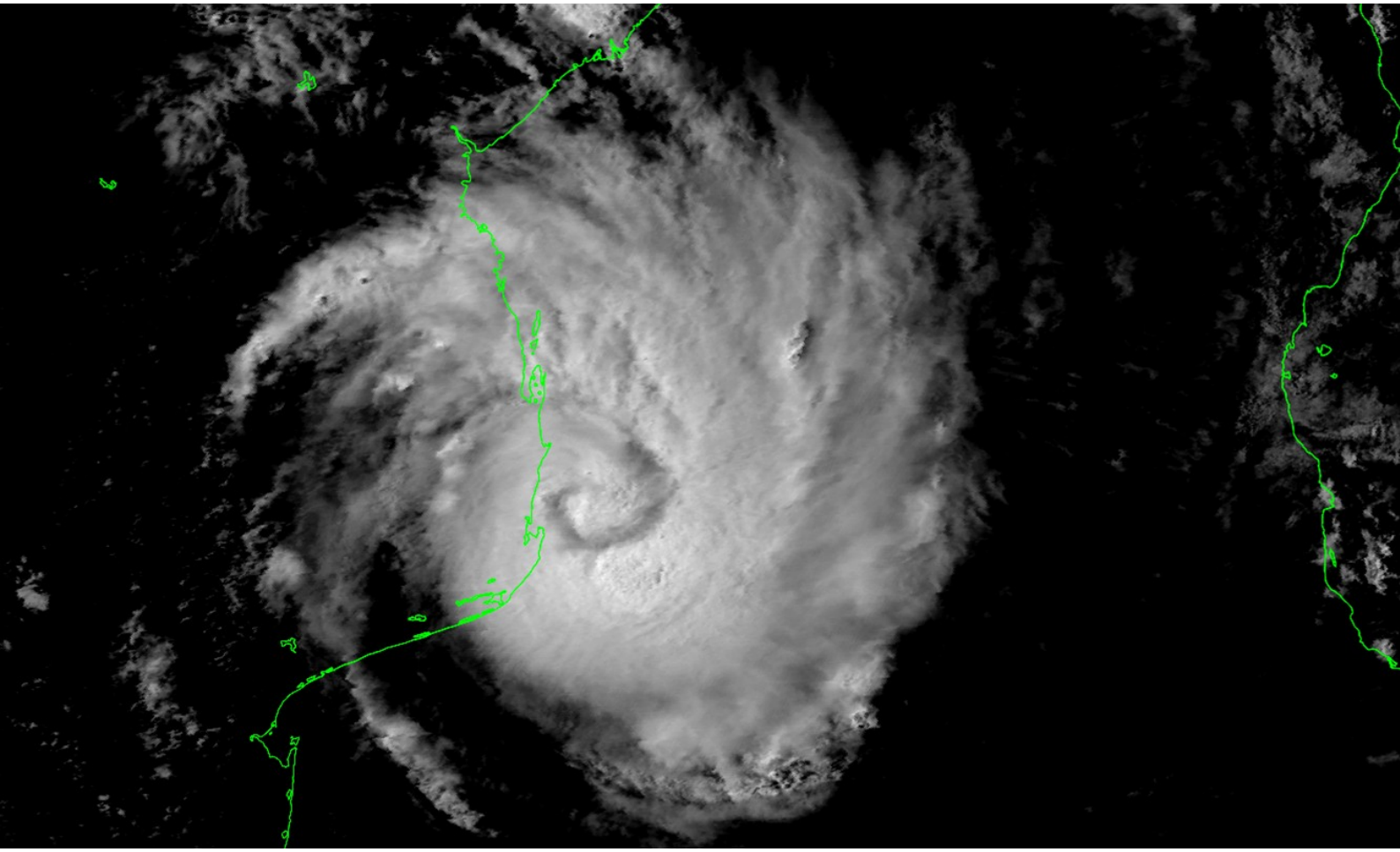
2017

Force Thirteen Cyclone Reports

Cyclone Dineo (201703)



Cyclone Dineo was the second furthest south cyclone to make landfall in Africa, and the furthest south cyclone of hurricane strength to do so. Dineo caused significant damage in Mozambique.

Compiled by Nathan Foy at Force Thirteen, February 20, 2017
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Cover photo: INSAT-3D image of Cyclone Dineo shortly before landfall on February 15th.

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1.1. Synoptic History

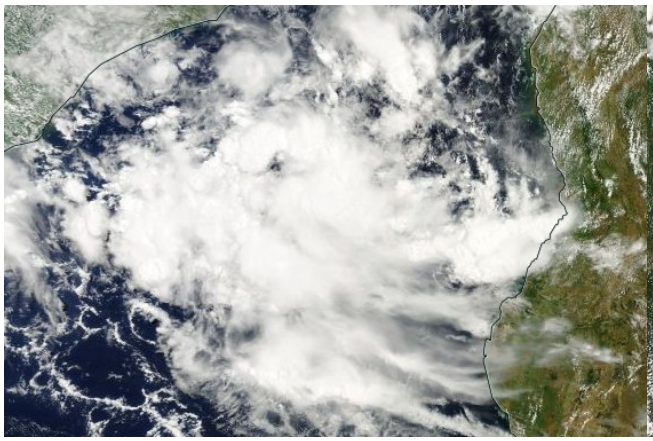
On February 10th, an area of thunderstorms developed in the Mozambique channel, and acquired rotation the next day. This rotation became particularly apparent by February 12th, and the system was classified as a tropical depression. The depression expanded and intensified into Tropical Storm Dineo on the 13th, whilst moving slowly towards the south-southwest. This movement continued with slight longitudinal fluctuations into February 14th, when the spiral banding became particularly apparent and the beginnings of an eye were noted.

On the night of February 14th into the morning of the 15th, Dineo ramped up its convective activity and continued development of its eye, which became complete and subsequently Dineo was upgraded to a Category 1 hurricane. Dineo, by this point, had drawn within 50 miles of the coast of Mozambique.

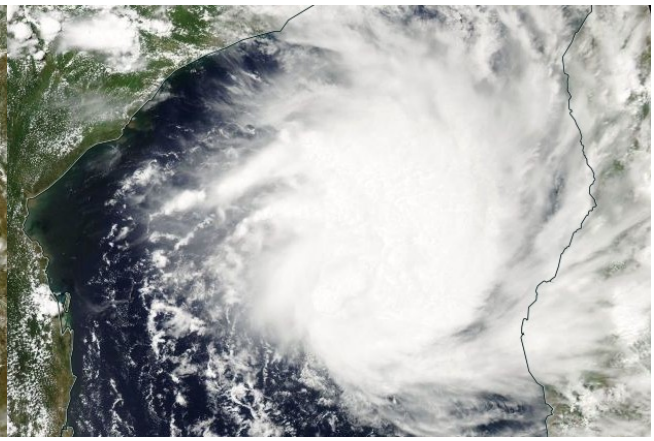
The storm stalled slightly as it gradually made landfall on Mozambique amidst another convective burst, and then sped up as it moved inland, quickly losing a large part of its convection only to flare up again later on February 16th, whilst 100 miles inland.

Whilst initially appearing to move towards South Africa, Dineo ultimately never encroached upon its territory at all, instead opting to track on the northern side of the border with Zimbabwe, where another burst on February 17th briefly brought cloud tops of −80 Celsius back to the storm.

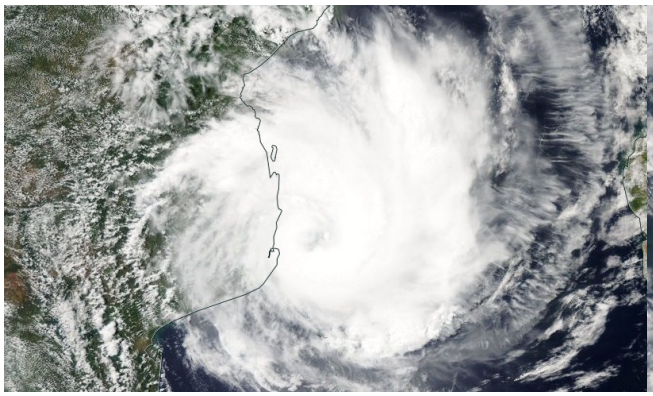
Dineo weakened to a tropical depression at 12:00 UTC on February 17th, whilst located over Zimbabwe. Its rotation gradually slowed as Dineo entered Botswana, still delivering copious amounts of rainfall to the area. By February 18th, Dineo lost its circulation and degenerated into a remnant low over Namibia, and remained traceable until February 20th when what little was left of the storm emerged over the subtropical waters of the South Atlantic. The system had tracked over land for approximately 1,500 miles by this point in time.



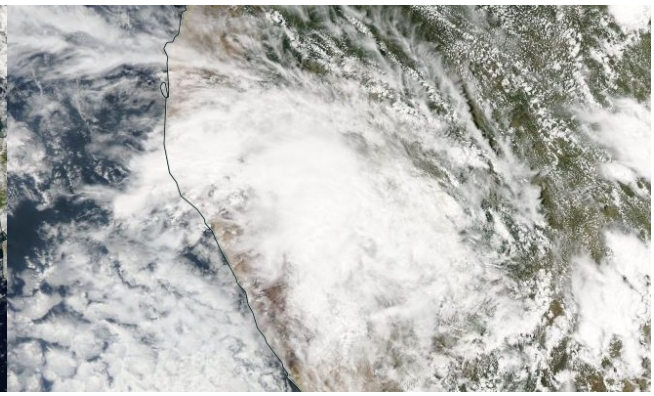
February 11th



February 13th



February 15th



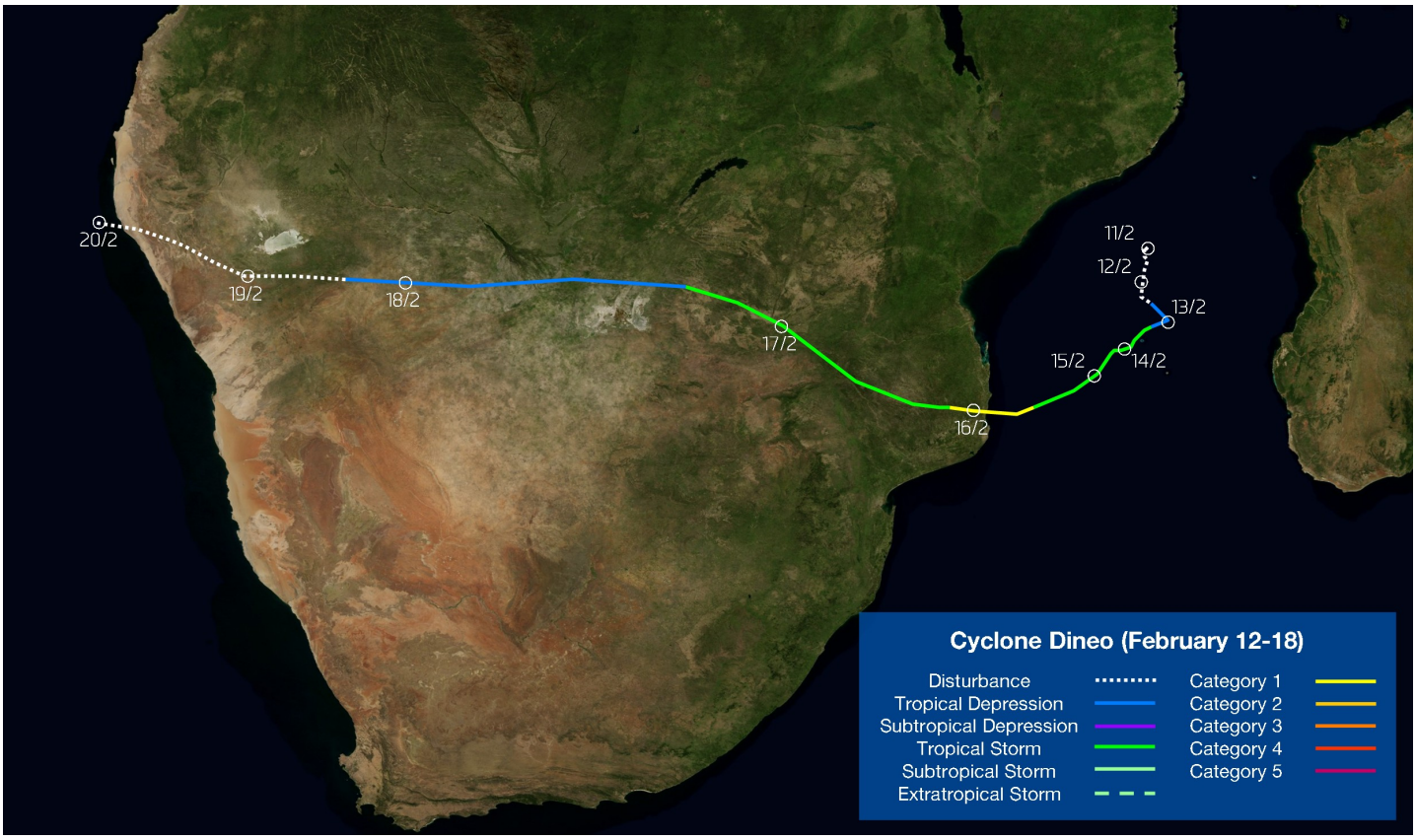
February 19th

1.2. Best Track

Below is the best track analysis from Force Thirteen, using Force Thirteen's SATOPS—a tool which uses infrared satellite imagery and cloud temperatures to estimate a storm's wind speed and air pressure. SATOPS does not take precedence over surface observations.

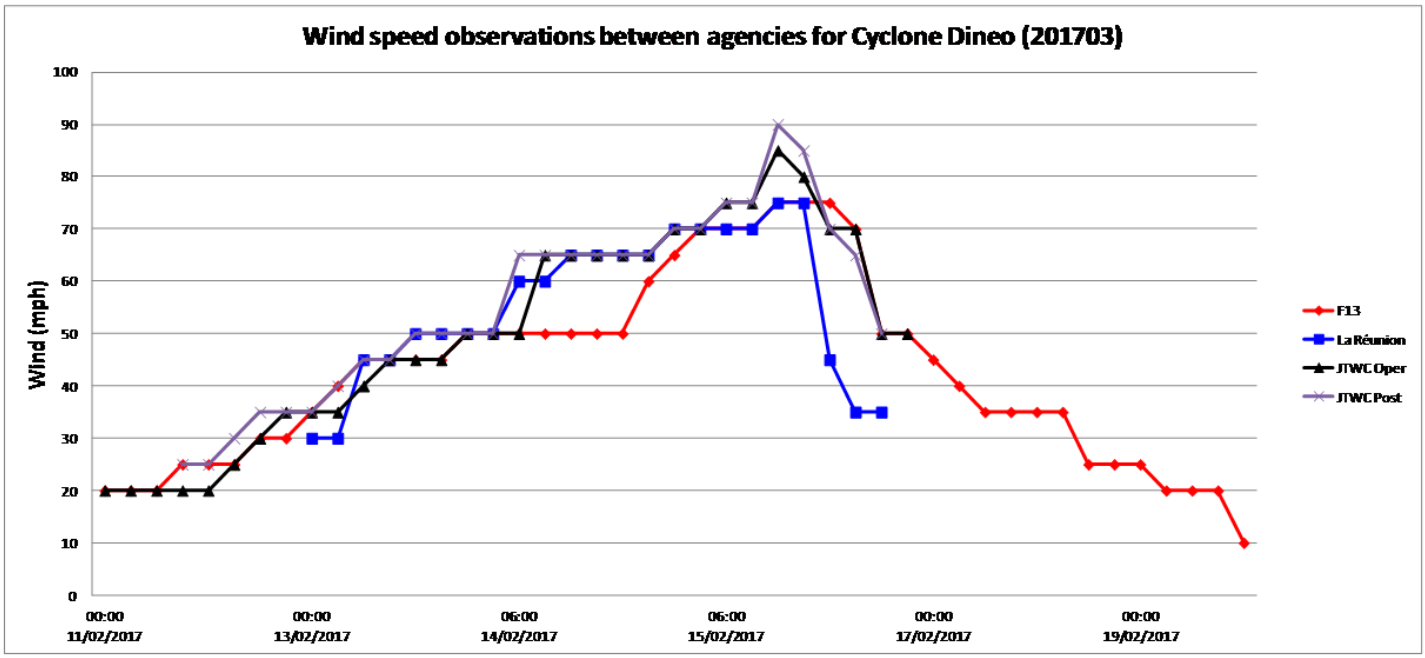
Date (dd/mm/yyyy)	Time	Latitude	Longitude	Wind (mph)	Pressure (mb)	Stage
11/02/2017	00:00	-18.5	40.6	20	1010	Disturbance
11/02/2017	06:00	-19.2	39.8	20	1008	Disturbance
11/02/2017	12:00	-19	39.6	20	1008	Disturbance
11/02/2017	18:00	-19.6	39.6	25	1006	Disturbance
12/02/2017	00:00	-19.7	39.7	25	1005	Disturbance
12/02/2017	06:00	-20.1	39.6	25	1004	Disturbance
12/02/2017	12:00	-20.9	39.5	30	1003	Disturbance
12/02/2017	18:00	-21	40.1	30	1003	Tropical Depression
13/02/2017	00:00	-21.3	40.5	35	999	Tropical Depression
13/02/2017	06:00	-21.4	40	40	998	Tropical Storm
13/02/2017	12:00	-21.7	39.7	45	997	Tropical Storm
13/02/2017	15:00	-21.8	39.6	45	996	Tropical Storm
13/02/2017	18:00	-21.8	39.6	45	996	Tropical Storm
13/02/2017	21:00	-22	39.5	45	996	Tropical Storm
14/02/2017	00:00	-22.3	39.5	50	995	Tropical Storm
14/02/2017	03:00	-22.2	38.8	50	994	Tropical Storm
14/02/2017	06:00	-22.2	38.7	50	993	Tropical Storm
14/02/2017	09:00	-22.2	38.6	50	991	Tropical Storm
14/02/2017	12:00	-22.3	38.4	50	991	Tropical Storm
14/02/2017	15:00	-22.4	38.5	50	992	Tropical Storm
14/02/2017	18:00	-22.5	38.6	50	992	Tropical Storm
14/02/2017	21:00	-22.6	38.3	60	989	Tropical Storm
15/02/2017	00:00	-22.8	37.9	65	985	Tropical Storm
15/02/2017	03:00	-22.9	37.6	70	982	Tropical Storm
15/02/2017	06:00	-23	37.2	70	980	Tropical Storm
15/02/2017	09:00	-23.3	36.9	70	979	Tropical Storm
15/02/2017	12:00	-23.5	36.6	75	977	Category 1
15/02/2017	18:00	-23.6	36	75	978	Category 1
16/02/2017	00:00	-23.5	34.6	75	978	Category 1
16/02/2017	06:00	-23.5	34.2	70	981	Tropical Storm
16/02/2017	12:00	-23.4	33.3	50	989	Tropical Storm
16/02/2017	18:00	-22.9	31.8	50	990	Tropical Storm
17/02/2017	00:00	-21.8	30.2	45	993	Tropical Storm
17/02/2017	06:00	-20.2	29	40	997	Tropical Storm
17/02/2017	12:00	-19.9	26.5	35	999	Tropical Depression
17/02/2017	18:00	-19.8	23.5	35	1000	Tropical Depression
18/02/2017	00:00	-20.1	20.8	35	1002	Tropical Depression
18/02/2017	06:00	-19.7	17.8	35	1005	Remnant Low
18/02/2017	12:00	-19.5	16.8	25	1009	Remnant Low
18/02/2017	18:00	-19.6	15.8	25	1009	Remnant Low
19/02/2017	00:00	-19.1	15.1	25	1010	Remnant Low
19/02/2017	06:00	-18.6	14.8	20	1012	Remnant Low
19/02/2017	12:00	-18.2	14.4	20	1013	Remnant Low
19/02/2017	18:00	-17.8	13.2	20	1014	Remnant Low
20/02/2017	00:00	-18	12.8	10	1016	Remnant Low

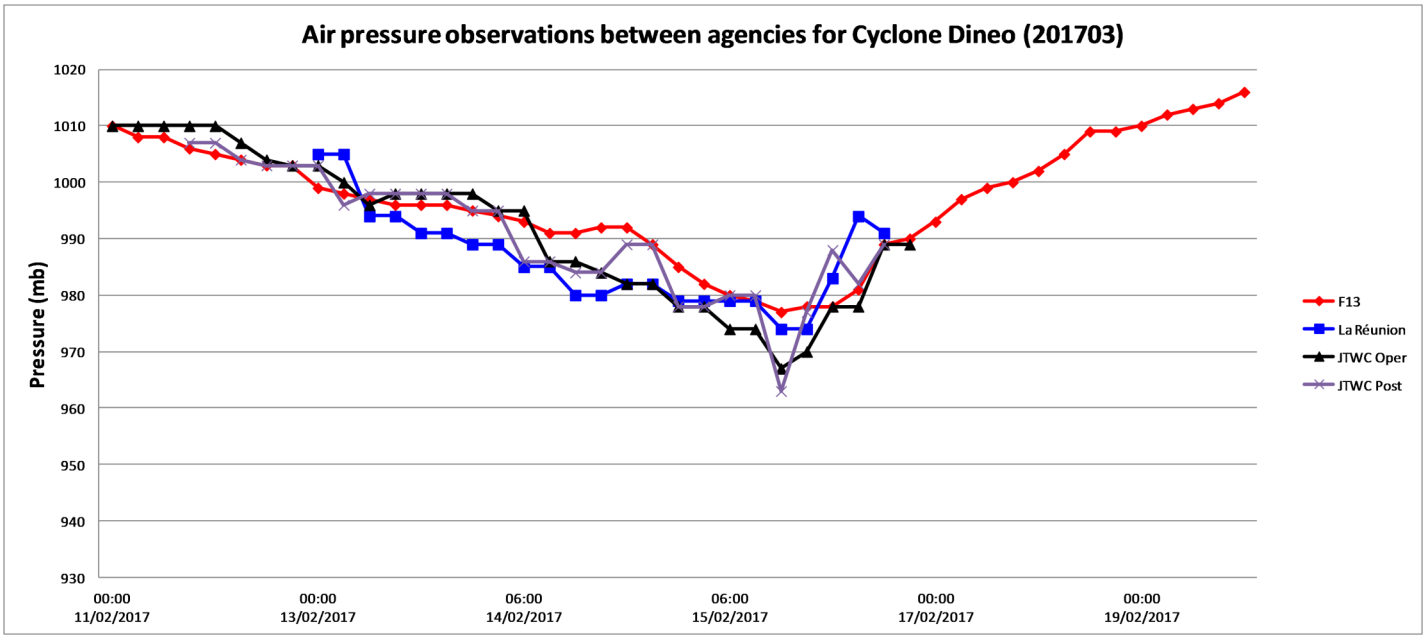
1.3. Track Chart



1.4. Comparison with other agencies

Dineo was monitored by the Regional Specialized Meteorological Centre in La Réunion, and by the U.S. Joint Typhoon Warning Center. Below compares how the three organisations compared with each other in terms of observed strength and intensity of Cyclone Dineo.





2. Effects on Land

Cyclone Dineo made landfall in southern Mozambique, and came within 6 miles of becoming the most southerly tropical cyclone landfall in Africa, losing out to Cyclone Domoina of 1984. However, Dineo is the most southerly hurricane strength cyclone to make landfall on the continent.

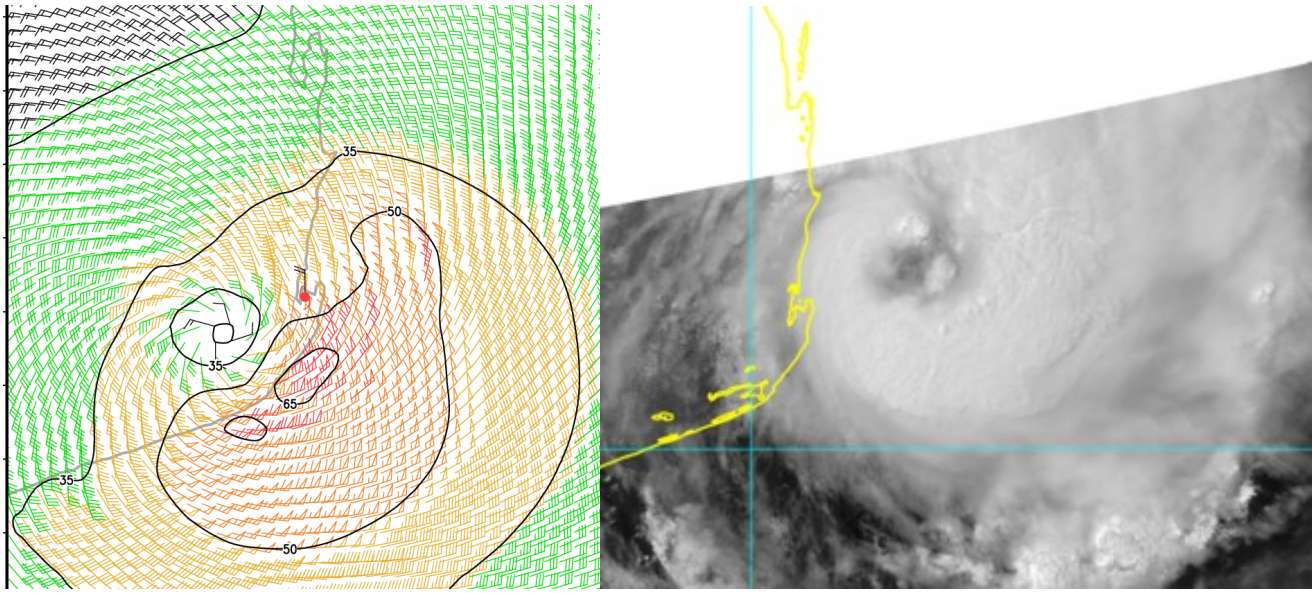
It is unknown whether warnings were formally raised in Mozambique, but it is assumed that they followed their procedure of issuing a Blue Alert 24 hours before Dineo's landfall, a Yellow Alert 12 hours prior to landfall, and finally a Red Alert 6 hours before landfall. In South Africa, Flood Warnings were in effect for eastern parts of Mpumalanga and Limpopo provinces, but ultimately the storm had changed course and weakened sufficiently to avert serious issues latterly.

An estimated 200mm of rainfall fell in rural parts of Manica and Safala provinces of Mozambique, with over 100mm falling in Inhambane and Gaza provinces. Seven were killed in the country. Over 20,000 buildings were damaged, mostly in the form of de-roofing. Around 8,000 buildings were destroyed, at worst.
Water supplies to several cities in Mozambique were cut for some days, but had returned by February 20th.

No reports from any other countries have surfaced at the time of publication.

Satellite derived storm-total rainfall by city:

Mozambique	
Muchungue	75mm
Vilankulo	60mm
Maxixe	45mm
Inhambane	40mm
Maputo	5mm
Zimbabwe	
Mutandahwe	90mm
Masvingo	80mm
Bulawayo	35mm
Botswana	
Maun	140mm
Pandamatenga	35mm
Francistown	25mm
Namibia	
Tsumkwe	120mm
Tsumeb	50mm



Satellite estimated winds and visible satellite image of Cyclone Dineo shortly before landfall in Mozambique.

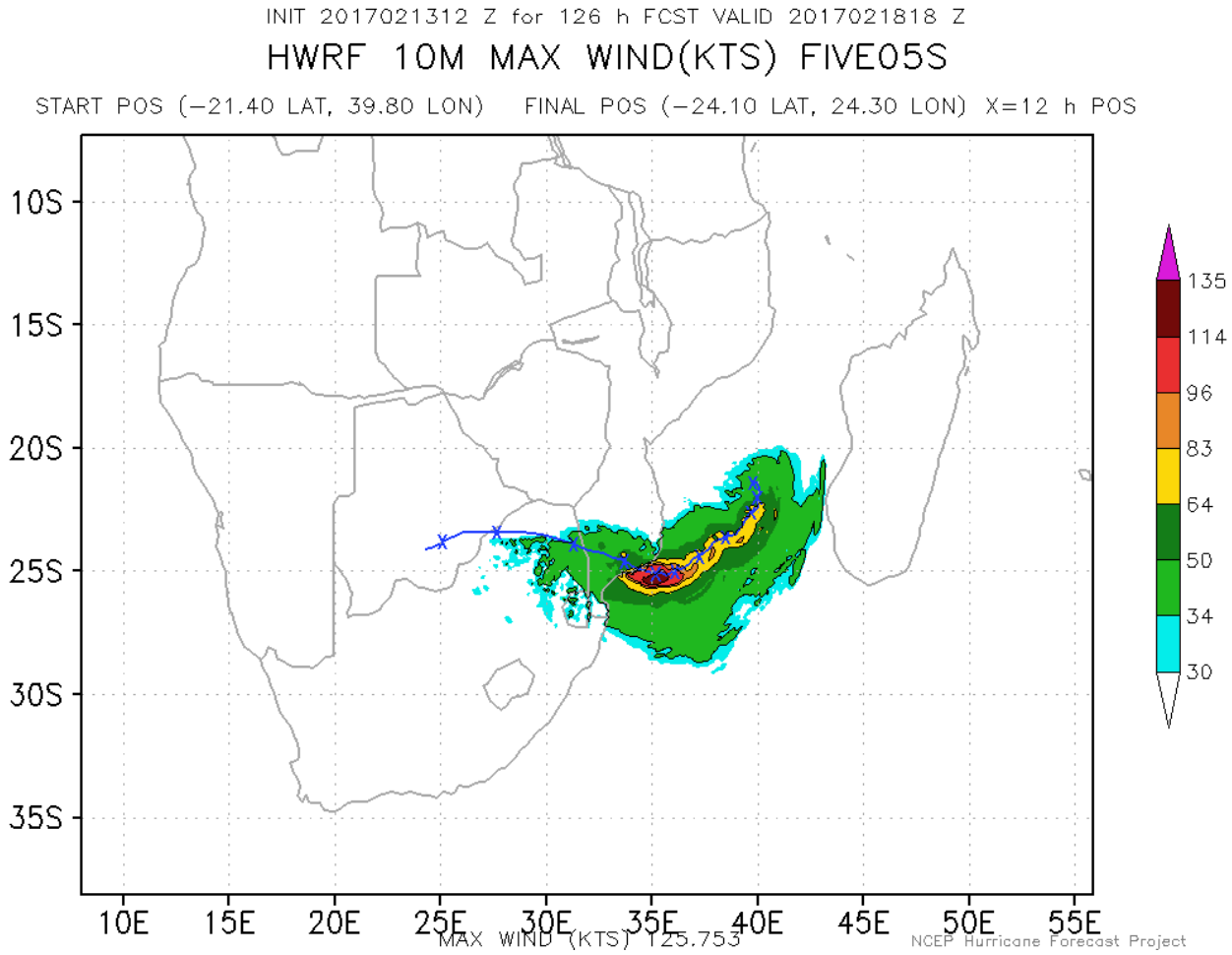
3. Forecasting Critique

Force Thirteen's initial forecast from February 14th, using a blend of RSMC Réunion's prediction and model runs, almost perfectly predicted the track, intensity and timing of Dineo until landfall.

However, forecasts from all organisations underestimated how long Dineo would survive as a tropical cyclone after landfall, and indeed both the Joint Typhoon Warning Center and Meteo France discontinued advisories within 12 hours of Dineo's landfall—almost two days prior to their imposed obligations, self-imposed or otherwise.

Like during Carlos, the top performing model of 2016, the HWRF, remained an outlier whilst forecasting Dineo, and was proved incorrect in predicting a landfall 100 miles further south and at Category 3 intensity.

The other major models, including the GFS, GFDL, and NAVGEM, did a fairly good job of forecasting the storm, though weakened Dineo too quickly after landfall with the exception of the GFDL on one or two model runs.



The HWRF model predicting a Category 4 cyclone 100 miles south of the actual landfall location. This particular run was initiated at 12:00 UTC on February 13th.

4. Cyclone Destruction Potential Scale

The Cyclone Destruction Potential Scale (CDPS) is a new way of measuring cyclone impacts in a more meaningful way. For the past 45 years, storms worldwide have been measured using the Saffir-Simpson Hurricane Wind Scale, split into five categories. However, this scale measures wind alone, and does not correlate well with actual impacts on land, measured by monetary damage.
The CDPS measures other factors, such as storm size and forward speed as well as intensity to create a ten tiered scale that encompasses tropical storms as well as hurricanes.

Stage 1—Small or weak storms that are unlikely to cause a significant impact.
Stage 2—Generally disorganised storms that can cause significant damage.
Stage 3—Further organised systems that are likely to cause significant damage.
Stage 4—Somewhat powerful storms that are likely to cause extensive damage.
Stage 5—Powerful storms that are likely to cause devastating damages.
Stage 6—Very powerful storms that are likely to cause catastrophic damage.
Stage 7—Extremely powerful storms that are likely to cause catastrophic damage.
Stage 8—Super storms that are likely to cause incredible damage.
Stage 9—Super storms that may cause total damage.
Stage 10—Super storms that are likely to cause total damage.

Cyclone Dineo was the second storm to be observed by Force Thirteen using the CDPS—a method which was adopted in January 2017.

Dineo remained a Stage 2 cyclone until reaching hurricane status, when it reached Stage 3 until shortly after landfall.

The Cyclone Destruction Potential Scale was created by Devon Williams in 2016. More information can be found at: https://drive.google.com/file/d/0B7pEWk6yHKggSE1STHg2UFJmbHM/view

4. Force Thirteen's Coverage on Dineo

Force Thirteen issued six video updates on Cyclone Dineo. The storm updates were unexpectedly popular due to elevated public interest in South Africa.

Viewer approval rating during the storm was 91%.
Interest during the storm was unparalleled for the basin, with Force Thirteen updates shared on 41 websites in South Africa, almost all of them pertaining to news and current events. We thank these organisations for assisting us in the dissemination of the latest information on the storm.

During the storm, we served 97,000 viewers in South Africa, 3,600 in Botswana, 3,100 in Zimbabwe, 1,600 in Namibia, 1,600 in Mozambique, 1,200 in Swaziland, and 300 in Lesotho.

Video coverage on Dineo ceased after the sixth update on February 16th.

Comments, suggestions and inquiries should be directed to force-13@hotmail.co.uk, or any of Force Thirteen's online platforms.