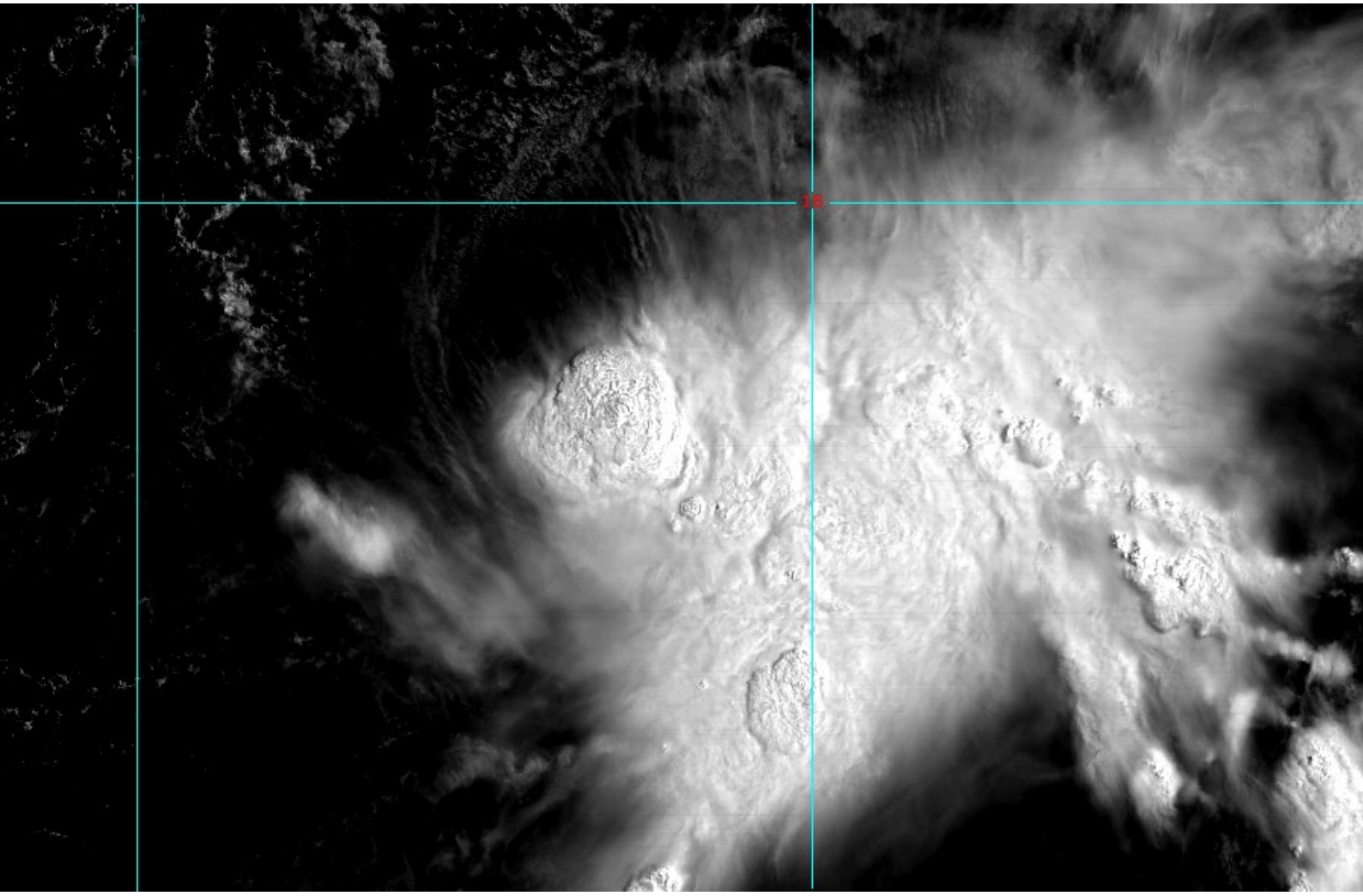
2017

Force Thirteen Cyclone Reports

Tropical Storm Muifa (201717)



Tropical Storm Muifa was a typical early-season storm in the Western Pacific, which struggled to gain composure for two days in April 2017.

Technical Report

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Cover photo: Himawari-8 image of Muifa near peak intensity shortly after 00:00 UTC on April 27.

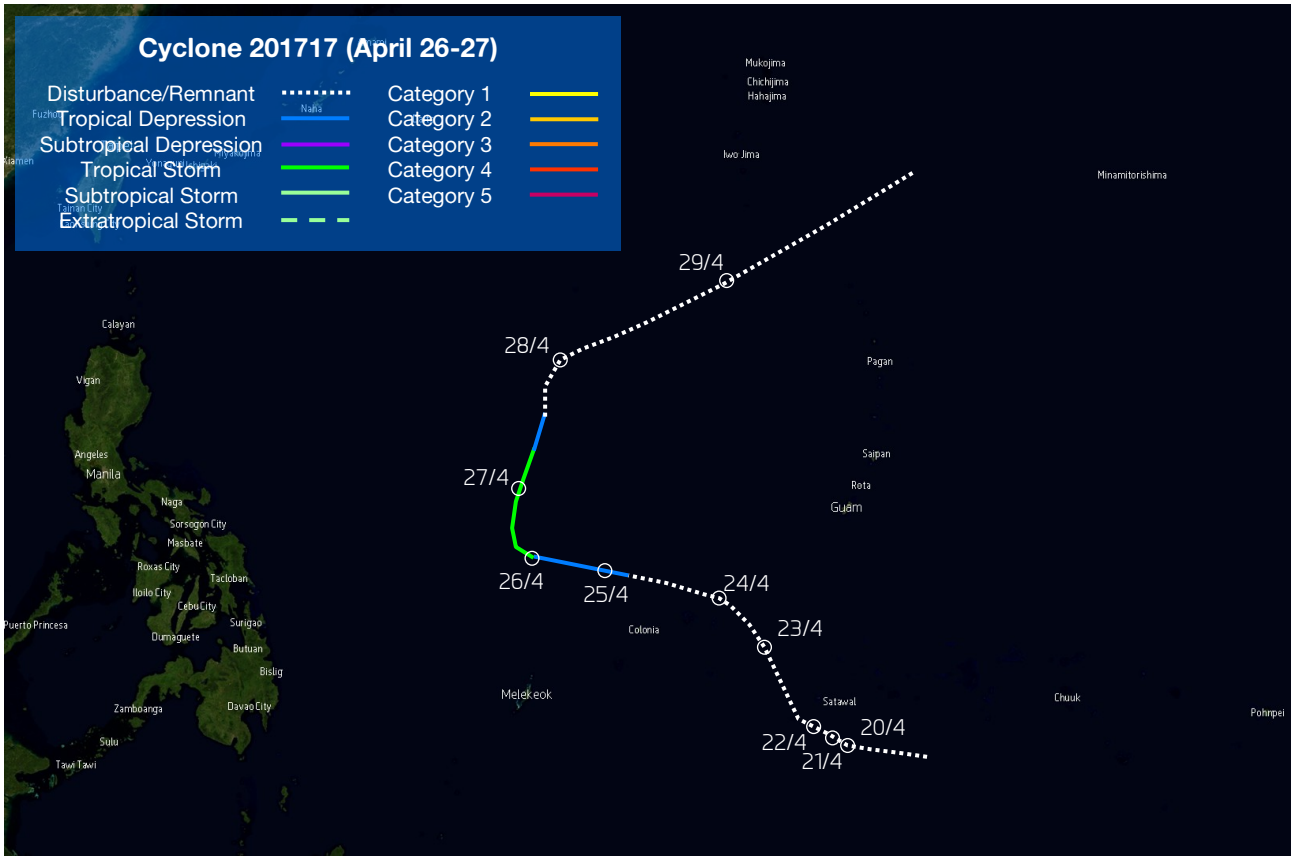
FORCE THIRTEEN

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.

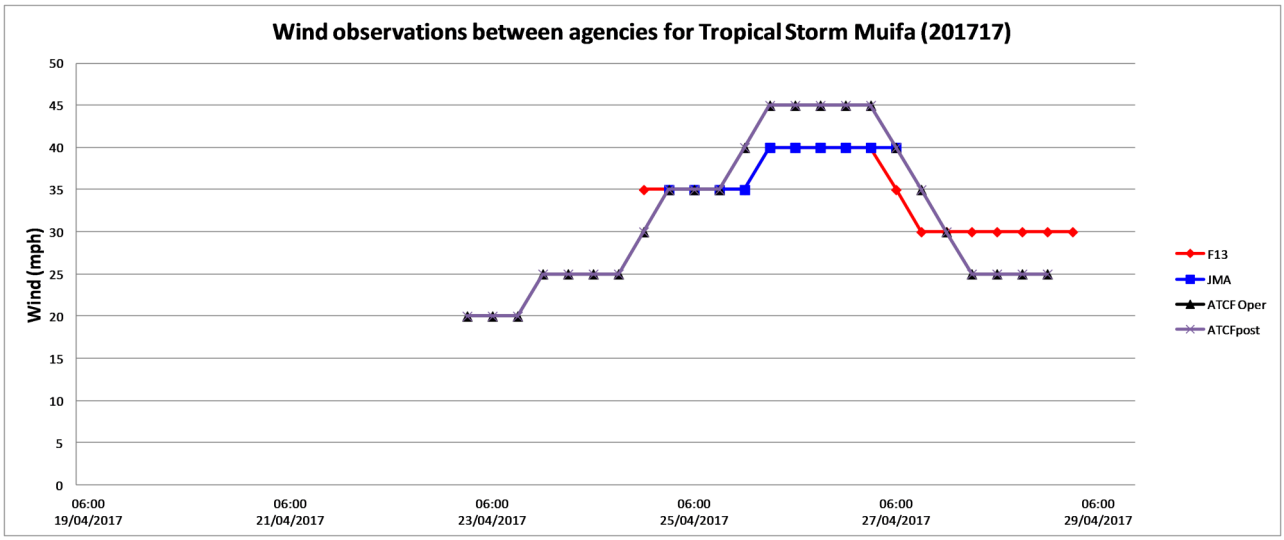
Date (dd/mm/yyyy)	Time	Latitude	Longitude	Wind	Press	Stage
19/04/2017	06:00	5.9	147.4			Tropical Disturbance
19/04/2017	12:00	6	146.4			Tropical Disturbance
19/04/2017	18:00	6.3	145.5			Tropical Disturbance
20/04/2017	00:00	6.3	145.5			Tropical Disturbance
20/04/2017	06:00	6.3	145.5			Tropical Disturbance
20/04/2017	12:00	6.3	145.5			Tropical Disturbance
20/04/2017	18:00	6.3	145.5			Tropical Disturbance
21/04/2017	00:00	6.3	145.5			Tropical Disturbance
21/04/2017	06:00	6.3	145.5			Tropical Disturbance
21/04/2017	12:00	6.3	145.5			Tropical Disturbance
21/04/2017	18:00	6.3	145.5			Tropical Disturbance
22/04/2017	00:00	6.3	145.5			Tropical Disturbance
22/04/2017	06:00	6.6	144.9			Tropical Disturbance
22/04/2017	12:00	7.5	144.6			Tropical Disturbance
22/04/2017	18:00	8	143.5			Tropical Disturbance
23/04/2017	00:00	10.3	141.9			Tropical Disturbance
23/04/2017	06:00	10.6	141.2			Tropical Disturbance
23/04/2017	12:00	11	140.4			Tropical Disturbance
23/04/2017	18:00	11.4	139.8			Tropical Disturbance
24/04/2017	00:00	11.7	139.2			Tropical Disturbance
24/04/2017	06:00	12.1	138.4			Tropical Disturbance
24/04/2017	12:00	12.4	137.4			Tropical Disturbance
24/04/2017	18:00	12.6	136.7	35	1006	Tropical Depression
25/04/2017	00:00	12.7	136.4	35	1004	Tropical Depression
25/04/2017	06:00	12.8	136	35	1004	Tropical Depression
25/04/2017	12:00	12.9	135.6	35	1003	Tropical Depression
25/04/2017	18:00	13	135.1	35	1003	Tropical Depression
26/04/2017	00:00	13.1	134.8	40	1001	Tropical Storm
26/04/2017	06:00	13.5	134.3	40	1002	Tropical Storm
26/04/2017	12:00	14	134.2	40	1004	Tropical Storm
26/04/2017	18:00	14.6	134.3	40	1003	Tropical Storm
27/04/2017	00:00	15.1	134.5	40	1004	Tropical Storm
27/04/2017	06:00	15.9	134.7	35	1005	Tropical Depression
27/04/2017	12:00	17	134.8	30	1006	Remnant Low
27/04/2017	18:00	17.9	134.7	30	1006	Remnant Low
28/04/2017	00:00	18.5	135.3	30	1007	Remnant Low
28/04/2017	06:00	19	136.3	30	1007	Remnant Low
28/04/2017	12:00	19.4	137.3	30	1008	Remnant Low
28/04/2017	18:00	20.5	138.9	30	1008	Extratropical
29/04/2017	00:00	21	140.5	30	1007	Extratropical
29/04/2017	06:00	22	143	30	1008	Extratropical
29/04/2017	12:00	24.5	144.5	35	1006	Extratropical

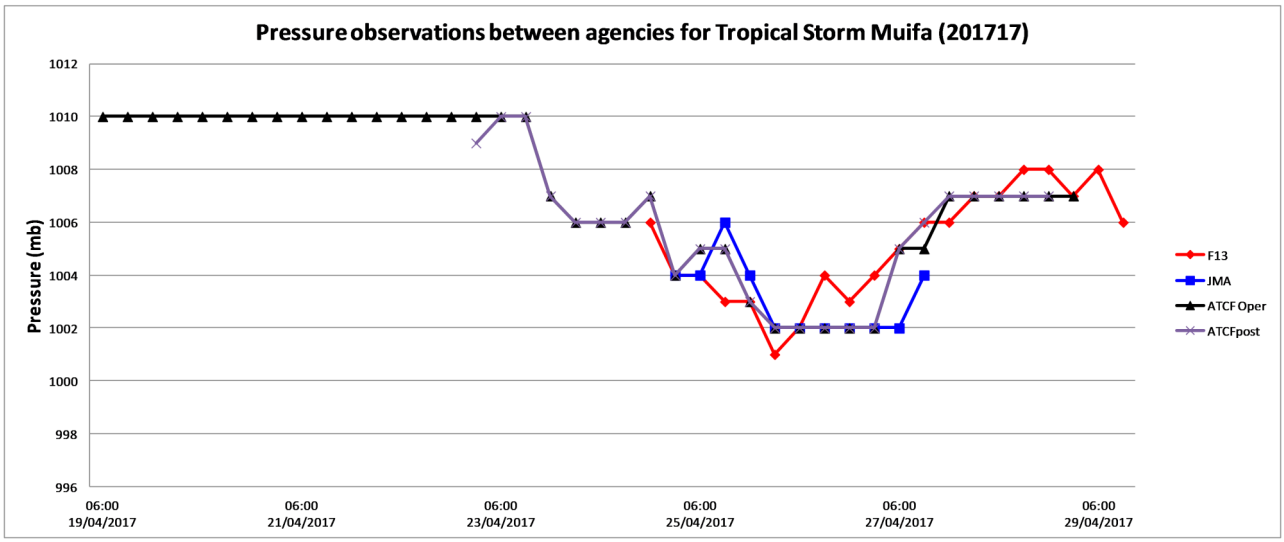
Track Chart


Cyclone 201717 (April 26-27)
Disturbance/Remnant
Tropical Depression
Subtropical Depression
Tropical Storm
Subtropical Storm
Extratropical Storm
Category 1
Category 2
Category 3
Category 4
Category 5
Mukojima
Chichijima
Hahajima
Iwo Jima
Minamitorishima
29/4
28/4
27/4
26/4
25/4
24/4
23/4
22/4
21/4
20/4
Calayan
Vigan
Angeles
Manila
Naga
Sorsogon City
Masbate
Roxas City
Tacloban
Iloilo City
Cebu City
Puerto Princesa
Surigao
Dumaguete
Butuan
Bislig
Zamboanga
Davao City
Sulu
Tawi Tawi
Pagan
Saipan
Rota
Guam
Colonia
Melekeok
Satawal
Chuuk
Pohnpei

Comparison with other agencies

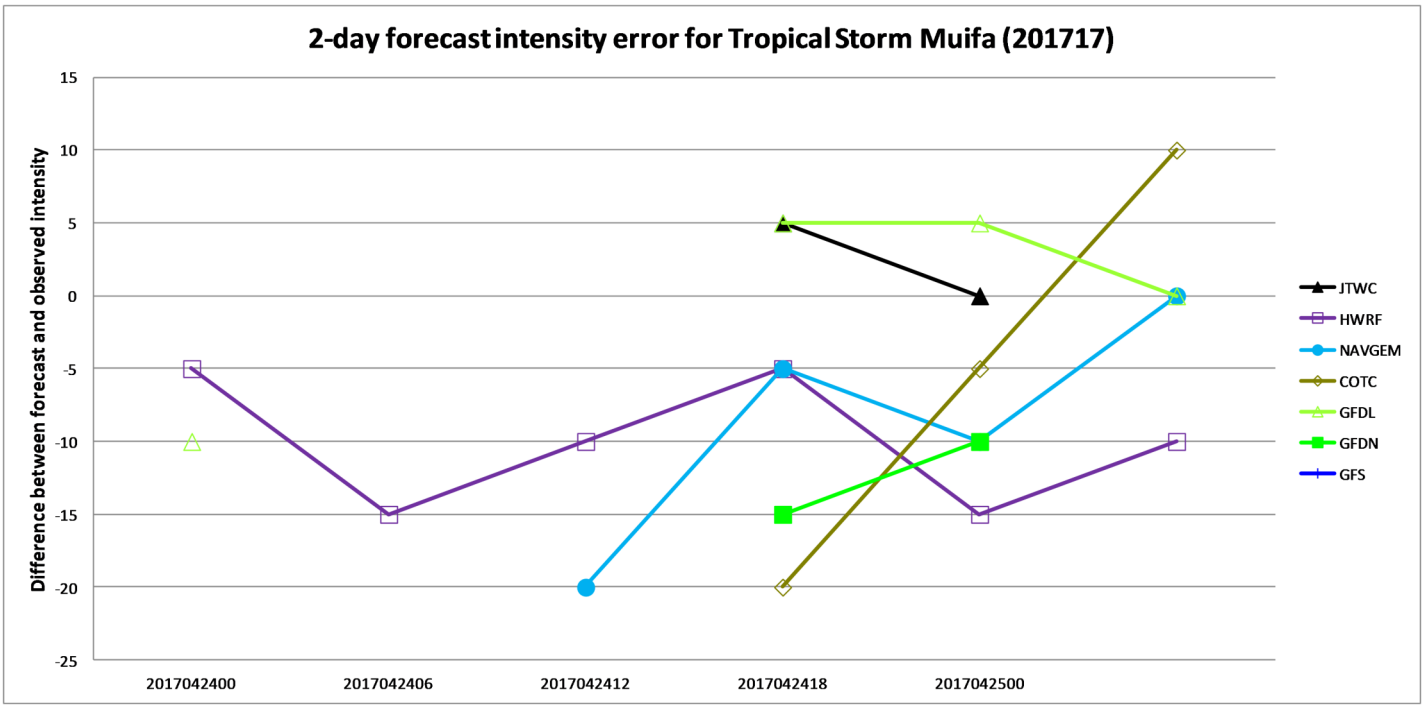
Muifa was monitored by the Regional Specialized Meteorological Centre, in this instance the Japanese Meteorological Agency. Also included are the Navy's automated observations (ATCF).
The charts below show comparisons between Force Thirteen's best track and the other agencies' observations.





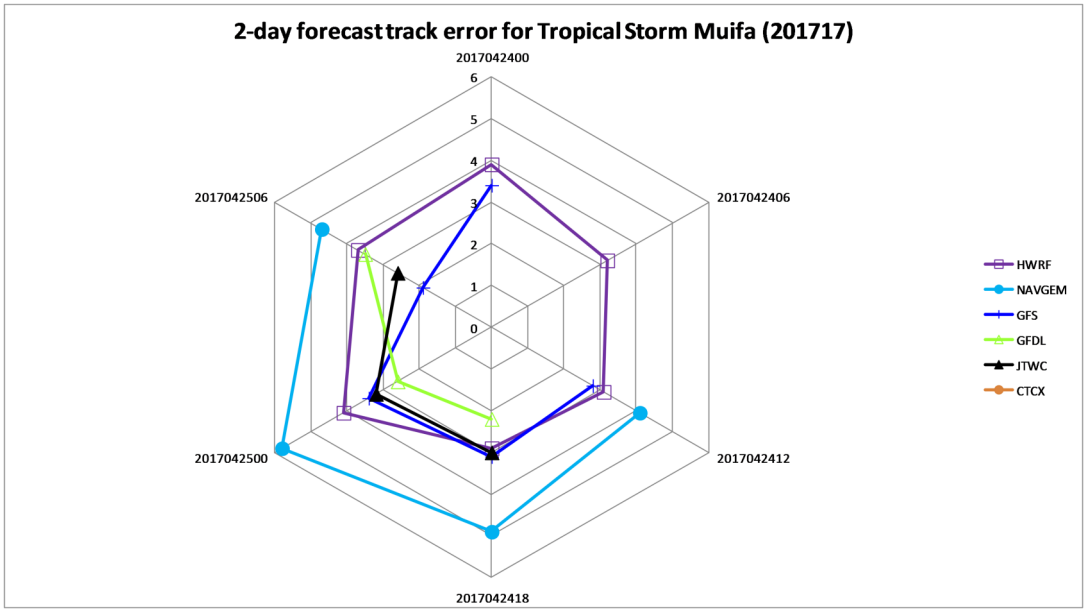
Forecasting Critique

The next pages show the track and intensity forecast error from the computer models and the JTWC during Tropical Storm Muifa. Since the storm dissipated within five days of the first model runs, five day error data is not available.
The intensity error chart shows how many miles per hour the model predictions were from the observed intensity two and five days later. A value of 0 denotes a perfectly accurate prediction. Negative values correspond to predictions lower than the observation, and positive values show predictions higher than the observation.



Forecasting Critique

The track error graphics show how far away from a perfectly accurate positional prediction the computer models and the JTWC predicted two and five days before the fact. Values are expressed in angular degrees, and a value closer to 0 (the center of the graphic) indicates a more accurate prediction.



Forecasting Critique

Data from the charts are published below.

2-day forecast intensity error								
Run	JTWC	JMA	HWRF	GFS	NAVGEM	GFDN	COTC	GFDL
2017042400			5					10
2017042406			15					
2017042412			10		20			
2017042418	5		5		5	15	20	5
2017042500	0		15		10	10	5	5
2017042506	5		10		0	0	10	0

Model	**Average**	**Predictions**
JTWC	3.3	3
JMA	0	0
HWRF	10	6
GFS	0	0
NAVGEM	8.8	4
GFDN	8.3	3
COTC	11.7	3
GFDL	5	4

Therefore, the best model for intensity was the GFDL

Forecasting Critique

Data from the charts are published below.

2-day forecast track error								
Run	JTWC	JMA	HWRF	GFS	NAVGEM	GFDN	COTC	GFDL
2017042400			3.9	3.4				
2017042406			3.2					
2017042412			3.1	2.8	4.1			
2017042418	3		2.9	3.1	4.9			2.2
2017042500	3.2		4.1	3.4	5.8			2.6
2017042506	2.6		3.7	1.9	4.7			3.5

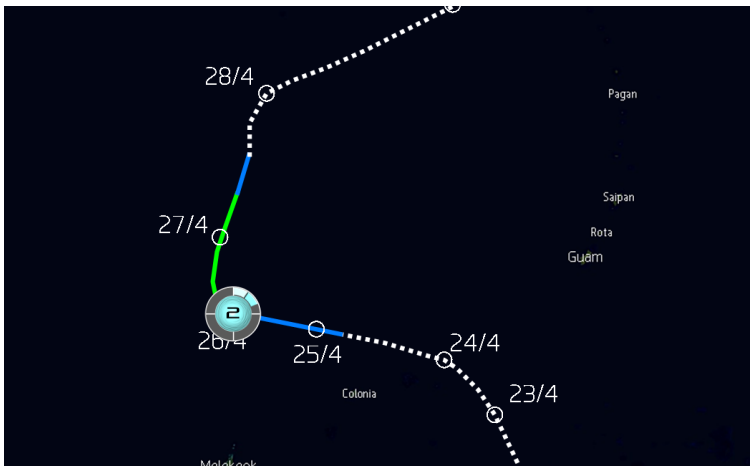
Model	**Average**	**Predictions**
JTWC	2.9	3
JMA	0	0
HWRF	3.5	6
GFS	2.9	5
NAVGEM	4.9	4
GFDN	0	0
COTC	0	0
GFDL	2.8	3

Therefore, the best model for track predictions was the GFDL.

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.



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

Muifa was a weak Stage 2 cyclone at peak.

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