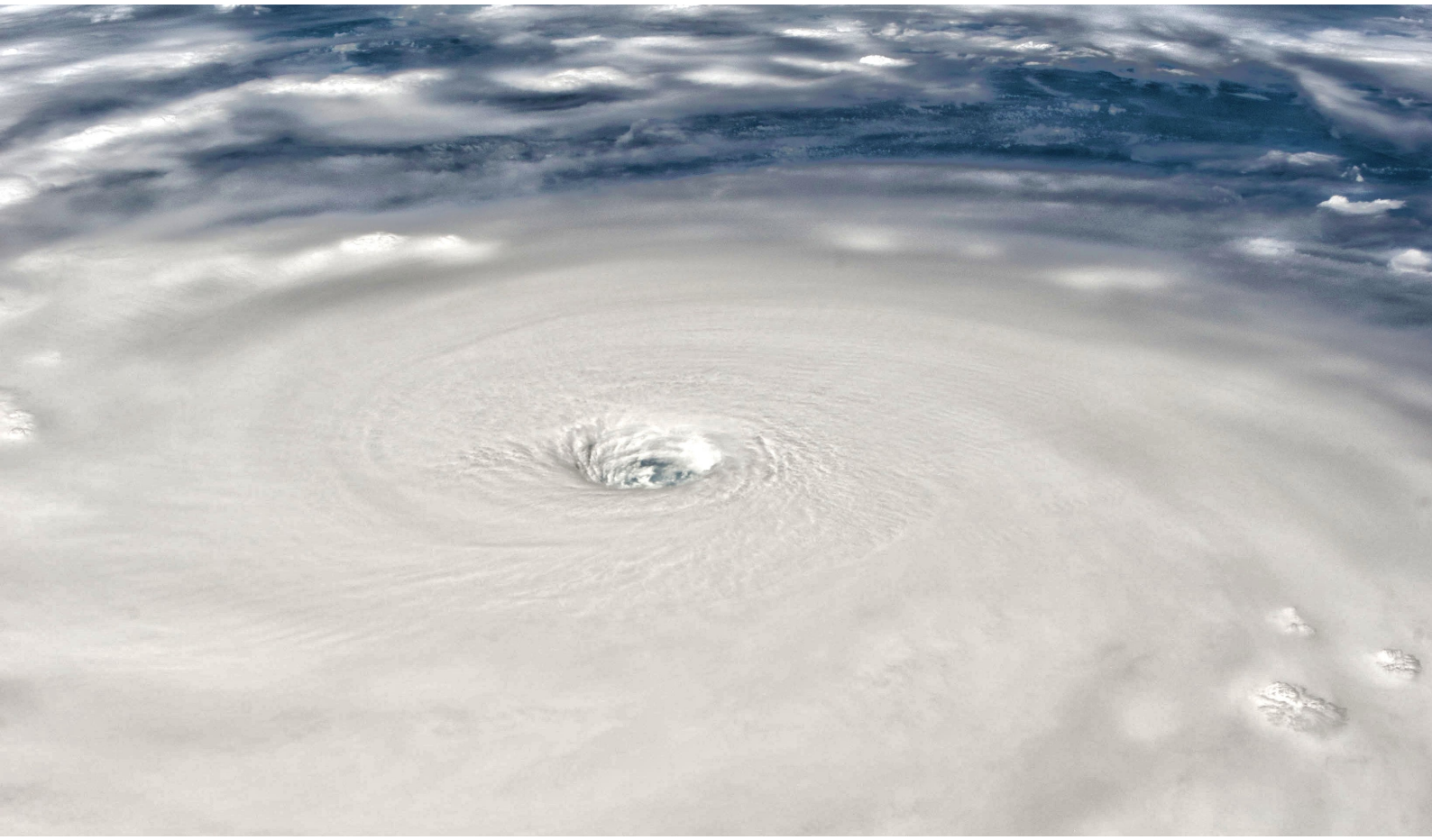
2016

Force Thirteen World Cyclone Report



A report on all cyclones that formed in 2016, with detailed season statistics and records that were achieved worldwide this year.

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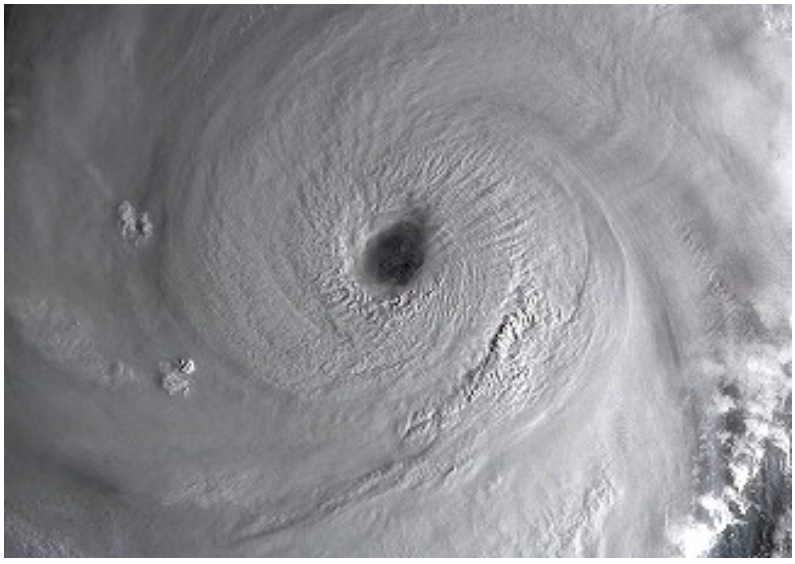
Cover photo: International Space Station photo of Super Typhoon Nepartak on July 7, 2016
Below: Himawari-8 visible image of Super Typhoon Haima on October 18, 2016



Contents

1. Background

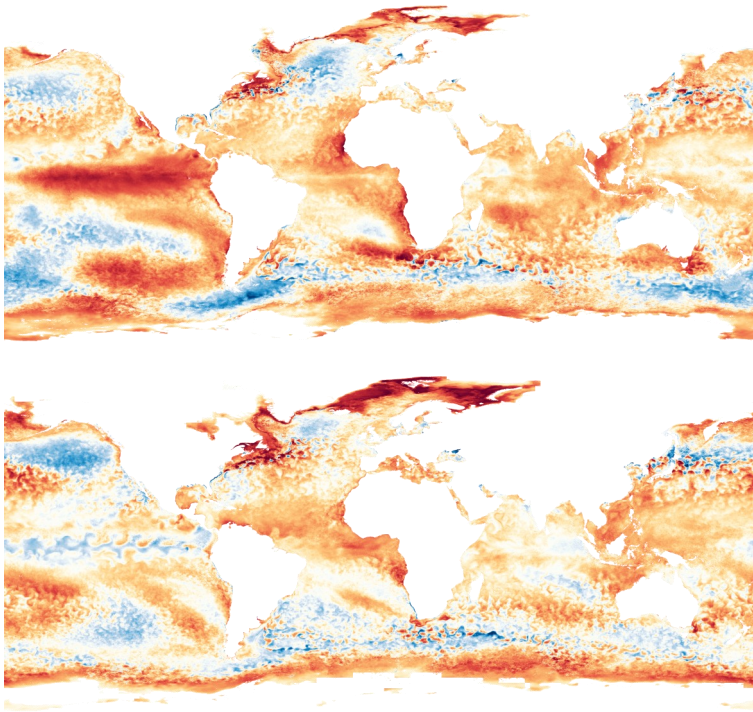
Activity in 2016 has been near average, influenced by a waning El Nino event that towards the end of the year began to display locally La Nina-type conditions in the equatorial eastern Pacific. This, however, was not reflected elsewhere, and overall tropical sea surface temperatures remained above normal. Comparatively, during 1998 and 1999, which had entered a significant La Nina event after the extreme El Nino event of 1997, saw slightly lower storm totals than 2016.

This year saw 98 tropical cyclones, of which 87 were tropical storms, 44 of hurricane strength, and 25 of major hurricane strength.
This compares to 115, 98, 55 and 39 last year.

The lingering of warmer waters contributed to two unusual formations in January—Hurricanes Alex and Pali. It could also be attributed, in part, to Category five storms Winston and Fantala in February and April.

The Western Pacific saw its first storm of the year on July 3rd, after a 199 1/2 day gap. This is six hours short of the gap seen in 1997-98, and is the fifth longest gap between storms on record, after 1916-17 (224 days), 1888-89 (235 days), and 1896-97 (244 days).
However, the storm that did form became the first of five Category 5 typhoons in the Western Pacific this year.

2016 in the Atlantic concluded with three major hurricanes in a row—Hurricanes Matthew, Nicole and Otto.



Top image: Sea Surface Temperature anomalies in January 2016, versus the lower image, showing SST anomalies in December 2016. The images depict the strong El Nino still in effect in January, and the neutral conditions experienced towards the latter half of the year in the lower image.

In mid-September, an unusual subtropical storm formed in the Bay of Biscay, and made landfall in southern France before rapidly dissipating.
There were also two weak cyclones in the Southern Atlantic this year—Deni and Eçai

Near the beginning of the year, Force Thirteen predicted a higher than usual chance of a major hurricane affecting Hispaniola, the Bahamas, and the Leeward Islands. This possibility verified in the case of all but the latter, when Hurricane Matthew traversed through the area in early October. Early indications also showed a high chance of tropical activity in Bermuda, which was received late in the year by Hurricane Nicole. The prediction also showed a high chance of tropical activity reaching Atlantic Canada, though this did not verify.

Early in the year, predictions were also made for the Western Pacific, projecting above average activity around the northern Philippines, the South China Sea, the Ryukyu Islands, and Kyushu, Japan. The prediction also noted that activity east of 150 degrees East would be unlikely. Most of these predictions verified, though notably, it did not pick up on the probability of activity near Taiwan.

The latter part of the year also saw some activity, with notable Atlantic, Western Pacific and Indian Ocean activity. Hurricane Matthew formed near the end of September, and made the strongest landfall in Haiti since Hurricane Cleo of 1964. Matthew also caused flooding in the southeastern US, with water levels in some areas setting new records.
Hurricane Otto formed near the end of the official hurricane season, in November, in the far southwestern Caribbean. Whilst at first appearing to resemble Hurricane Martha of 1969, which made landfall in Panama—Otto eventually moved westwards and made landfall in southern Nicaragua, becoming the furthest south major hurricane in the basin when it reached Category 3 status near its landfall.
Finally, Typhoon Nock-ten finished off the year's activity in the Western Pacific, becoming a Category 5 storm and making landfall in the Philippines over the Christmas period.

2. The 2016 Datasheet

Since 2014, we have compiled datasheets showing all the storms of the year based on several criteria. This provides easy access to particular records about storms that occurred this year.
The columns, reading from left to right, show: The storm name, basin of formation, date of formation (year, month, day), date of dissipation (year, month, day), Peak intensity in miles per hour, lowest central pressure in millibars, Saffir-Simpson Hurricane Wind Scale Category, and secondary peak in mph and mb.

		Formed			Dissipated			Intensity				
Name	Basin	Year	M	D	Year	M	D	Peak mph	Low mb	SSHS	Sec mph	Sec mb
Meranti	WP	2016	9	9	2016	9	14	180	894	5		
Fantala	SI	2016	4	11	2016	4	24	180	898	5	120	930
Winston	SP	2016	2	10	2016	2	24	180	905	5	120	955
Nepartak	WP	2016	7	3	2016	7	9	175	900	5		
Haima	WP	2016	10	15	2016	10	21	175	905	5		
Chaba	WP	2016	9	24	2016	10	5	165	906	5		
Nock-ten	WP	2016	12	21	2016	12	28	165	910	5		
Matthew	AL	2016	9	28	2016	10	9	160	943	5	150	933
Seymour	EP	2016	10	23	2016	10	28	155	939	4		
Lionrock	WP	2016	8	17	2016	8	30	152	925	4	130	940
Uriah	SI	2016	2	13	2016	2	20	145	925	4		
Malakas	WP	2016	9	11	2016	9	20	145	930	4	120	945
Emeraude	SI	2016	3	15	2016	3	22	145	940	4	85	965
Blas	EP	2016	7	2	2016	7	10	145	944	4		
Lester	EP	2016	8	24	2016	9	7	145	944	4	140	947
Songda	WP	2016	10	8	2016	10	12	130	925	4		
Ula	SP	2015	12	26	2016	1	12	130	945	4	105	965
Nicole	AL	2016	10	4	2016	10	18	130	950	4	90	968
Madeline	EP	2016	8	26	2016	9	3	130	951	4	60	997
Georgette	EP	2016	7	21	2016	7	27	130	954	4		
Megi	WP	2016	9	22	2016	9	29	125	935	3		
Sarika	WP	2016	10	12	2016	10	19	125	935	3		
Gaston	AL	2016	8	22	2016	9	3	125	953	3	120	957
Namtheun	WP	2016	8	31	2016	9	5	120	950	3		
Darby	EP	2016	7	11	2016	7	26	117	961	3	65	997
Otto	AL	2016	11	21	2016	11	26	115	975	3	75	984
Orlene	EP	2016	9	11	2016	9	16	110	966	2	80	985
Victor	SP	2016	1	14	2016	1	22	105	960	2		
Amos	SP	2016	4	20	2016	4	24	105	965	2		
Celia	EP	2016	7	6	2016	7	16	105	968	2	50	1001
Meari	WP	2016	11	2	2016	11	7	100	960	2		

		Formed			Dissipated			Intensity				
Name	Basin	Year	M	D	Year	M	D	Peak mph	Low mb	SSHS	Sec mph	Sec mb
Pali	CP	2016	1	7	2016	1	14	100	977	2	65	989
Nida	WP	2016	7	29	2016	8	3	90	975	1		
Zena	SP	2016	4	5	2016	4	7	90	978	1		
Newton	EP	2016	9	4	2016	9	7	88	980	1		
Earl	AL	2016	8	2	2016	8	6	85	979	1	60	999
Paine	EP	2016	9	17	2016	9	20	85	979	1		
Alex	AL	2016	1	12	2016	1	15	85	981	1		
Hermine	AL	2016	8	28	2016	9	3	85	982	1	60	997
Vardah	NI	2016	12	7	2016	12	12	85	982	1	85	982
Frank	EP	2016	7	21	2016	7	28	83	981	1		
Corentin	SI	2016	1	21	2016	1	25	80	970	1		
Stan	SI	2016	1	28	2016	1	31	80	975	1	75	978
Aere	WP	2016	10	5	2016	10	13	80	975	1		
Mirinae	WP	2016	7	25	2016	7	28	75	980	1		
Chanthu	WP	2016	8	12	2016	8	17	75	980	1		
Karl	AL	2016	9	14	2016	9	25	75	988	1	45	1004
Ulika	CP	2016	9	26	2016	9	30	74	993	1		
Omais	WP	2016	8	2	2016	8	8	70	975	TS		
Mindulle	WP	2016	8	17	2016	8	23	70	980	TS		
Tatiana	SP	2016	2	9	2016	2	14	70	983	TS		
Abela	SI	2016	7	16	2016	7	19	70	987	TS		
Bransby	SI	2016	10	2	2016	10	6	70	988	SS		
Estelle	EP	2016	7	15	2016	7	22	70	990	TS	70	990
Tokage	WP	2016	11	23	2016	11	28	70	992	TS		
Roanu	NI	2016	5	18	2016	5	21	65	983	TS	60	985
Eçaí	SA	2016	12	4	2016	12	6	65	992	SS		
Howard	EP	2016	7	31	2016	8	3	65	997	TS		
Conson	WP	2016	8	7	2016	8	15	60	985	TS		
17S	SI	2016	3	28	2016	3	30	60	992	TS		
Ian	AL	2016	9	12	2016	9	16	60	994	TS		
Lisa	AL	2016	9	19	2016	9	24	60	997	TS	40	1008
Kyant	NI	2016	10	25	2016	10	26	60	998	TS		
Ivette	EP	2016	8	2	2016	8	8	60	999	TS		
Javier	EP	2016	8	7	2016	8	9	60	999	TS		
Kay	EP	2016	8	18	2016	8	23	60	1000	TS	50	1000
Dianmu	WP	2016	8	18	2016	8	19	50	980	TS		
Yvette	SI	2016	12	19	2016	12	23	50	987	TS		
Daya	SI	2016	2	10	2016	2	12	50	992	TS		
Yalo	SP	2016	2	25	2016	2	26	50	993	TS		

		Formed			Dissipated			Intensity				
Name	Basin	Year	M	D	Year	M	D	Peak mph	Low mb	SSHS	Sec mph	Sec mb
Roslyn	EP	2016	9	25	2016	9	29	50	1000	TS		
Nada	NI	2016	11	29	2016	12	1	50	1000	TS		
Lupit	WP	2016	7	23	2016	7	24	50	1000	TS		
Malou	WP	2016	9	5	2016	9	7	50	1000	TS		
Agatha	EP	2016	7	2	2016	7	5	50	1002	TS	45	1004
Fiona	AL	2016	8	16	2016	8	23	50	1004	TS	45	1006
Kompasu	WP	2016	8	19	2016	8	21	45	994	TS		
Rai	WP	2016	9	11	2016	9	13	45	996	TS		
Deni	SA	2016	11	15	2016	11	16	45	998	SS		
Ma-on	WP	2016	11	10	2016	11	13	45	998	TS		
Bonnie	AL	2016	5	27	2016	6	4	45	1006	TS	40	1006
Danielle	AL	2016	6	19	2016	6	21	45	1007	TS		
Two	NI	2016	6	27	2016	6	28	40	993	TS		
"One"	AL	2016	9	15	2016	9	16	40	998	SS		
16P	SP	2016	3	16	2016	3	16	40	998	TS		
14W	WP	2016	8	23	2016	8	25	40	1002	TS		
Tina	EP	2016	11	13	2016	11	13	40	1005	TS		
Julia	AL	2016	9	14	2016	9	18	40	1007	TS	40	1009
17W	WP	2016	9	11	2016	9	11	35	1000	TD		
One-E	EP	2016	6	6	2016	6	8	35	1006	TD		
03W	WP	2016	7	17	2016	7	17	35	1006	TD		
28W	WP	2016	11	11	2016	11	12	35	1008	TD		
Eight	AL	2016	8	28	2016	9	1	35	1009	TD		

These intensity values are based upon existing information and our own analysis and is correct to our best estimations as of December 30, 2016. Many storms have their intensities measured by satellites alone, unless they make landfall or is intercepted by a reconnaissance plane. Thus, most typhoons and southern hemisphere cyclones at peak intensity are merely estimates and may be higher or lower.

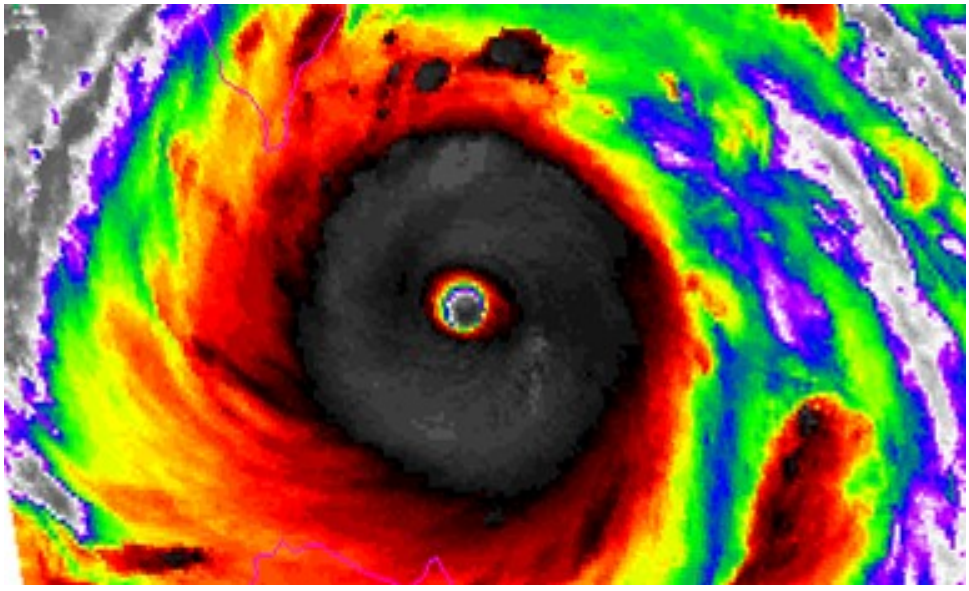


Image: Enhanced infrared image of Super Typhoon Meranti, at 14:00 UTC on September 13, 2016. Meranti is assessed to be the strongest storm of the year worldwide. NOAA Floaters

2.2. Storms listed by amount of landfalls

Only storms that made landfalls are shown below.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Landfalls
Nock-ten	WP	2016	12	21	2016	12	28	5
Matthew	AL	2016	9	28	2016	10	9	4
Tokage	WP	2016	11	23	2016	11	28	4
Malakas	WP	2016	9	11	2016	9	20	3
Sarika	WP	2016	10	12	2016	10	19	3
Earl	AL	2016	8	2	2016	8	6	2
Newton	EP	2016	9	4	2016	9	7	2
Nepartak	WP	2016	7	3	2016	7	9	2
Mirinae	WP	2016	7	25	2016	7	28	2
Nida	WP	2016	7	29	2016	8	3	2
Dianmu	WP	2016	8	18	2016	8	19	2
Meranti	WP	2016	9	9	2016	9	14	2
Megi	WP	2016	9	22	2016	9	29	2
Haima	WP	2016	10	15	2016	10	21	2
Bonnie	AL	2016	5	27	2016	6	4	1
Danielle	AL	2016	6	19	2016	6	21	1
Hermine	AL	2016	8	28	2016	9	3	1
Julia	AL	2016	9	14	2016	9	18	1
"One"	AL	2016	9	15	2016	9	16	1
Otto	AL	2016	11	21	2016	11	26	1
Roanu	NI	2016	5	18	2016	5	21	1
Nada	NI	2016	11	29	2016	12	1	1
Vardah	NI	2016	12	7	2016	12	12	1
Stan	SI	2016	1	28	2016	1	31	1
Winston	SP	2016	2	10	2016	2	24	1
Mindulle	WP	2016	8	17	2016	8	23	1
Lionrock	WP	2016	8	17	2016	8	30	1
Namtheun	WP	2016	8	31	2016	9	5	1
Rai	WP	2016	9	11	2016	9	13	1
Aere	WP	2016	10	5	2016	10	13	1

2.3 Storms listed by countries affected

Only storms that affected land are shown below. A storm doesn't have to make landfall to affect land. A landfall occurs when the center of the eye or the center of circulation crosses over land, not if the peripheral or even central core of the storm moves over land.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Countries
Matthew	AL	2016	9	28	2016	10	9	8
Ula	SP	2015	12	26	2016	1	12	5
Earl	AL	2016	8	2	2016	8	6	4
Vardah	NI	2016	12	7	2016	12	12	4
Otto	AL	2016	11	21	2016	11	26	3
Roanu	NI	2016	5	18	2016	5	21	3
Fantala	SI	2016	4	11	2016	4	24	3
Winston	SP	2016	2	10	2016	2	24	3
Meranti	WP	2016	9	9	2016	9	14	3
Malakas	WP	2016	9	11	2016	9	20	3
"One"	AL	2016	9	15	2016	9	16	2
Nepartak	WP	2016	7	3	2016	7	9	2
Mirinae	WP	2016	7	25	2016	7	28	2
Nida	WP	2016	7	29	2016	8	3	2
Dianmu	WP	2016	8	18	2016	8	19	2
Megi	WP	2016	9	22	2016	9	29	2
Chaba	WP	2016	9	24	2016	10	5	2
Sarika	WP	2016	10	12	2016	10	19	2
Haima	WP	2016	10	15	2016	10	21	2
Alex[1]	AL	2016	1	12	2016	1	15	1
Bonnie	AL	2016	5	27	2016	6	4	1
Danielle	AL	2016	6	19	2016	6	21	1
Gaston	AL	2016	8	22	2016	9	3	1
Hermine	AL	2016	8	28	2016	9	3	1
Julia	AL	2016	9	14	2016	9	18	1
Karl	AL	2016	9	14	2016	9	25	1
Nicole	AL	2016	10	4	2016	10	18	1
Javier	EP	2016	8	7	2016	8	9	1
Lester	EP	2016	8	24	2016	9	7	1
Madeline	EP	2016	8	26	2016	9	3	1
Newton	EP	2016	9	4	2016	9	7	1
Paine	EP	2016	9	17	2016	9	20	1

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Countries
Nada	NI	2016	11	29	2016	12	1	1
Stan	SI	2016	1	28	2016	1	31	1
Daya	SI	2016	2	10	2016	2	12	1
Mindulle	WP	2016	8	17	2016	8	23	1
Lionrock	WP	2016	8	17	2016	8	30	1
Kompasu	WP	2016	8	19	2016	8	21	1
Namtheun	WP	2016	8	31	2016	9	5	1
Rai	WP	2016	9	11	2016	9	13	1
Aere	WP	2016	10	5	2016	10	13	1
Tokage	WP	2016	11	23	2016	11	28	1
Nock-ten	WP	2016	12	21	2016	12	28	1

[1] Hurricane Alex was evaluated by Force Thirteen to have never made landfall during its lifetime, despite reports suggesting otherwise.

Image: Force Thirteen enhanced image of Hurricane Matthew several hours after reaching peak intensity. Matthew affected a total of eight countries throughout its extensive track through the Caribbean and Western Atlantic. *International Space Station*

2.3. Storms listed by death toll

Only storms that caused fatalities are listed below. Unconfirmed reports and missing persons are not counted towards these totals. Information is correct as of December 30, 2016

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Fatalities
Matthew	AL	2016	9	28	2016	10	9	1659
Lionrock	WP	2016	8	17	2016	8	30	550
Roanu	NI	2016	5	18	2016	5	21	227
Nepartak	WP	2016	7	3	2016	7	9	86
Earl	AL	2016	8	2	2016	8	6	67
Winston	SP	2016	2	10	2016	2	24	44
Vardah	NI	2016	12	7	2016	12	12	38
Aere	WP	2016	10	5	2016	10	13	35
Sarika	WP	2016	10	12	2016	10	19	34
Meranti	WP	2016	9	9	2016	9	14	30
Megi	WP	2016	9	22	2016	9	29	24
Otto	AL	2016	11	21	2016	11	26	23
Dianmu	WP	2016	8	18	2016	8	19	16
Haima	WP	2016	10	15	2016	10	21	15
Fantala	SI	2016	4	11	2016	4	24	13
Newton	EP	2016	9	4	2016	9	7	12
Nada	NI	2016	11	29	2016	12	1	12
Rai	WP	2016	9	11	2016	9	13	12
Chaba	WP	2016	9	24	2016	10	5	7
Hermine	AL	2016	8	28	2016	9	3	5
Mirinae	WP	2016	7	25	2016	7	28	5
Nida	WP	2016	7	29	2016	8	3	4
Nock-ten	WP	2016	12	21	2016	12	28	3
Bonnie	AL	2016	5	27	2016	6	4	2
Nicole	AL	2016	10	4	2016	10	18	2
Mindulle	WP	2016	8	17	2016	8	23	2
Malakas	WP	2016	9	11	2016	9	20	2
Alex	AL	2016	1	12	2016	1	15	1
Danielle	AL	2016	6	19	2016	6	21	1
Ula	SP	2015	12	26	2016	1	12	1
Kompasu	WP	2016	8	19	2016	8	21	1

Storms listed by injured persons

Only storms that caused injuries are listed below. Unconfirmed reports are not counted towards these totals. Due to scarcity of information for some storms, this information may not reflect the true situation, however of the storms we do have injury information on, it is likely to be accurate. Values listed in *italics* are estimated numbers. Information is assumed correct as of December 30, 2016.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Injured
Megi	WP	2016	9	22	2016	9	29	625
Matthew	AL	2016	9	28	2016	10	9	442
Winston	SP	2016	2	10	2016	2	24	141
Mindulle	WP	2016	8	17	2016	8	23	61
Earl	AL	2016	8	2	2016	8	6	13
Nicole	AL	2016	10	4	2016	10	18	7
Haima	WP	2016	10	15	2016	10	21	4
Hermine	AL	2016	8	28	2016	9	3	*2*

Storms listed by missing persons

Only storms that have missing persons are listed below. Unconfirmed reports are not counted towards these totals. Values listed in *italics* are estimated numbers. Please note that missing persons are usually considered to be fatalities after a period, and this information may change. Information is assumed correct as of December 30, 2016.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Missing
Roanu	NI	2016	5	18	2016	5	21	*40*
Nepartak	WP	2016	7	3	2016	7	9	19
Megi	WP	2016	9	22	2016	9	29	17
Meranti	WP	2016	9	9	2016	9	14	15
Nock-ten	WP	2016	12	21	2016	12	28	10
Chaba	WP	2016	9	24	2016	10	5	4
Earl	AL	2016	8	2	2016	8	6	2
Dianmu	WP	2016	8	18	2016	8	19	2
Matthew	AL	2016	9	28	2016	10	9	1

2.4. Storms listed by monetary damages

Only storms that caused monetary damages are listed below. Unconfirmed numbers are not counted towards these totals. Values listed in *italics* are estimated numbers. Information is assumed correct as of December 30, 2016.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Damages $m
Matthew	AL	2016	9	28	2016	10	9	10580
Meranti	WP	2016	9	9	2016	9	14	2630
Vardah	NI	2016	12	7	2016	12	12	2000
Roanu	NI	2016	5	18	2016	5	21	1700
Nepartak	WP	2016	7	3	2016	7	9	1520
Winston	SP	2016	2	10	2016	2	24	1400
Sarika	WP	2016	10	12	2016	10	19	755
Malakas	WP	2016	9	11	2016	9	20	739
Haima	WP	2016	10	15	2016	10	21	726
Mirinae	WP	2016	7	25	2016	7	28	334
Lionrock	WP	2016	8	17	2016	8	30	325
Earl	AL	2016	8	2	2016	8	6	250
Aere	WP	2016	10	5	2016	10	13	112
Nock-ten	WP	2016	12	21	2016	12	28	100.1
Newton	EP	2016	9	4	2016	9	7	96
Nida	WP	2016	7	29	2016	8	3	89
Rai	WP	2016	9	11	2016	9	13	37.3
Otto	AL	2016	11	21	2016	11	26	*34*
Chaba	WP	2016	9	24	2016	10	5	18.3
Dianmu	WP	2016	8	18	2016	8	19	6.9
Fantala	SI	2016	4	11	2016	4	24	4.5
Bonnie	AL	2016	5	27	2016	6	4	0.64

2.5. Storms listed by buildings damaged

Only storms that caused building damages are listed below. Unconfirmed numbers are not counted towards these totals. Due to scarcity of information for some storms, this information may not reflect the true situation. Values listed in *italics* are estimated numbers. Information is assumed correct as of December 30, 2016.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Buildings dmg.
Matthew	AL	2016	9	28	2016	10	9	*200600*
Nock-ten	WP	2016	12	21	2016	12	28	92070
Haima	WP	2016	10	15	2016	10	21	76071
Winston	SP	2016	2	10	2016	2	24	*40200*
Roanu	NI	2016	5	18	2016	5	21	40000
Lionrock	WP	2016	8	17	2016	8	30	19500
Sarika	WP	2016	10	12	2016	10	19	11356
Megi	WP	2016	9	22	2016	9	29	*10017*
Aere	WP	2016	10	5	2016	10	13	*8200*
Earl	AL	2016	8	2	2016	8	6	*8181*
Hermine	AL	2016	8	28	2016	9	3	5776
Nida	WP	2016	7	29	2016	8	3	*2417*
Newton	EP	2016	9	4	2016	9	7	1665
Mirinae	WP	2016	7	25	2016	7	28	1425
Fantala	SI	2016	4	11	2016	4	24	*1000*
Meranti	WP	2016	9	9	2016	9	14	942
Rai	WP	2016	9	11	2016	9	13	277
Ula	SP	2015	12	26	2016	1	12	50
Bonnie	AL	2016	5	27	2016	6	4	15
Alex	AL	2016	1	12	2016	1	15	*5*
Julia	AL	2016	9	14	2016	9	18	1
Otto	AL	2016	11	21	2016	11	26	1

Storms listed by buildings destroyed

Only storms that caused building destruction are listed below. Unconfirmed numbers are not counted towards these totals. Due to scarcity of information for some storms, this information may not reflect the true situation. Values listed in *italics* are estimated numbers. Information is assumed correct as of December 30, 2016.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Destroyed
Aere	WP	2016	10	5	2016	10	13	*93000*
Matthew	AL	2016	9	28	2016	10	9	*45004*
Nock-ten	WP	2016	12	21	2016	12	28	31526
Vardah	NI	2016	12	7	2016	12	12	29,647
Lionrock	WP	2016	8	17	2016	8	30	25000
Haima	WP	2016	10	15	2016	10	21	17364
Winston	SP	2016	2	10	2016	2	24	*6964*
Nepartak	WP	2016	7	3	2016	7	9	3144
Sarika	WP	2016	10	12	2016	10	19	1421
Megi	WP	2016	9	22	2016	9	29	*1220*
Meranti	WP	2016	9	9	2016	9	14	1190
Earl	AL	2016	8	2	2016	8	6	*1015*
Fantala	SI	2016	4	11	2016	4	24	334
Nida	WP	2016	7	29	2016	8	3	300
Roanu	NI	2016	5	18	2016	5	21	66
Mirinae	WP	2016	7	25	2016	7	28	12
Dianmu	WP	2016	8	18	2016	8	19	11
Hermine	AL	2016	8	28	2016	9	3	10
Rai	WP	2016	9	11	2016	9	13	9
Newton	EP	2016	9	4	2016	9	7	6

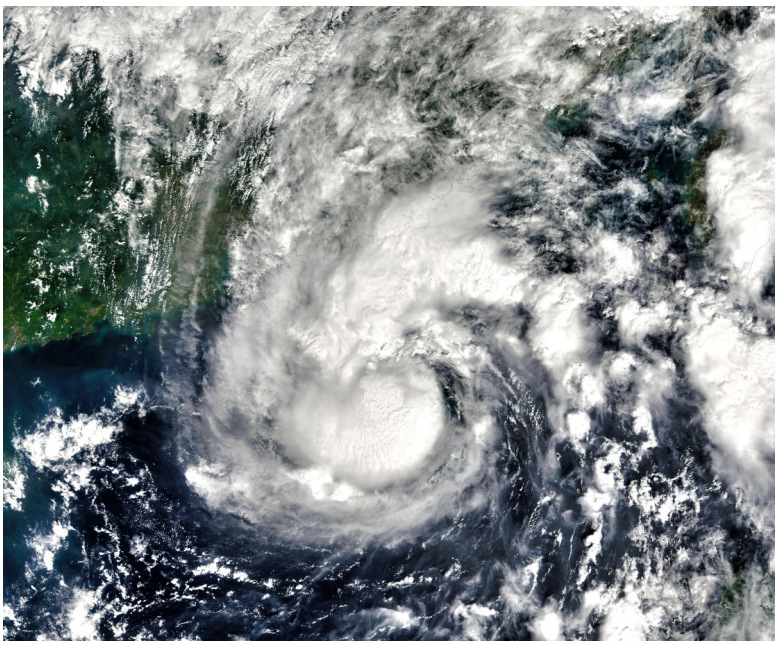


Image: Force Thirteen enhanced visible image of Tropical Storm Aere in the South China Sea. The storm did most of its damage as a remnant depression over Vietnam. MODIS

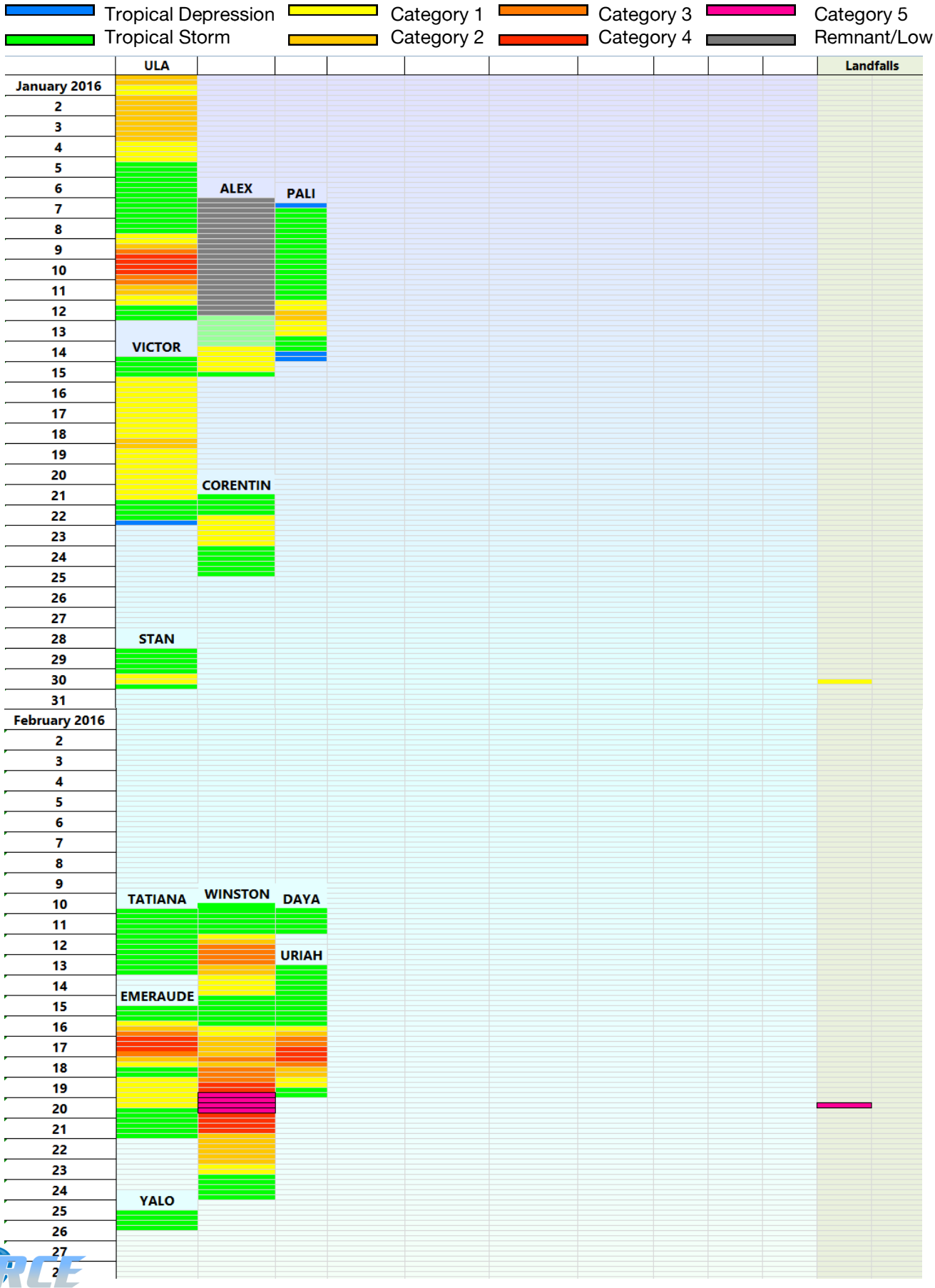
2.6. Storms listed by evacuees

Only storms that caused known evacuations are listed below. Unconfirmed numbers are not counted towards these totals. Due to scarcity of information for many storms, this information may not reflect the true situation. Values listed in *italics* are estimated numbers. Information is assumed correct as of December 30, 2016.

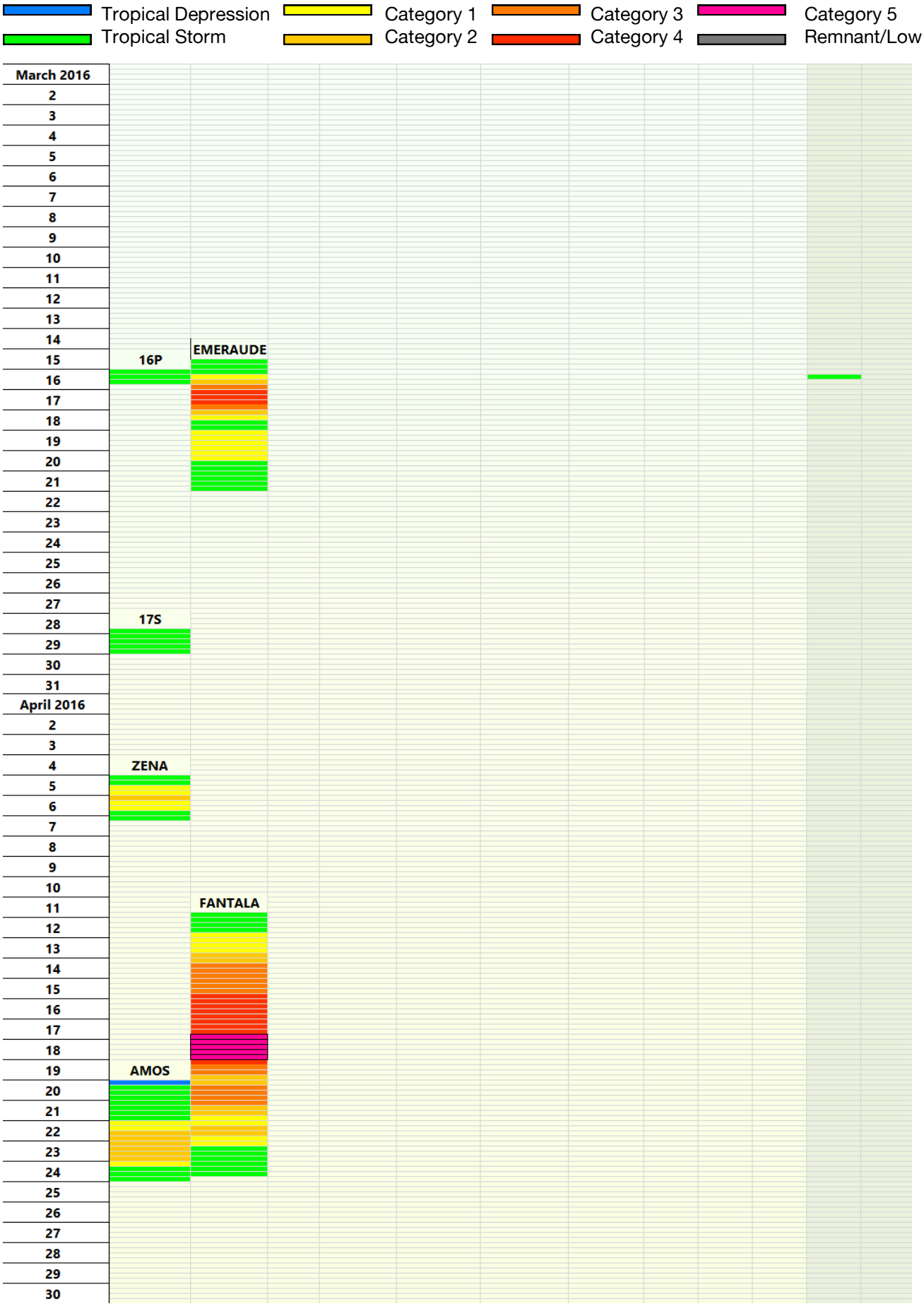
		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Evacuees
Mindulle	WP	2016	8	17	2016	8	23	852700
Nock-ten	WP	2016	12	21	2016	12	28	487825
Roanu	NI	2016	5	18	2016	5	21	*200000*
Haima	WP	2016	10	15	2016	10	21	158736
Nepartak	WP	2016	7	3	2016	7	9	154000
Megi	WP	2016	9	22	2016	9	29	120000
Sarika	WP	2016	10	12	2016	10	19	39934
Vardah	NI	2016	12	7	2016	12	12	17400
Earl	AL	2016	8	2	2016	8	6	*15600*
Tokage	WP	2016	11	23	2016	11	28	12459
Otto	AL	2016	11	21	2016	11	26	11678
Danielle	AL	2016	6	19	2016	6	21	1200
Hermine	AL	2016	8	28	2016	9	3	1000
Lionrock	WP	2016	8	17	2016	8	30	1000
Ula	SP	2015	12	26	2016	1	12	480
Matthew	AL	2016	9	28	2016	10	9	469
Newton	EP	2016	9	4	2016	9	7	210
Fantala	SI	2016	4	11	2016	4	24	100
Amos	SP	2016	4	20	2016	4	24	63

2.7. 2016 Storm Timeline

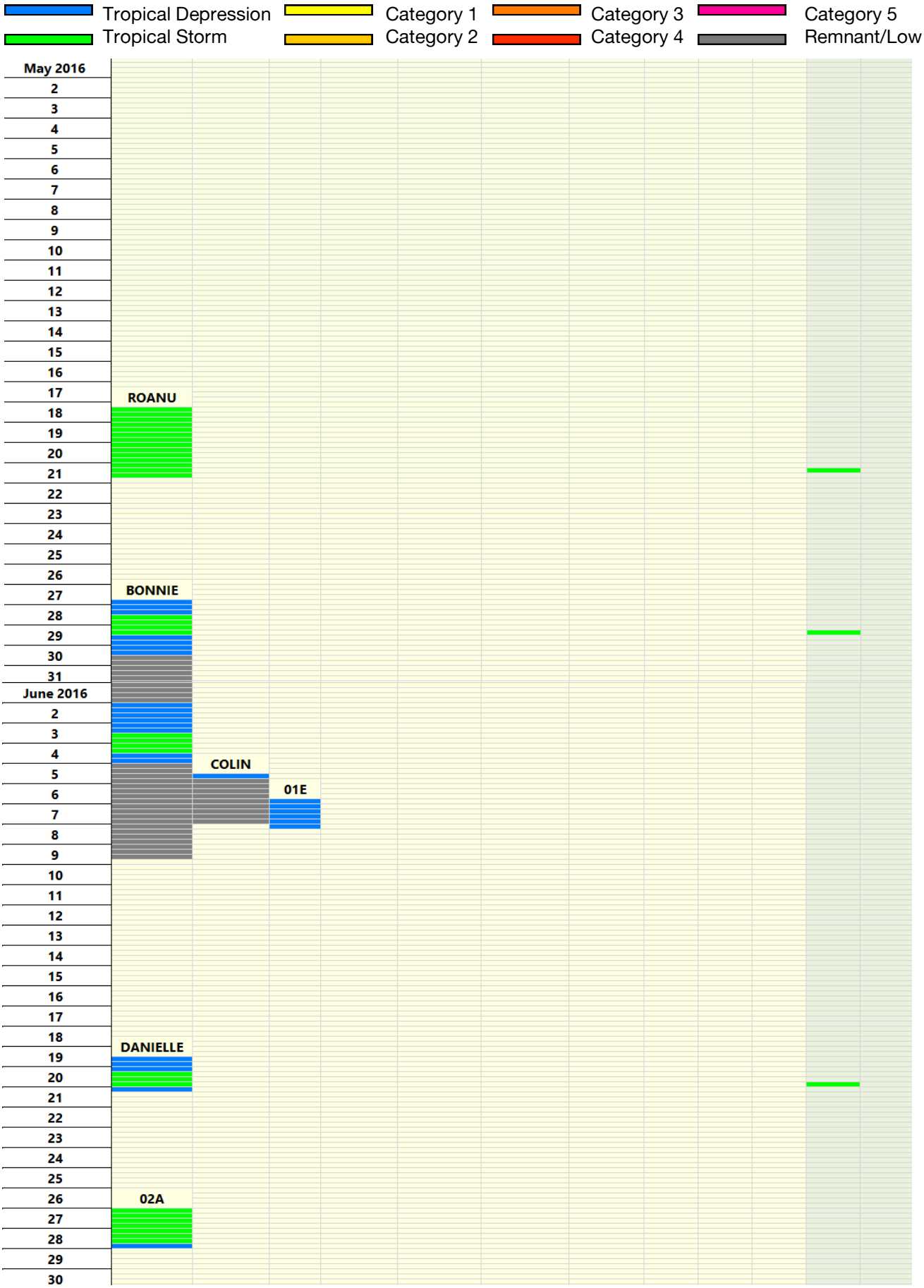
Below shows the progression at six-hourly intervals of worldwide tropical cyclone activity in 2016.
All intensity categories are in correspondence with the Saffir-Simpson Hurricane Wind Scale.



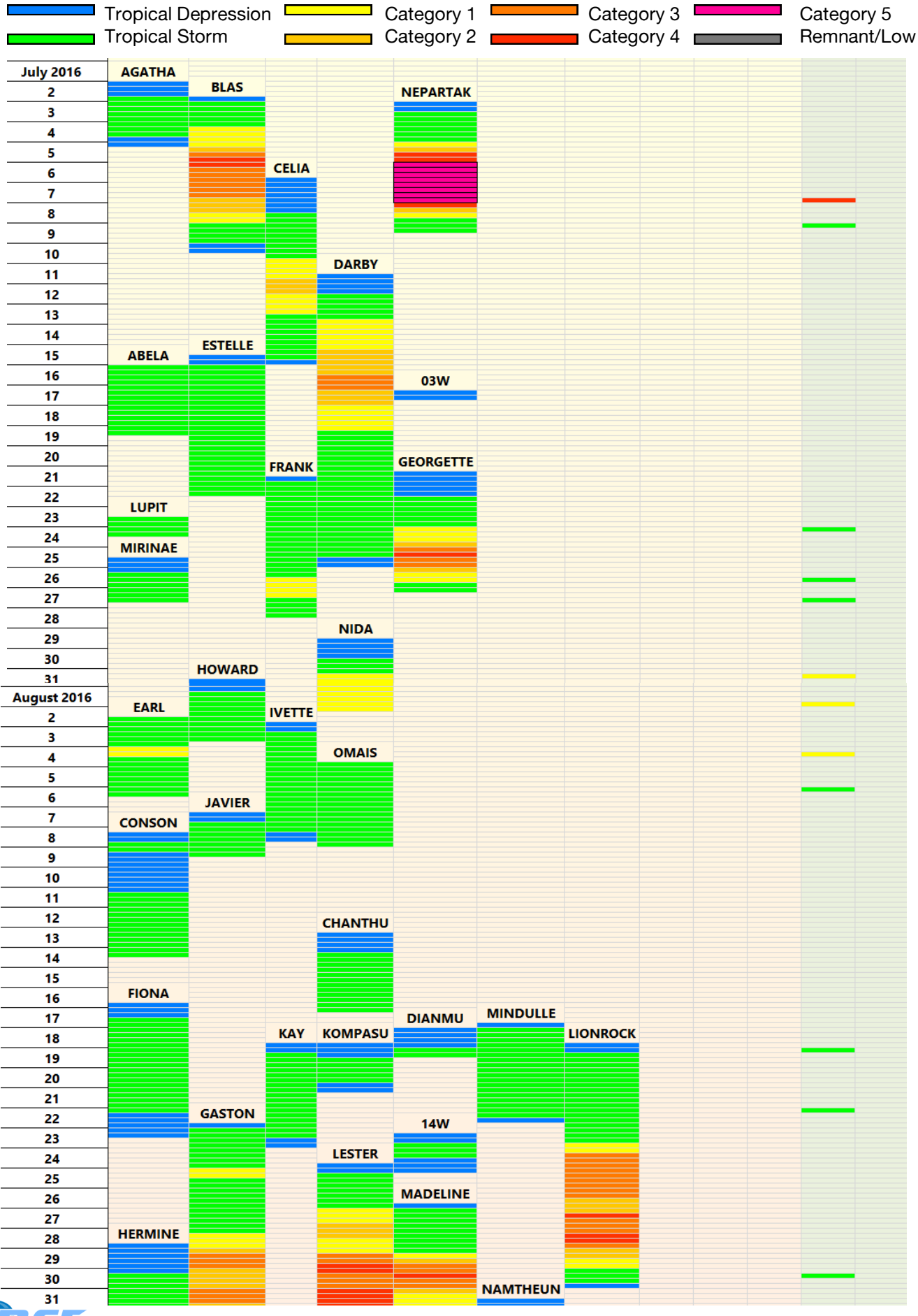
2016 Storm Timeline



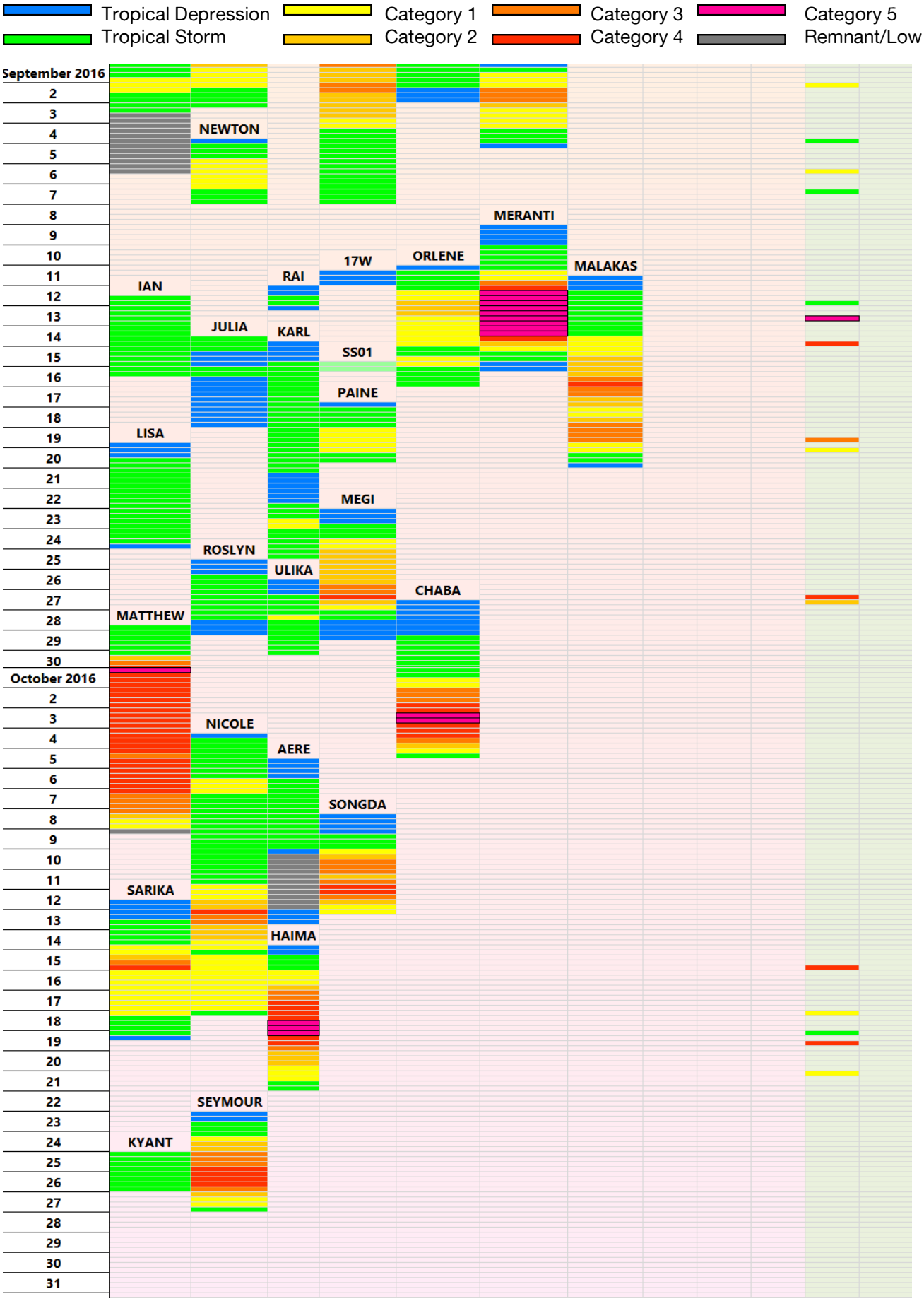
2016 Storm Timeline



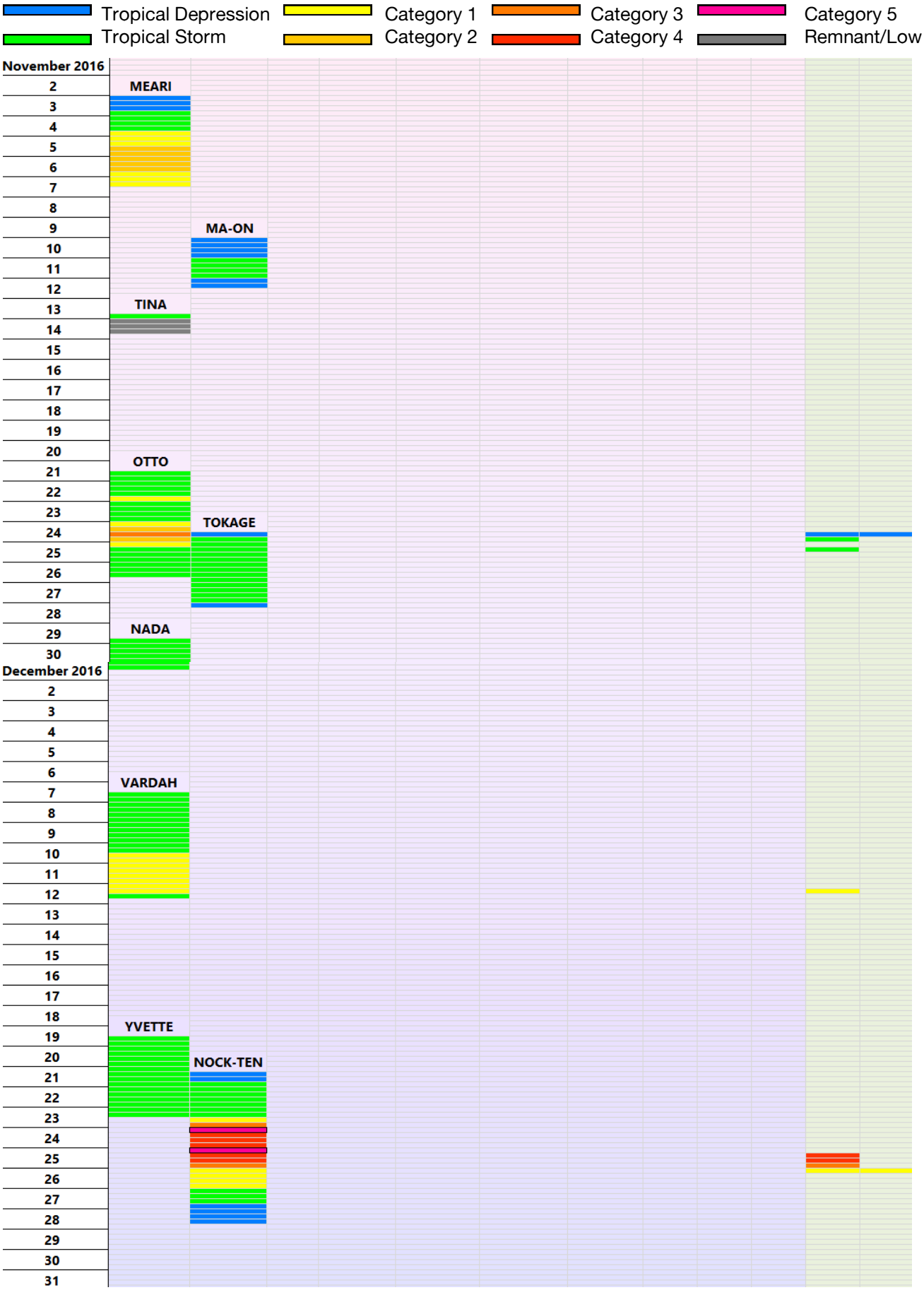
2016 Storm Timeline



2016 Storm Timeline



2016 Storm Timeline



3. Notable Storms of 2016

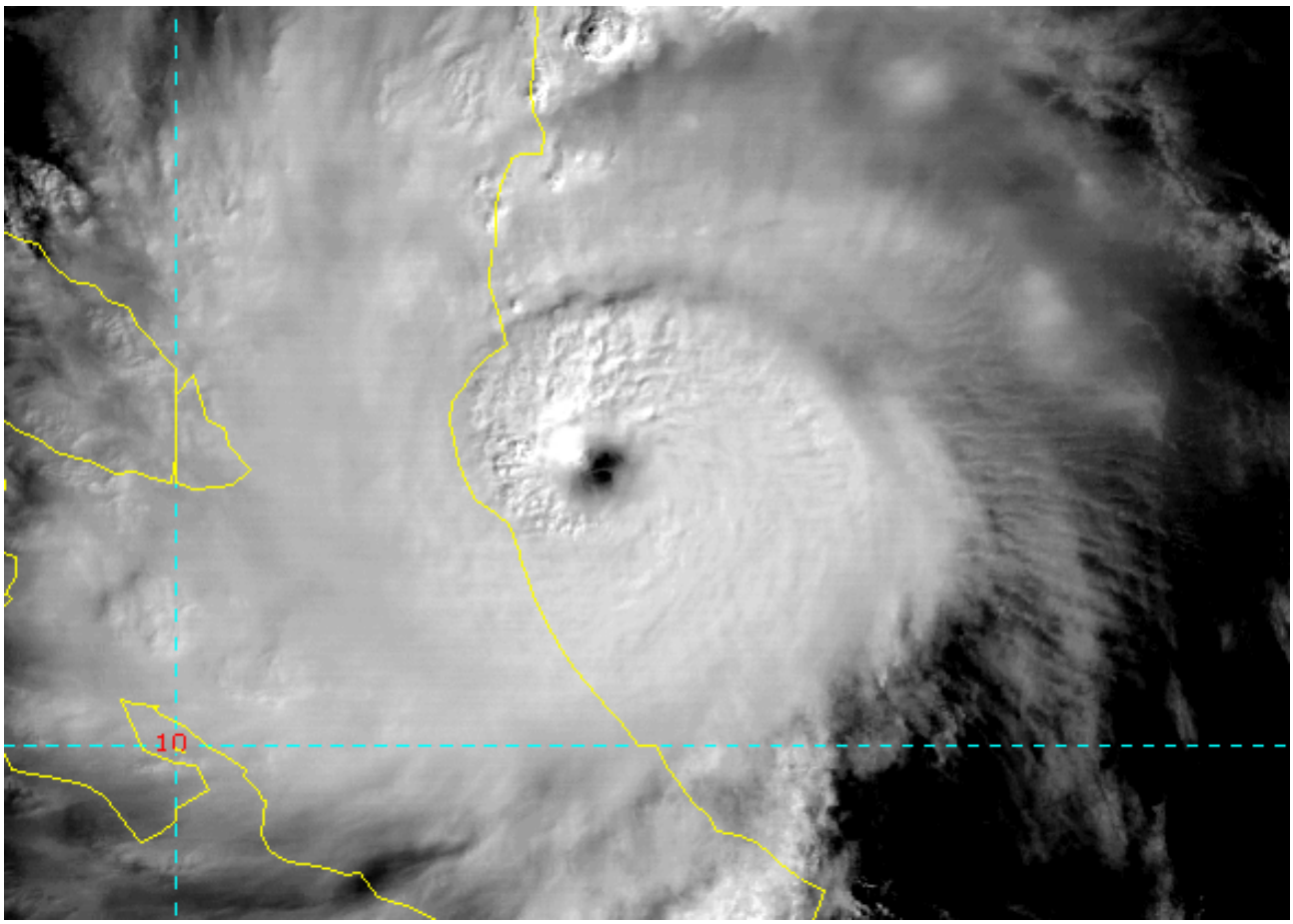
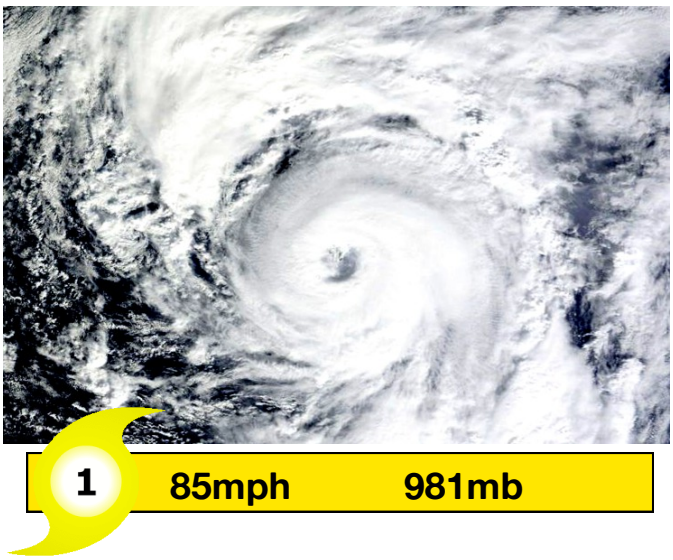


Image: Force Thirteen enhanced image of Hurricane Otto shortly before landfall in Nicaragua in November 2016.

This section contains more detailed reports and analysis on notable storms of the year worldwide. Not all storms that are considered notable are included in this section, though storms that require further explanation and exploration are shown.

3.1. Hurricane Alex



Hurricane Alex was the first storm to form in January in the Atlantic since 1978, and the first hurricane to do so since 1938. Alex peaked as a Category 1 hurricane on the Saffir-Simpson Hurricane Wind Scale.

Alex was first tracked in the western Atlantic on January 7th, and speculation persisted for several days as the extratropical storm traversed eastwards across the Atlantic.

On January 12th, the system gained subtropical characteristics and was designated a Subtropical Storm on this day, in post-season analysis. Early on the 14th, Alex gained tropical characteristics and formed an eye, soon becoming an official hurricane as it approached the Azores, where Hurricane Warnings were posted.

Alex passed just east of the island of Terceira as it began to weaken, with the island receiving the western eyewall. The National Hurricane Center, however, designates the occurrence as an actual landfall despite the storm's center of circulation being over a dozen miles offshore.

Alex then proceeded quickly towards the north-northwest, losing hurricane status shortly before turning post-tropical. The storm then went on to affect Greenland.

Alex was one of two surprising early year occurrences in the northern hemisphere, the other being Hurricane Pali in the Central Pacific, which formed a few days prior.

Sea Surface Temperatures during Alex's development were consistently below the threshold required for tropical cyclone development, though were slightly above average for the time of year, along with conditions near the area where Pali formed. At least in the latter case, this can be attributed to the ongoing El Nino event.

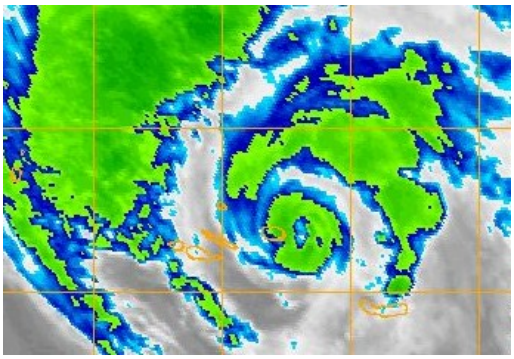
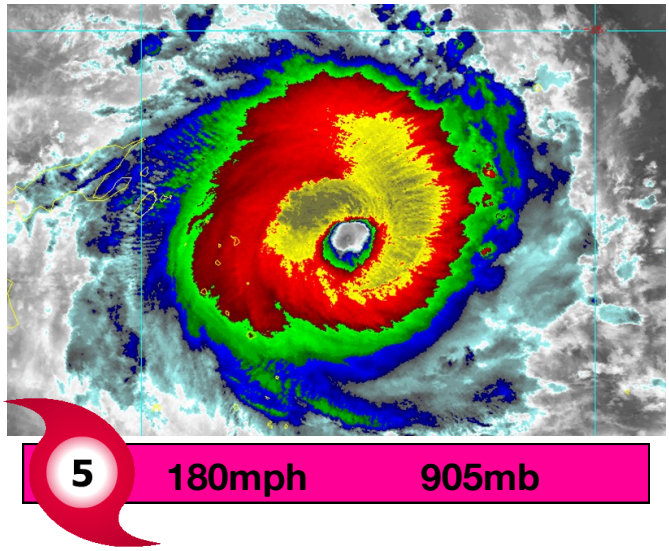


Image: Alex whilst making its closest pass to the island of Terceira, Azores U.S. Navy

3.2. Cyclone Winston

Cyclone Winston existed in some form for most of the month of February, reaching major hurricane status three times and becoming the strongest storm to make landfall in Fiji to date.



During Cyclone Winston's peak, the storm displayed annular characteristics with a very well defined eye, though the storm capitulated slightly shortly before its Fijian landfall.

Winston formed on February 7th, gaining tropical storm status some days later east of Vanuatu. The storm then unexpectedly rapidly intensified to Category 3 status east of the southernmost islands of Vanuatu, before curving towards the southeast and then northeast as it weakened gradually back to tropical storm intensity.

Winston then passed just north of Tonga as it began strengthening again, though confusion remained amongst forecasters as to whether the storm would curve back towards Fiji, and at what intensity. Ultimately, Winston stalled well south of Samoa and reached major hurricane intensity for a second and third time as it moved back towards the west. Picking up pace, it became apparent that Winston would impact Fiji at a significant intensity.

Part of Winston's eye passed over Koro island as it peaked with winds of 180mph, and it seemed at first that the storm may make landfall on Vanua Levu. But Winston jogged to the south and made landfall instead on Viti Levu, having begun a weakening process.

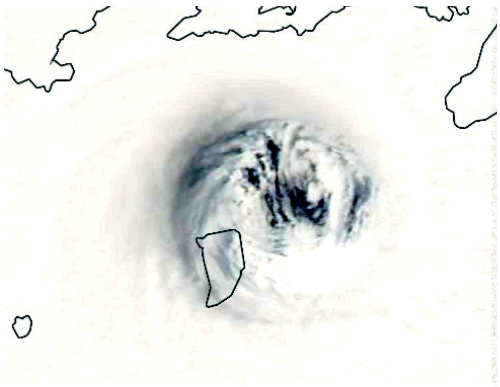


Image: Cyclone Winston near peak intensity as it clipped Koro island, Fiji

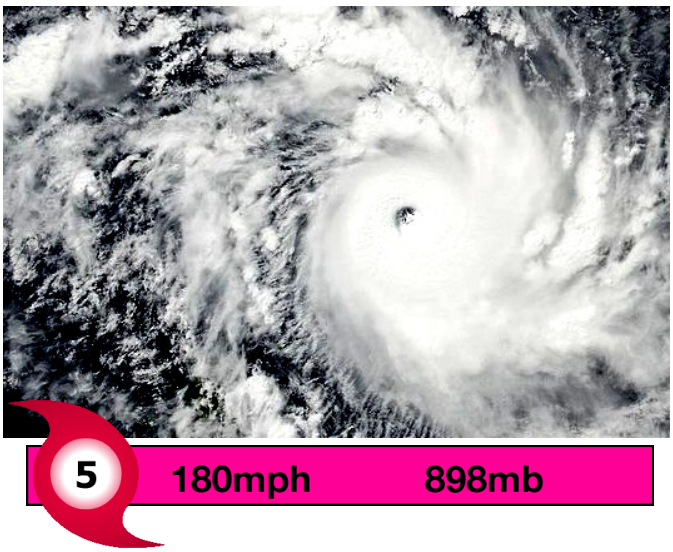
Winston pulled away from Fiji the next day, still as a Category 4 storm, becoming quasi-stationary between Fiji and Vanuatu, and some forecasts hinted at a possible return to Fiji, though Winston eventually continued towards the south and continued to weaken.

Winston then degenerated into a Subtropical Storm, turned towards the west and entered the Coral Sea, tracking northwest and finally affecting the Cape York peninsula of Australia as a weak depression.

Most of Winston's damage occurred in Fiji, with damages amounting to at least $1.4 billion. This makes Winston the costliest storm to exist in the Southern Pacific. There was also a small amount of damage reported in Tonga.

Image: Cyclone Winston damage in Fiji

3.3. Cyclone Fantala



Cyclone Fantala was the only other Category 5 storm to form in the southern hemisphere in 2016, and became the strongest storm to form in the Southwest Indian Ocean, and the second most intense, after Gafilo of 2004.

Fantala formed in the second week of April in the central Indian Ocean, and proceeded on a westerly track, gradually intensifying for several days before reaching Category 5 intensity on April 17th, whilst bearing down on the Farquhar group of islands in the Seychelles.

The following day, the storm began weakening and stalled before reversing course and moving southeast, fluctuating in intensity but gradually weakening over the next few days.

Fantala stalled again as a Category 2 cyclone, before again reversing course and tracked close to the Farquhar islands for a third time as it devolved into a remnant low. Fantala caused 13 fatalities in all, and damages amounting to $4.5 million.

Force Thirteen's SATOPS (our system of measuring a storm's intensity based upon cloud top and eye analysis, though not intended to supersede direct observations, where available) measured a peak intensity of 182mph from Fantala, at 11:00 UTC on April 17th, with estimates at or near 180mph for much of the afternoon.

Therefore, Force Thirteen's analysis assesses the storm to have attained 180mph winds with an estimated pressure of 898mb, using the common wind-pressure ratio for storms in these circumstances.

Cyclone Fantala was a rarity, particularly for the area in which it attained its peak intensity, and also becoming the second furthest north Category 5 storm in the southern hemisphere.

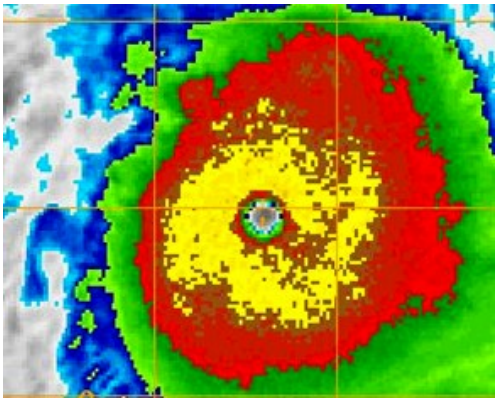
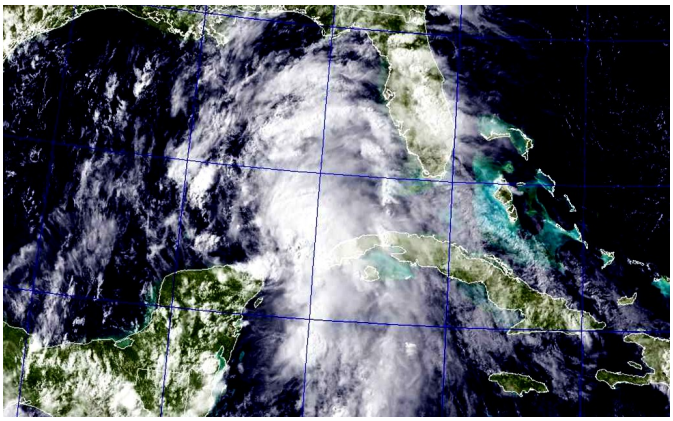


Image: Cyclone Fantala passing over the Farquhar islands near peak intensity. U.S. Navy

3.4. June system in the Gulf of Mexico (“Colin”)

Perhaps the most contentious decision of the 2016 Atlantic Hurricane Season was the naming of Colin by the National Hurricane Center, a decision which has polarised opinion amongst storm trackers.



35mph 1005mb

Force Thirteen’s analysis of the system was that briefly, whilst developing over the Yucatan peninsula, the system displayed a center of circulation of enough clarity to warrant tropical depression status. However, this was quickly lost as the storm moved towards the north over the Gulf of Mexico. Thus, whilst “Colin” attained tropical storm force winds, the defining element of what constitutes a cyclone was absent, and so Colin cannot be categorised as a tropical cyclone beyond the first six hours after the National Hurricane Center declared it to be a tropical depression.

Nonetheless, the storm was officially named at 21:30 UTC on June 5th.
Later that evening, the National Hurricane Center released a forecast discussion, stating that "the low-level center is impossible to discern from infrared imagery”, and that “another Hurricane Hunter mission is scheduled to investigate the storm” three hours later. The implications of this particular statement were that the system was not presently a tropical cyclone, but that it would be classified as such until they got a second confirmation that it was not the case.

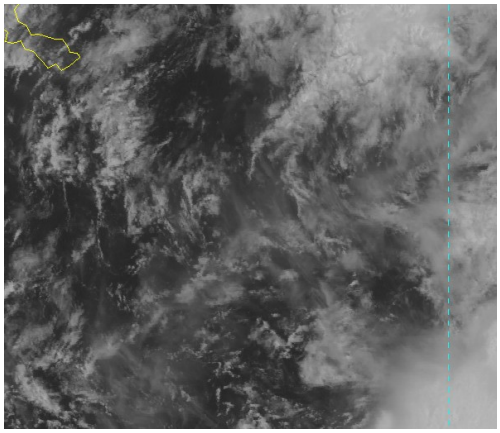


Image: The disturbance exhibiting little in the way of a circulation center whilst approaching Florida.

However, the next reconnaissance mission appeared to indeed bring the second confirmation, in the form of two or more competing centers, commonly seen in tropical disturbances:
"Air Force Reserve Hurricane Hunter aircraft suggest that at least two small-scale circulation centers are present"

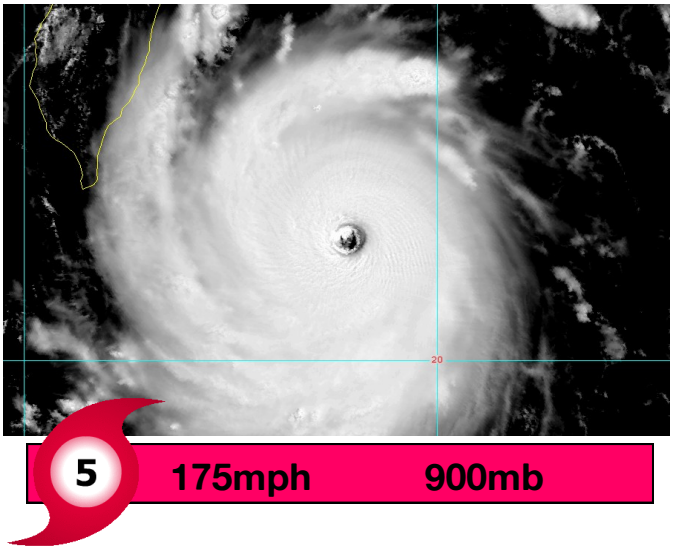
This was followed by another statement of non-verification in the next discussion statement:
"The satellite presentation of Colin does not resemble that of a classical tropical cyclone", also noting that “Colin could lose its status as a tropical cyclone while impacts are still occurring along the coast."

These statements suggest that Colin was not a tropical cyclone from at least 03:00 UTC on June 6th until that afternoon, when the next discussion was published:
"Colin does not look much like a tropical cyclone in satellite imagery this afternoon."
This particular statement offers no explanation or reason for suggesting that Colin should therefore have been a tropical cyclone at this stage, either. That evening, Colin approached the coast of Florida:
"Surface observations and shortwave infrared imagery suggest that the center of Colin is just offshore of the coastline"
However, such a center still remained almost indiscernible, and certainly not of the requirements to facilitate tropical cyclone classification.
Finally, as the storm moved off the coast of the United States and into the western Atlantic, another discussion was published doubting the official classification of the storm:
"Surface and aircraft data indicate that the center of Colin has moved off of the coast of Georgia into the Atlantic. Overall, the system does not look very tropical."

For these reasons, Force Thirteen’s analysis displays Colin as only a short lived tropical depression before degenerating into a disturbance, even though tropical storm force winds were present. It is also worth noting that Colin generated two tornadoes, more than any tropical cyclone did worldwide in 2016.

3.5. Super Typhoon Nepartak

After nearly a 200-day absence of storm activity in the western Pacific, the 2016 season roared into life with Typhoon Nepartak in early July.



Nepartak began life near the Micronesian islands, and began moving towards the northwest—a movement it would sustain for most of its life. Nepartak gradually intensified, and did so rapidly on July 5th, becoming the second-fastest intensifying storm over a 24 hour period during the year.

Later, on July 6th, Nepartak reached Category 5 intensity, though began an eyewall replacement cycle late on that day. For a time, Nepartak lost Category 5 intensity, before regaining it at 23:00 UTC on July 6th.

Nepartak then went on to peak with winds of 175mph and an estimated pressure of 900mb, which was also the estimate used by the Japan Meteorological Agency.
A Taiwanese buoy measured an air pressure of 897mb when Nepartak began to weaken on its final approach to the island, though this was later invalidated and revised upwards to 911mb.

Typhoon Nepartak disintegrated quickly shortly before landfall, with Force Thirteen's analysis suggesting a landfall intensity of around 135mph with a pressure of 931mb. This weakening continued as Nepartak moved on towards China, making landfall there as a tropical storm.

Force Thirteen ran updates on YouTube and regularly updated the Storm Early Warning System, a supplementary feature to the automated tracker on the Force Thirteen website. This was the first time SEWS was used for a significant cyclone, and the graphics were used on Force Thirteen's live streaming service whilst the storm was approaching Taiwan.

Force Thirteen ran live coverage for two hours on July 5th and July 6th, and ran 7 hours of coverage on July 7th. Force Thirteen also ran four recorded updates in the days prior. The coverage was generally received very positively by viewers.

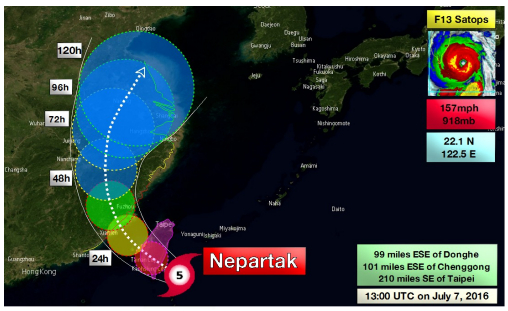
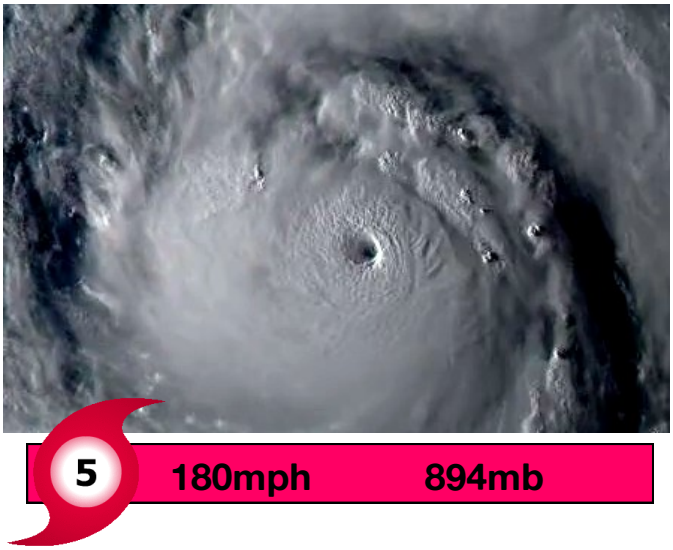


Image: Force Thirteen SEWS during the typhoon, July 7th

3.6. Super Typhoon Meranti



Typhoon Meranti was probably the most intense cyclone recorded worldwide in 2016, and is tied for the strongest, according to Force Thirteen's analysis.

Meranti initially formed west of Guam, and moved towards the west-northwest and gradually developed, expediting its pace on September 11th. Strengthening continued until the next day when Meranti became a Category 5 storm.

During Meranti's peak, Force Thirteen's SATOPS measured peak wind speeds to be around 182mph with a pressure of 894mb, though the JTWC reported winds of up to 190mph.

Whilst near its peak intensity, Meranti passed over the island of Itbayat, of the Batanes island group in the Philippines. Significant damages were reported but nobody was killed on the island. However, at least 30 died elsewhere throughout the storm's path.

Virtually all of the $2.6 billion in monetary damages occurred in China, where Meranti impacted whilst still at typhoon intensity.

Force Thirteen issued seven recorded updates, and four hours of live streaming during the life of Typhoon Meranti. Our coverage of the storm received a 97% approval rating.

Typhoon Meranti, using Force Thirteen's analysis, is the strongest September typhoon since Typhoon Hope in 1970, and the most intense September typhoon since Typhoon Elsie of 1969.
If one uses the JTWC estimate of 190mph, this makes Meranti the strongest September typhoon since Typhoon Sally of 1964.

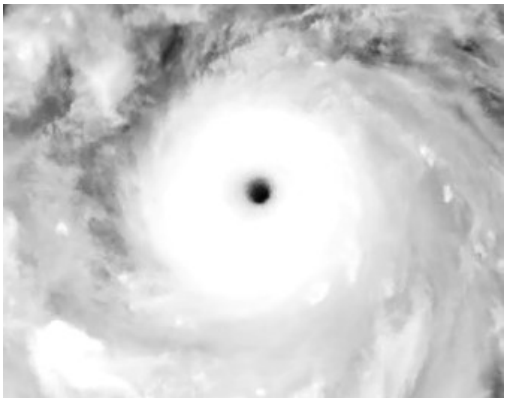


Image: Infrared image of Typhoon Meranti near peak, captured by the Himawari-8 satellite

3.7. Bay of Biscay Subtropical Storm

In mid-September 2016, an extratropical cyclone stalled over the Bay of Biscay and gradually moved towards the east-southeast, and began to exhibit subtropical characteristics.

At 17:00 UTC on September 15, the system was classified as a subtropical depression by Force Thirteen SEWS, and upgraded to a tropical storm by 21:00 UTC, based upon satellite estimated winds and subtropical appearance.

At around 03:00 UTC on September 16, the storm made landfall near the France/Spain border, and rapidly dissipated over the Pyrenees mountains. The system was still discernible by 09:00 UTC near Barcelona but had lost any cyclonic storm characteristics.

This storm was not identified by the National Hurricane Center, though there is debate as to whether the organisation extends its jurisdiction to cover this area.

The storm was never given a name by any national weather service, though Metéo-France acknowledged its subtropical storm status, and a weather buoy measured its minimum pressure of 997mb. Prior to this direct measurement, Force Thirteen's estimates had the storm at 1008mb.

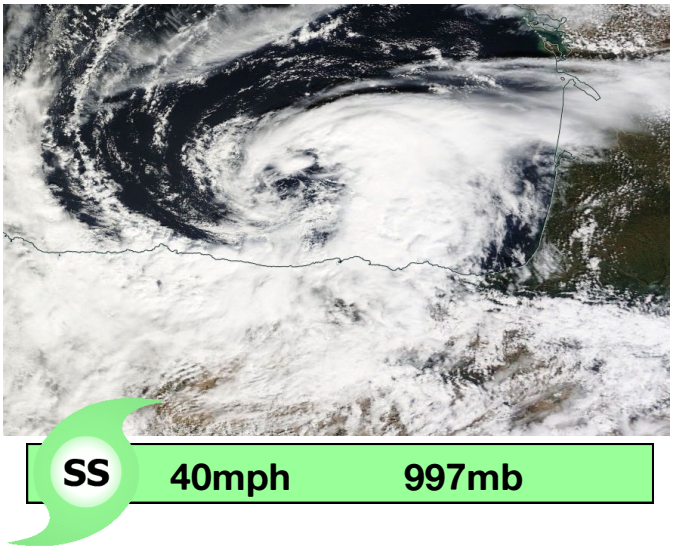


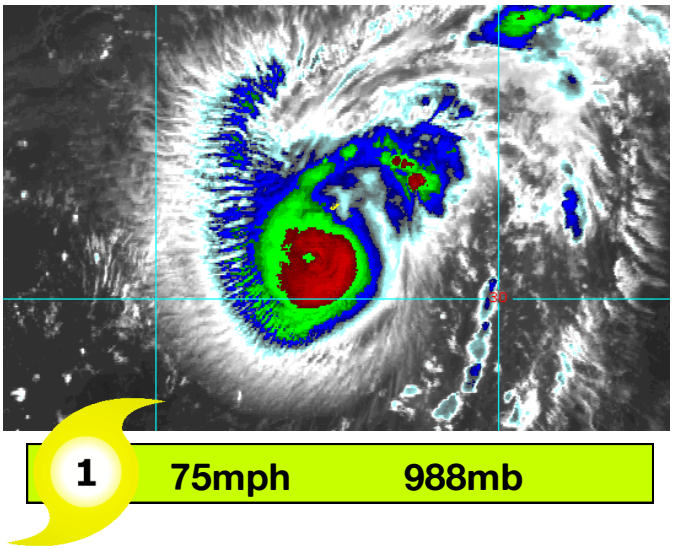
Image: SATOPS analysis of the track and intensity of the subtropical storm. Force Thirteen

3.8. Hurricane Karl

In late September, Hurricane Karl was active in the Atlantic, the twelfth tropical cyclone of the year.

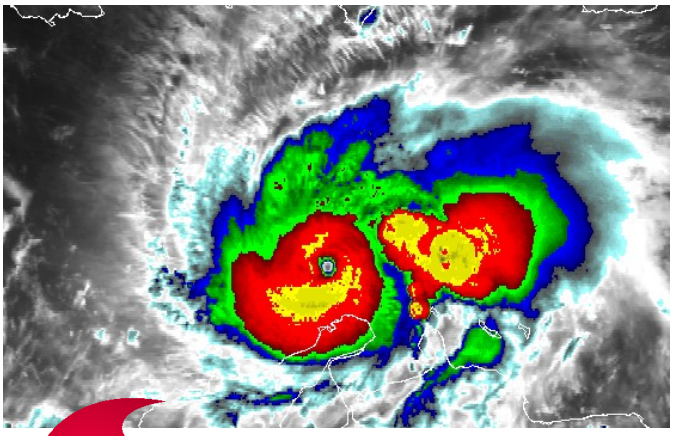
Whilst Karl was not designated as a hurricane operationally, Force Thirteen's analysis showed that Karl did briefly attain hurricane status in the early hours of September 24th as it neared Bermuda, before capitulating and ultimately not affecting the island significantly.

Some tropical storm force winds were reported on the island, and small scale power outages occurred. However, no significant damage occurred.



3.9. Hurricane Matthew

By far the strongest and most damaging storm of the Atlantic in 2016 was Hurricane Matthew, which formed near the end of September over the Lesser Antilles.



Matthew at first sped across the eastern Caribbean before slowing down and rapidly intensifying, becoming a Category 5 hurricane for a four hour period on October 1st.

At around the same time, the storm made its closest approach to the northern tip of Colombia, causing some issues there.

Matthew weakened slightly from its peak, though generally maintained wind speeds of around 150mph until making landfall in Haiti on October 4th. Matthew's eye then disappeared from satellite imagery and further weakening took place, though the eye maintained a solid composure on radar as it made another landfall near the eastern tip of Cuba. For a short period, Matthew lost Category 4 intensity as it passed just north of Cuba, before re-attaining its status as it moved towards the Bahamas.

Matthew peaked with winds of 160mph and a pressure of around 943mb, though the storm's pressure fell until shortly before landfall in Haiti, when it bottomed out at an estimated 933mb, based upon a reconnaissance aircraft reading of 934mb shortly prior.

Hurricane Matthew then passed very close to Nassau, and rounded the western tip of Grand Bahama, still at Category 4 intensity, finally losing its strength for good on October 7th, whilst located barely 50 miles off the coast of Cape Canaveral, Florida. Matthew remained a major hurricane until the next day, when it made its closest approach to Savannah, Georgia, and lost hurricane status late on October 8th near the outer banks of North Carolina.

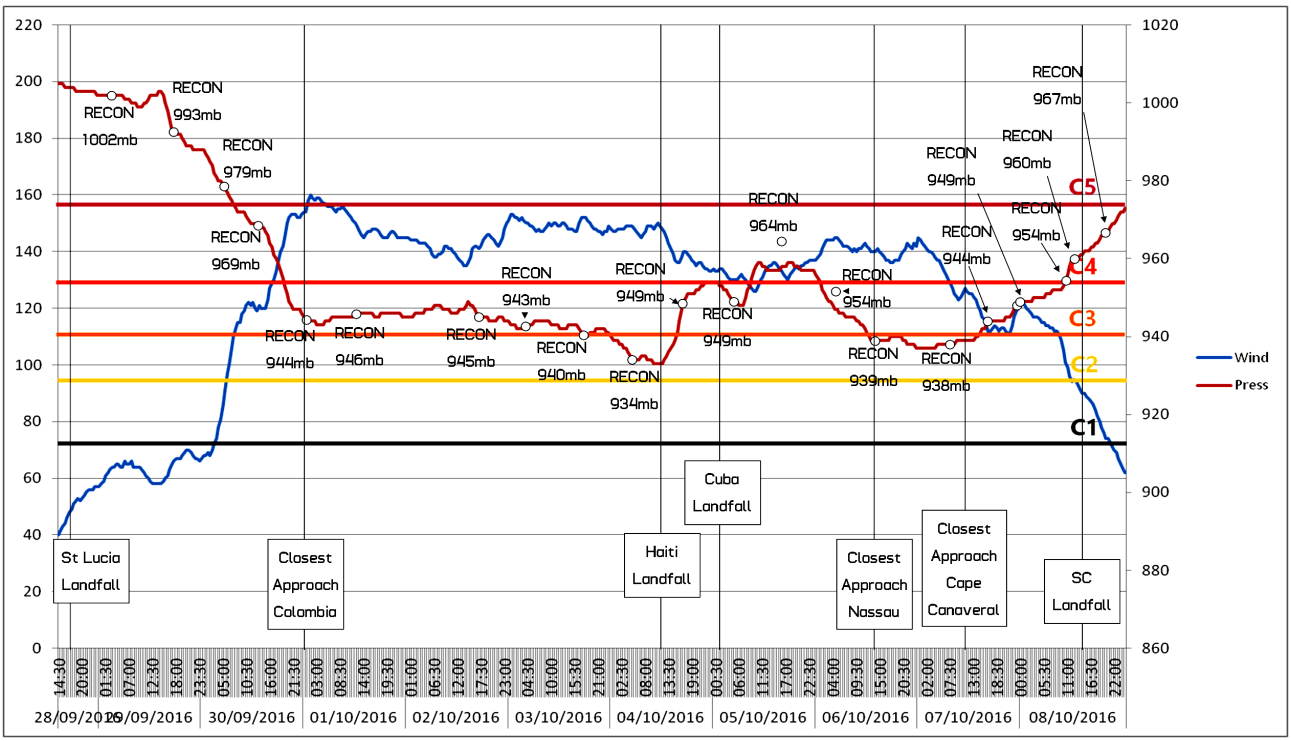


Image: SATOPS analysis of the entire life of Hurricane Matthew, along with reconnaissance aircraft observations. Force Thirteen

3.9. Hurricane Matthew (continued)

Force Thirteen covered Hurricane Matthew extensively, with 11 recorded updates in English, two recorded updates in Spanish, and 106 hours of live coverage on the storm, 104 of those being consecutive to each other.

During Force Thirteen's live coverage of Matthew, the channel served over 216,000 viewers with an estimated approval rating of 95% or higher. At least 20 members of our team contributed to the coverage during the lifespan of Matthew, without whom the coverage would not have been possible to produce on such a comprehensive scale.

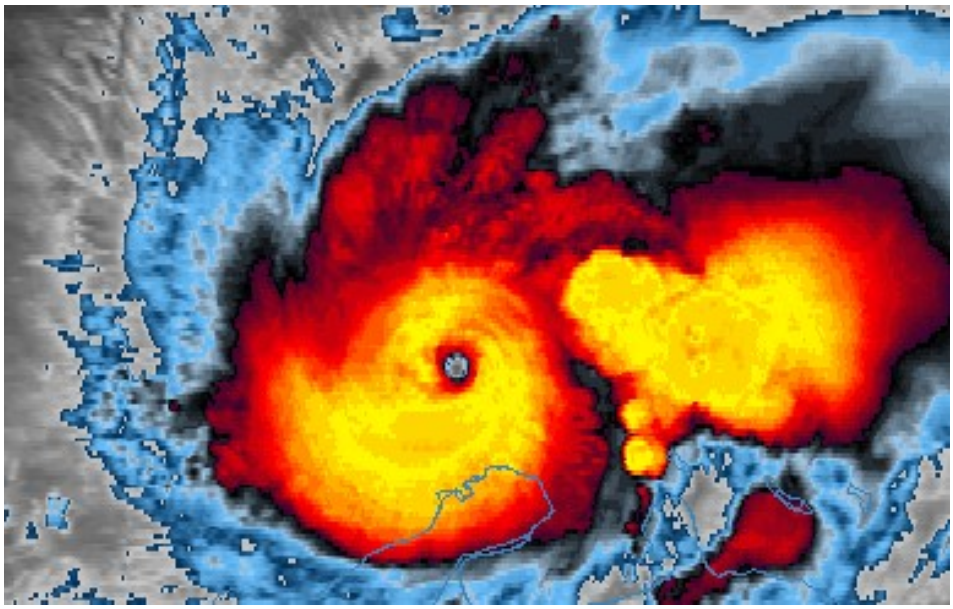


Image: Infrared image of Hurricane Matthew near peak intensity, along with a secondary flare up to the east of the storm.

NOAA Floaters/Force Thirteen Tropical Archive

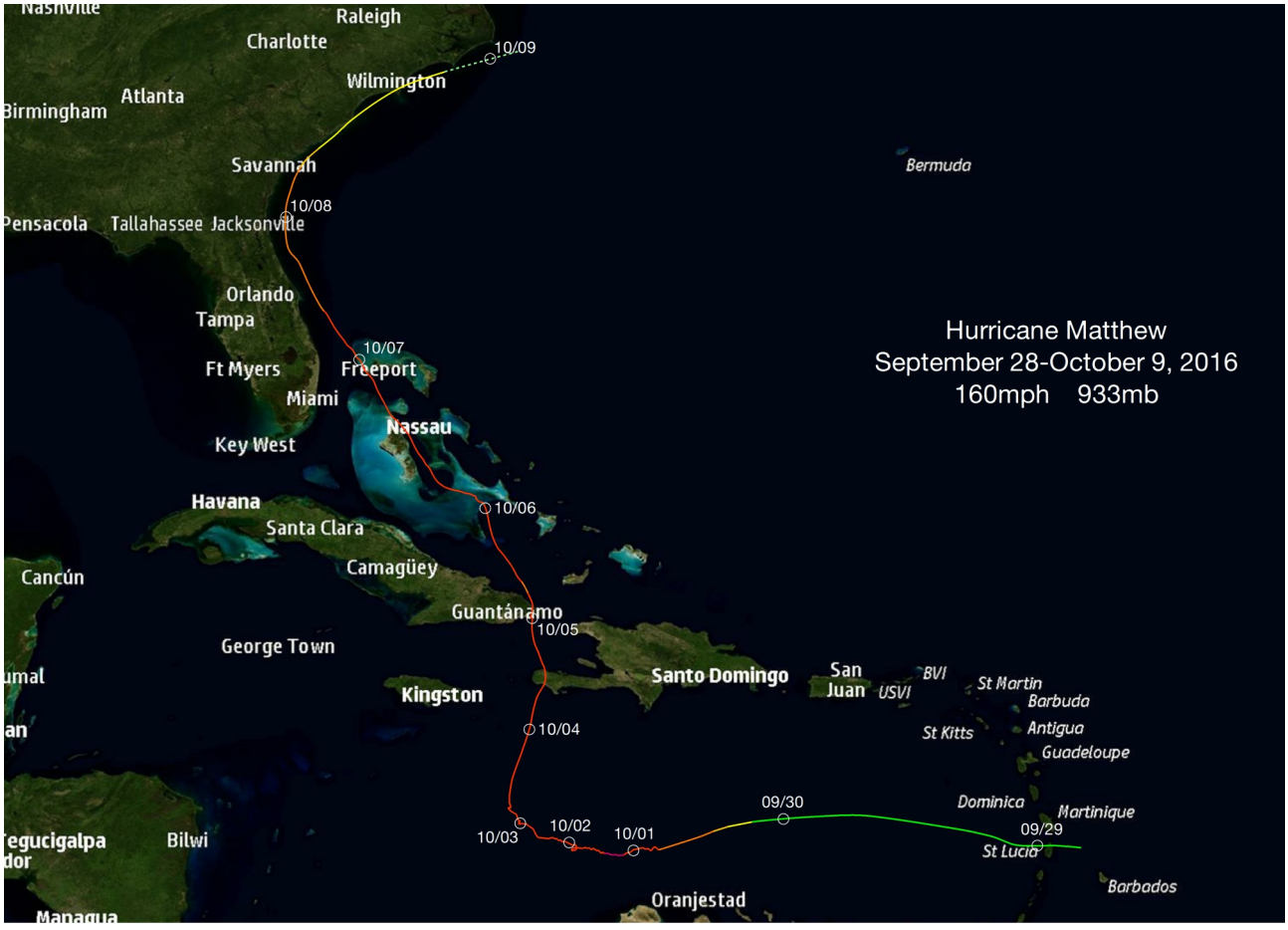


Image: SATOPS analysis of the track and intensity of Hurricane Matthew. Force Thirteen

3.10. Tropical Storm Tina

Tropical Storm Tina was a short lived cyclone in the Eastern Pacific, and dissipated within hours of being designated as a tropical storm.

Tina formed as a tropical depression on November 14th, but strong wind shear affected the storm from the outset, and only managed to attain tropical storm status for approximately one hour until wind shear swept away all of its remaining convective activity.

Tina did persist for a few days afterwards as a remnant low, and turned towards the west away from any landmass.

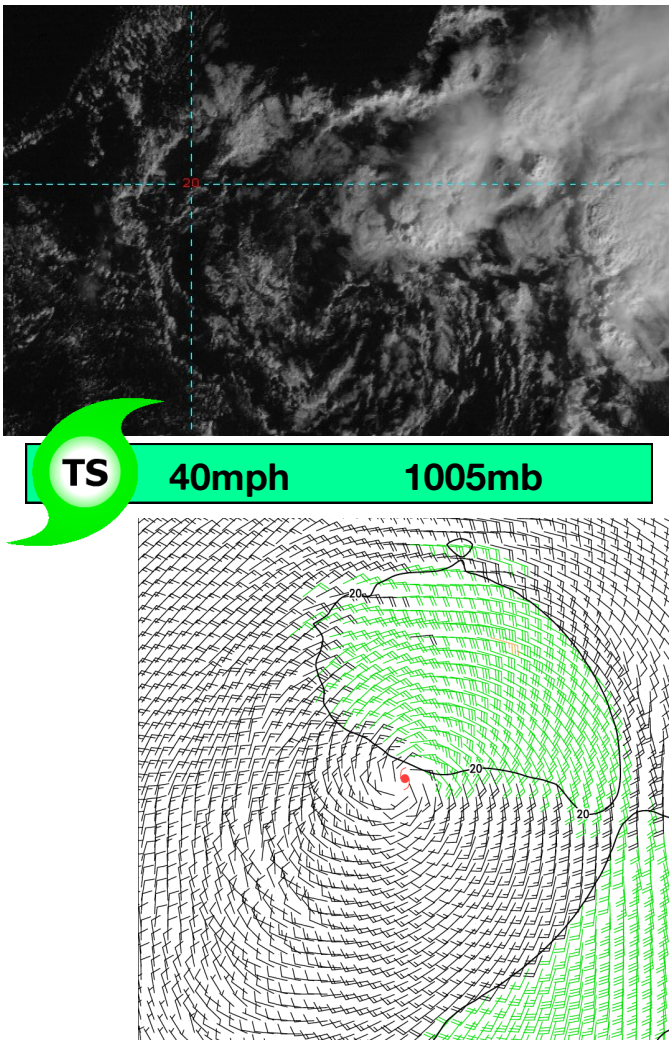
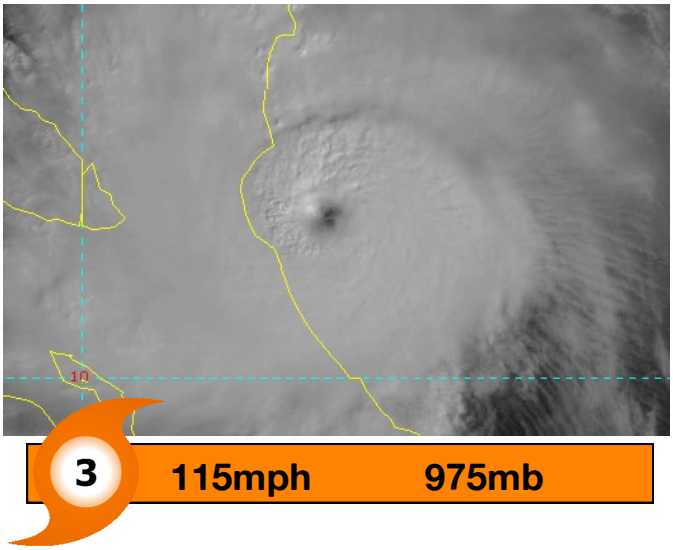


Image: Satellite estimated wind analysis of Tropical Storm Tina, showing 1 wind barb exhibiting tropical storm force winds, out of 1,399 displayed.
RAMMB

3.11. Hurricane Otto

Hurricane Otto was the final storm of the 2016 Atlantic hurricane season, forming just days before the end of the official bounds of the season.



Otto formed on November 21st in the south-western Caribbean Sea, almost mirroring the formation of Hurricane Martha in 1969. However, Otto changed course before reaching Panama, and instead moved westwards, attaining hurricane status briefly on November 23rd, before weakening and re-attaining hurricane status the next day.

Otto then intensified further and peaked briefly as a Category 3 major hurricane on the afternoon of November 24th. Otto then made landfall, resulting in several casualties in Costa Rica and Nicaragua.

Hurricane Otto maintained its status almost until reaching the eastern Pacific, where it finally lost hurricane status and gradually weakened as it moved out to sea, eventually dissipating on November 26th.

Force Thirteen's SATOPS identified Otto to be a Category 3 storm for a two hour period between 15:00 UTC and 17:00 UTC, moments before it made landfall in Nicaragua.

Otto is the second furthest south storm to make landfall as a hurricane in the Atlantic, after an unnamed storm impacted Trinidad and Tobago in 1933.

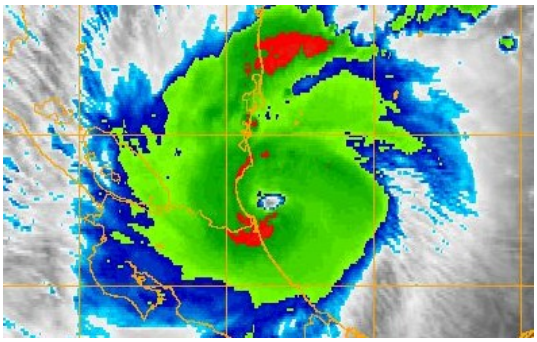


Image: Infrared image of Hurricane Otto near peak intensity on November 24. U.S. Navy

4. 2016 Records

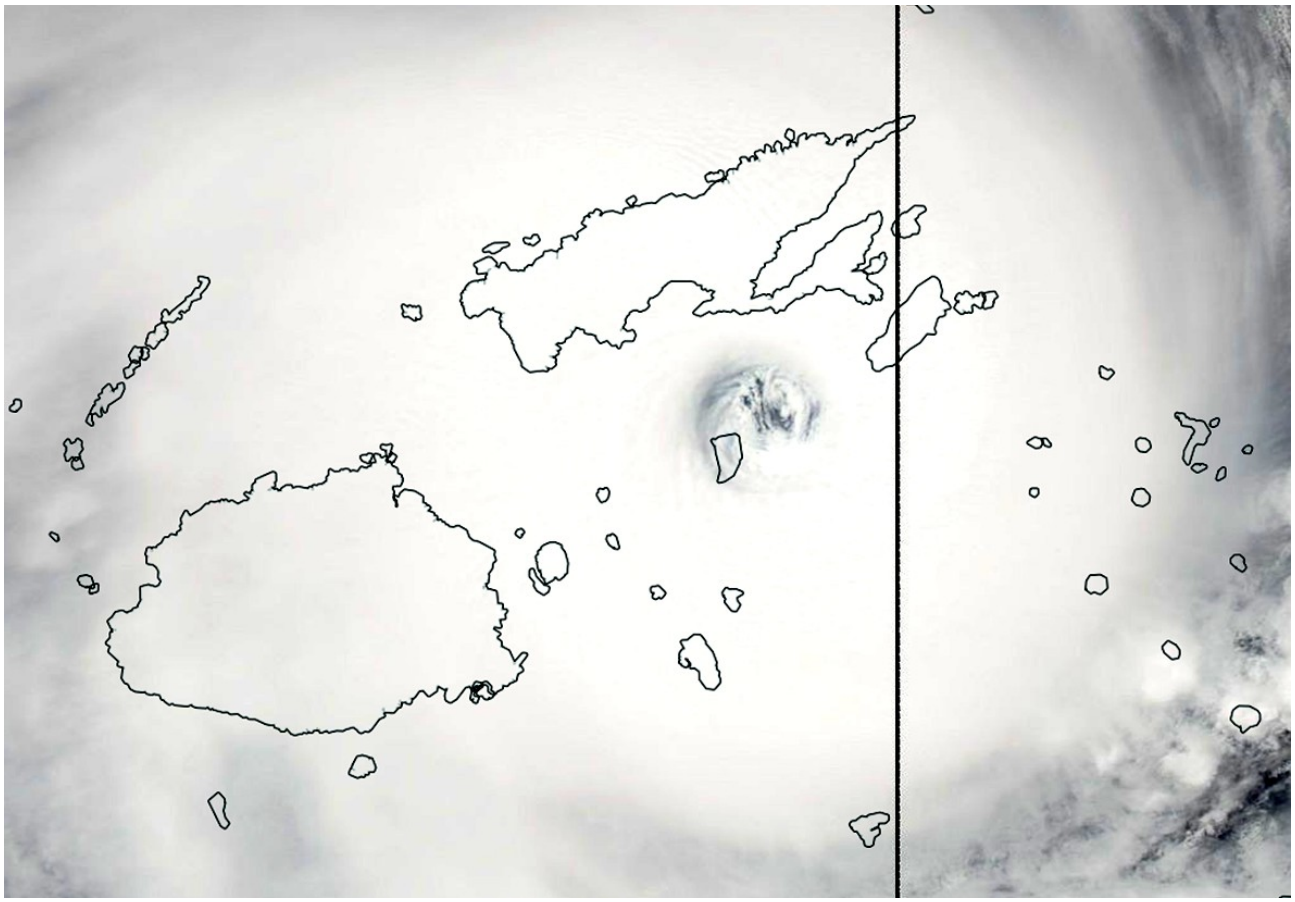


Image: Force Thirteen enhanced image of Cyclone Winston in February 2016, captured by MODIS

Intensity and Longevity Records

The next page will show all the records set in 2016 for intensity and longevity. In the records section of this report, all storms that set their record in 2016 will be counted as part of this year's records, even if they formed or dissipated in a different calendar year. If a storm's record encompasses multiple years (as could be seen in longevity records, for instance), the record will be counted towards both years.

4.1. Intensity and Longevity Records

Most intense central pressures

World

1. Typhoon Meranti	894mb
2. Cyclone Fantala	898mb
3. Typhoon Nepartak	900mb

Atlantic

1. Hurricane Matthew	933mb
2. Hurricane Nicole	950mb
3. Hurricane Gaston	953mb

Eastern Pacific (includes Central)

1. Hurricane Seymour	939mb
2. Hurricane Blas	944mb
=. Hurricane Lester	944mb

Western Pacific

1. Typhoon Meranti	894mb
2. Typhoon Nepartak	900mb
3. Typhoon Haima	905mb

North Indian Ocean

1. Cyclone Vardah	982mb
2. Cyclone Roanu	983mb
3. Cyclone Two	993mb

South Indian Ocean

1. Cyclone Fantala	898mb
2. Cyclone Uriah	925mb
3. Cyclone Emeraude	940mb

South Pacific Ocean

1. Cyclone Winston	905mb
2. Cyclone Ula	945mb
3. Cyclone Victor	960mb

Strongest Wind Speeds

World

1. Typhoon Meranti	180mph
=. Cyclone Fantala	180mph
=. Cyclone Winston	180mph

Atlantic

1. Hurricane Matthew	160mph
2. Hurricane Nicole	130mph
3. Hurricane Gaston	125mph

Eastern Pacific (includes Central)

1. Hurricane Seymour	155mph
2. Hurricane Blas	145mph
=. Hurricane Lester	145mph

Western Pacific

1. Typhoon Meranti	180mph
2. Typhoon Nepartak	175mph
=. Typhoon Haima	175mph

North Indian Ocean

1. Cyclone Vardah	85mph
2. Cyclone Roanu	65mph
3. Cyclone Kyant	60mph

South Indian Ocean

1. Cyclone Fantala	180mph
2. Cyclone Uriah	145mph
=. Cyclone Emeraude	145mph

South Pacific Ocean

1. Cyclone Winston	180mph
2. Cyclone Ula	130mph
3. Cyclone Victor	105mph
=. Cyclone Amos	105mph

Most intense Category 4 storms

World

1. Typhoon Lionrock	925mb
=. Cyclone Uriah	925mb
=. Typhoon Songda	925mb

Strongest 24 hour average wind

World

1. Typhoon Meranti	175.0mph
2. Cyclone Fantala	172.0mph
3. Typhoon Nepartak	170.0mph

Most intense Category 3 storms

World

1. Typhoon Megi	935mb
=. Typhoon Sarika	935mb
3. Typhoon Namtheun	950mb

Most Intense 24 hour average air pressure

World

1. Typhoon Meranti	901.3mb
2. Cyclone Fantala	903.8mb
3. Typhoon Nepartak	906.5mb

Intensity and Longevity Records (continued)

Longest duration as a tropical storm or stronger

World

1. Cyclone Winston	366 hours
2. Cyclone Ula	336 hours
3. Hurricane Nicole	318 hours

Atlantic

1. Hurricane Nicole	318 hours
2. Hurricane Matthew	278 hours
3. Hurricane Gaston	264 hours

Eastern Pacific (includes Central)

1. Hurricane Darby	312 hours
2. Hurricane Lester	294 hours
3. Hurricane Celia	174 hours

Western Pacific

1. Typhoon Lionrock	288 hours
2. Typhoon Malakas	204 hours
3. Typhoon Haima	168 hours

North Indian Ocean

1. Cyclone Vardah	120 hours
2. Cyclone Roanu	84 hours
3. Cyclone Nada	48 hours

South Indian Ocean

1. Cyclone Fantala	312 hours
2. Cyclone Uriah	168 hours
3. Cyclone Emeraude	150 hours

South Pacific Ocean

1. Cyclone Winston	366 hours
2. Cyclone Ula	336 hours
3. Cyclone Victor	198 hours

Longest duration as a Category 5 storm

World

1. Typhoon Meranti	48 hours
2. Typhoon Nepartak	42 hours
3. Cyclone Fantala	30 hours

Atlantic

1. Hurricane Matthew	4 hours

Eastern Pacific (includes Central)

None

Western Pacific

1. Typhoon Meranti	48 hours
2. Typhoon Nepartak	42 hours
3. Typhoon Haima	18 hours

North Indian Ocean

None

South Indian Ocean

1. Cyclone Fantala	30 hours

South Pacific Ocean

1. Cyclone Winston	24 hours

Longest duration at sub-900mb

World

1. Typhoon Meranti	3 hours
=. Cyclone Fantala	3 hours

Longest duration at Category 4 or stronger

World

1. Hurricane Matthew	181 hours
2. Cyclone Fantala	84 hours
3. Multiple storms	60 hours

Longest duration at sub-920mb

World

1. Cyclone Fantala	36 hours
2. Typhoon Nepartak	21 hours
3. Typhoon Meranti	15 hours

Longest duration at Category 1 or stronger

World

1. Cyclone Winston	258 hours
2. Cyclone Fantala	252 hours
3. Hurricane Matthew	236 hours

Longest duration at Category 4 without strengthening

World

1. Hurricane Seymour	24 hours
=. Cyclone Uriah	24 hours
=. Cyclone Ula	24 hours

Longest duration at Category 3 without strengthening

World

1. Hurricane Gaston	36 hours
2. Multiple storms	18 hours

Longest duration at Category 2 without strengthening

World

1. Hurricane Orlene	24 hours
2. Hurricane Pali	12 hours
=. Cyclone Victor	12 hours

Longest duration at Category 1 without strengthening

World

1. Cyclone Vardah	48 hours
=. Typhoon Nida	48 hours
3. Cyclone Corentin	36 hours

Intensity and Longevity Records (continued)

Longest duration at Tropical Storm w/o strengthening

World

1. Tropical Storm Estelle	144 hours
2. Tropical Storm Ivette	120 hours
3. Tropical Storm Fiona	114 hours

Shortest Duration

World

1. Tropical Storm Tina	1 hour
2. Tropical Storm Rai	12 hours
=. Tropical Storm Dianmu	12 hours

Coldest Cloud Tops

World

1. Typhoon Nock-ten	-90.0°C (-130°F)
2. Cyclone Winston	-89.0°C (-128°F)
=. Cyclone Fantala	-89.0°C (-128°F)

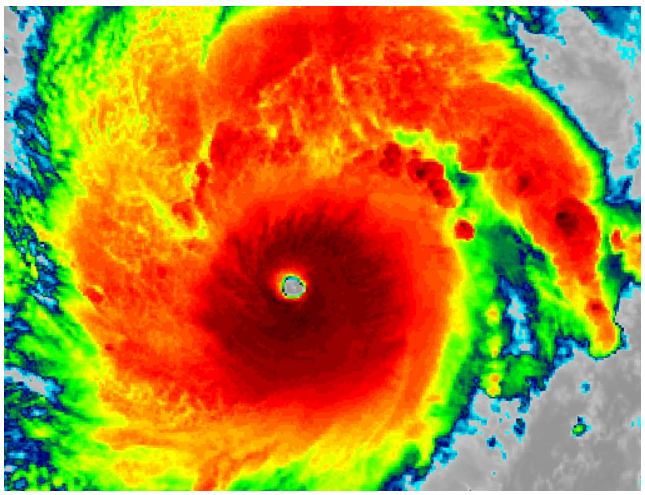


Image: Infrared image of Typhoon Nock-ten. Colder cloud tops indicate thunderstorm activity extending to higher elevations of the atmosphere, and is a significant indicator of how intense an individual thunderstorm is (for storms weaker than Category 3), or an indicator of how strong the whole cyclone is (for storms stronger than Category 3).
Himawari-8

4.2. Activity Records

Most tropical storms or stronger active simultaneously

World

1. Six, on August 19-20
2. Five, on August 30
=. Five, on September 1

Atlantic

1. Three, on September 16

Eastern Pacific (includes Central)

1. Three, on July 21-22

Western Pacific

1. Three, on August 19-20
=. Three, on September 12

North Indian Ocean

1. One, on multiple occasions

South Indian Ocean

1. One, on multiple occasions

South Pacific Ocean

1. Two, on February 10-13

Most Tropical Storms or stronger active in a 30-day period

World

1. Twenty, from August 17-September 16
2. Nineteen, from August 18-September 17
=. Nineteen, from August 19-September 18

Atlantic

1. Seven, from August 22-September 21
2. Six, from August 17-September 16
3. Five, on multiple occasions

Eastern Pacific (includes Central)

1. Eight, from July 2-August 1
2. Six, from July 6-August 5
=. Six, from August 26-September 25

Western Pacific

1. Thirteen, from August 13-September 12
2. Twelve, from July 23-August 22
=. Twelve, from July 25-August 24

North Indian Ocean

1. Two, from November 29-December 29

South Indian Ocean

1. Four, from January 21-February 20
2. Three, from March 15-April 14
3. Two, on multiple occasions

South Pacific Ocean

1. Three, from January 14-February 15
=. Three, from February 10-March 11

Most hurricanes active simultaneously

World

1. Four, on August 29
=. Four, on September 1-2

Most hurricanes active in a 30-day period

World

1. Fourteen, from August 25-September 24
=. Fourteen, from August 29-September 28

Most Category 3 storms active simultaneously

World

1. Three, on August 29
2. Two, on multiple occasions

Most Category 3s active in 30-day period

World

1. Eight, from September 27-October 27

Most Category 4 storms active simultaneously

World

1. Two, on July 5-6
=. Two, on October 3-4

Most Category 4s active in 30-day period

World

1. Eight, from September 27-October 27

Most consecutive days with a tropical storm active

World

1. Forty-two, from September 10-October 21
2. Twenty-eight, from August 10-September 7
3. Twenty-seven, in January and July

Most consecutive days with two tropical storms active

World

1. Thirty-nine, from September 11-October 19
2. Twenty-two, from August 17-September 7
3. Sixteen, from July 12-27

Activity Records (continued)

Most consecutive days with a hurricane active **World** 1. Sixteen, from January 8-23 =. Sixteen, from August 22-September 7 2. Thirteen, from April 12-24	Most consecutive days with two hurricanes active **World** 1. Nine, from August 27-September 4 2. Eight, from October 11-18 3. Seven, from October 1-7
Most consecutive days with a major hurricane active **World** 1. Ten, from August 24-September 2 2. Nine, from September 30-October 8	Most consecutive days with two major hurricanes active **World** 1. Five, from August 29-September 2 2. Three, on multiple occasions

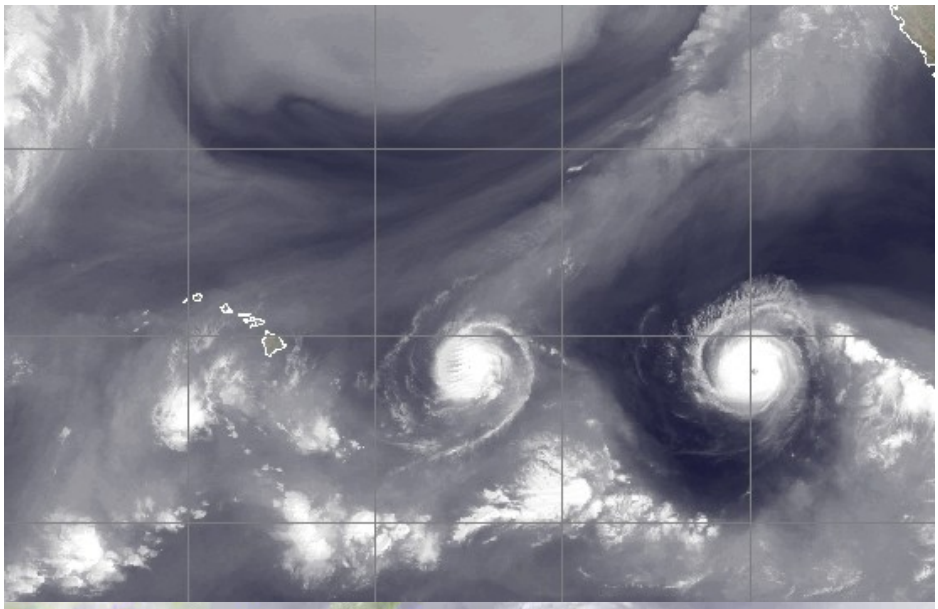


Image: Water vapour imagery of Hurricanes Lester and Madeline in the Eastern Pacific, accompanied by another disturbance to the west on August 29.
UW-CIMSS

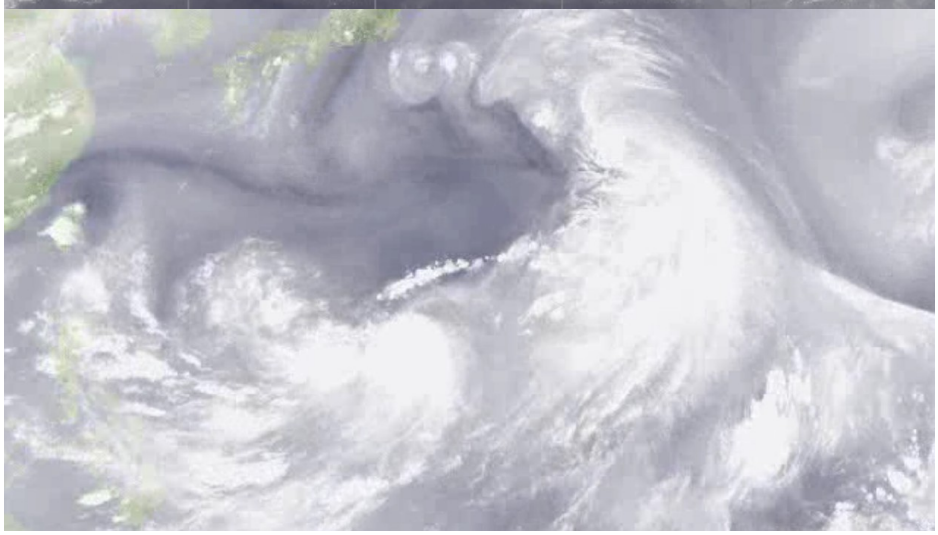


Image: Water vapour imagery of Tropical Storms Dianmu, Mindulle and Lionrock, with Kompasu also becoming named shortly after this image was taken.
August 19, 2016
Himawari-8

4.3. Landfall Records

Strongest landfalls

World

1. Typhoon Meranti	180mph
2. Cyclone Winston	165mph
3. Hurricane Matthew	150mph
=. Typhoon Nock-ten	150mph

Most landfalls

World

1. Typhoon Nock-ten	5
2. Hurricane Matthew	4
=. Tropical Storm Tokage	4

Most hurricane landfalls

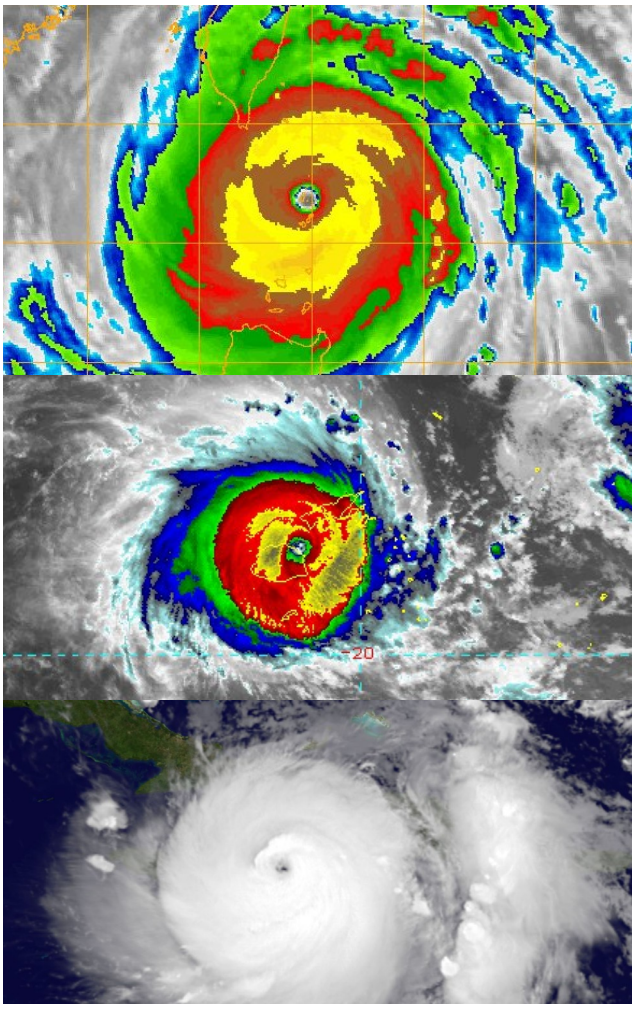
World

1. Typhoon Nock-ten	5
2. Hurricane Matthew	3
3. Multiple storms	2

Most major hurricane landfalls

World

1. Typhoon Nock-ten	2
=. Hurricane Matthew	2



Landfall totals for 2016

Tropical Depressions	2	(45)
Tropical Storms	18	(43)
Category 1	12	(25)
Category 2	1	(13)
Category 3	2	(12)
Category 4	8	(10)
Category 5	2	(2)

Storm-landfall intensity ratios

Tropical Depressions	52%
Tropical Storms	52%
Category 1	56%
Category 2	39%
Category 3	46%
Category 4	45%
Category 5	25%

Images from top to bottom:
1. Infrared imagery of Typhoon Meranti making landfall on the island of Itbayat on September 13.
US Navy
2. Infrared imagery of Cyclone Winston making its landfall in Fiji on February 20.
RAMMB
3. GOES-13 image of Hurricane Matthew shortly before landfall in Haiti on October 4.
NASA

4.4. Eye and Size Records

Largest Eyes

World

1. Typhoon Sarika	175nm
2. Typhoon Nida	117nm
3. Typhoon Haima	114nm

Smallest Eyes

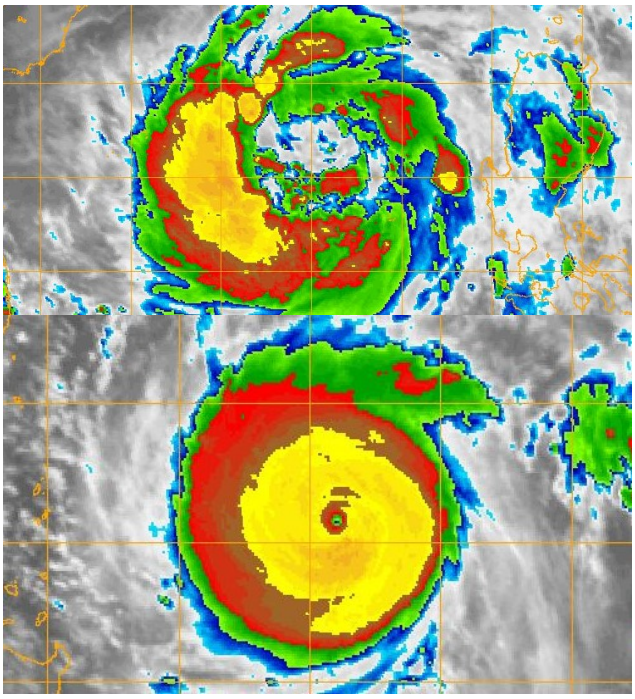
World

1. Typhoon Nepartak	7nm
2. Typhoon Nock-ten	12nm
=. Hurricane Otto	12nm

Warmest Eyes

World

1. Typhoon Nepartak	22.0°C (71.6°F)
2. Typhoon Meranti	21.0°C (69.8°F)
3. Typhoon Nock-ten	17.0°C (62.6°F)



Images from top to bottom:
1. Infra-red image of Typhoon Sarika displaying its 175nm wide eye, and potentially two other circulations within it for a brief spell.
2. Infra-red image of Typhoon Nepartak shortly before beginning an eyewall replacement cycle, displaying an eye diameter of around 7nm.
U.S. Navy

Largest Storm Size

World

1. Cyclone Corentin	290nm
2. Hurricane Nicole	280nm
3. Cyclone Victor	260nm
4. Cyclone Uriah	210nm

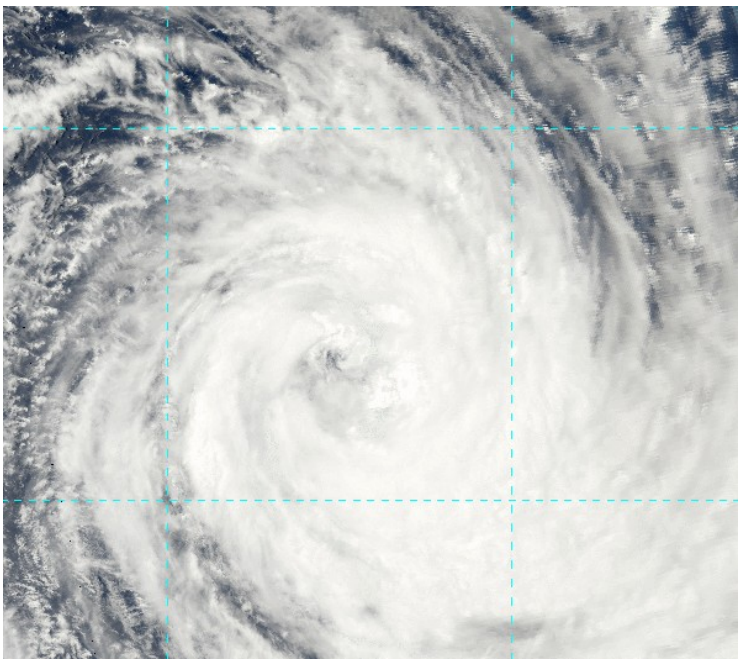


Image: Natural-colour visible image of Cyclone Corentin, believed to have the largest wind radius in 2016.
AQUA

4.5. Intensification Records

Fastest over a 12 hour period

World

1. Hurricane Matthew	+70mph
2. Typhoon Meranti	+50mph
3. Typhoon Nock-ten	+45mph
=. Typhoon Songda	+45mph
=. Cyclone Winston	+45mph

Fastest over a 24 hour period

World

1. Typhoon Meranti	+95mph
2. Typhoon Nepartak	+85mph
3. Hurricane Matthew	+80mph
4. Cyclone Emeraude	+75mph
5. Cyclone Ula	+65mph

Fastest time to increase wind speeds by 100mph

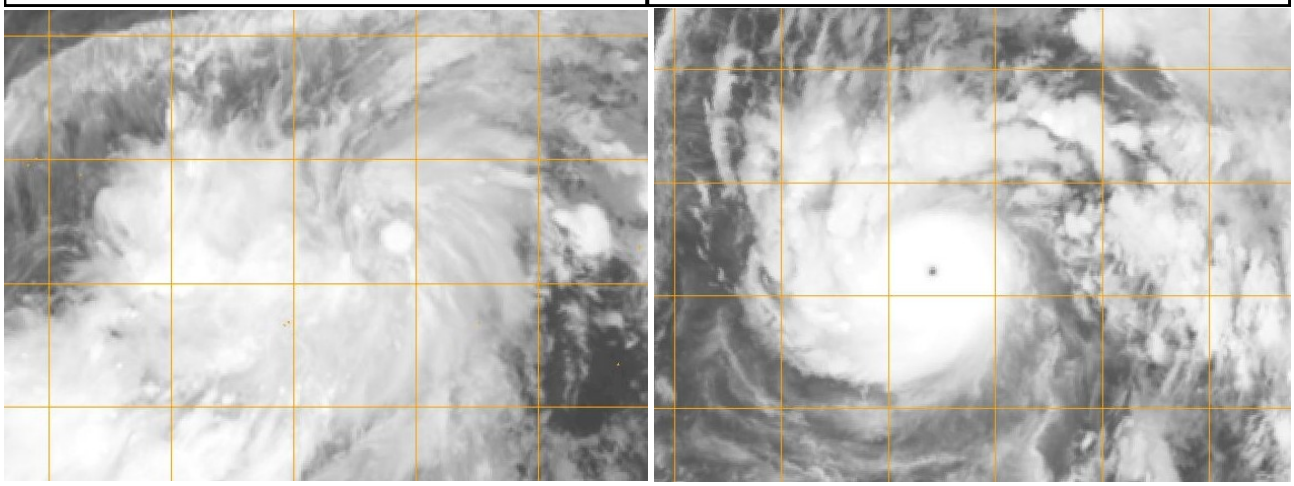
World

1. Typhoon Nepartak	30 hours
=. Typhoon Meranti	30 hours
=. Typhoon Nock-ten	30 hours

Fastest time to decrease pressure by 100mb

World

1. Typhoon Nepartak	54 hours



Above: Comparison images of Typhoon Nepartak. The first image was taken at 02:00Z on July 3rd, when Nepartak was a tropical depression. The second image was taken at 21:00Z on July 5th, as it attained Category 5 intensity, 67 hours after the first image.

4.6. Damages

Costliest storms (USD)

World

1. Hurricane Matthew	$10,580,000,000
2. Typhoon Meranti	$2,630,000,000
3. Cyclone Vardah	$2,000,000,000

Atlantic

1. Hurricane Matthew	$10,580,000,000
2. Hurricane Earl	$250,000,000
3. Hurricane Otto	$34,000,000

Eastern Pacific (includes Central)

1. Hurricane Newton	$96,000,000

Western Pacific

1. Typhoon Meranti	$2,630,000,000
2. Typhoon Nepartak	$1,520,000,000
3. Typhoon Sarika	$755,000,000

North Indian Ocean

1. Cyclone Vardah	$2,000,000,000
2. Cyclone Roanu	$1,700,000,000

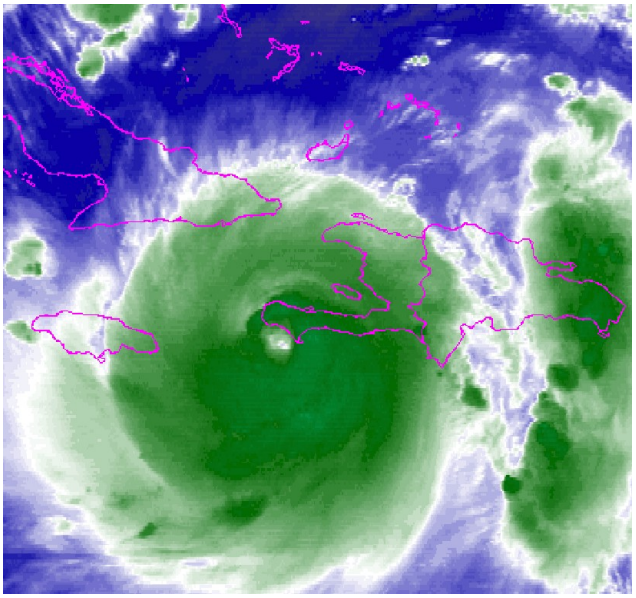
South Indian Ocean

1. Cyclone Fantala	$4,500,000

South Pacific Ocean

1. Cyclone Winston	$1,400,000,000

Image: Hurricane Matthew shortly before its landfall in Haiti, causing most of its damages and fatalities there.
NOAA Floaters



Buildings Damaged

World

1. Hurricane Matthew	200,600
2. Typhoon Nock-ten	92,070
3. Typhoon Haima	76,071

Most landslides

World

1. Hurricane Earl	3
=. Hurricane Otto	3
2. Multiple storms	1 each

Buildings Destroyed

World

1. Typhoon Aere	93,000
2. Hurricane Matthew	45,004
3. Typhoon Nock-ten	31,526

Most tornadoes

World

1. Hurricane Hermine	1
=. Tropical Storm Julia	1

Most fatalities

World

1. Hurricane Matthew	1,659
2. Typhoon Lionrock	550
3. Cyclone Roanu	227

Largest storm surge

World

1. Cyclone Winston	16 feet
2. Hurricane Earl	11 feet
3. Cyclone Roanu	7 feet

Most injuries

World

1. Typhoon Megi	625
2. Hurricane Matthew	442
3. Cyclone Winston	141

Largest rainfall totals

World

1. Typhoon Aere	747mm
2. Hurricane Hermine	568mm
3. Typhoon Malakas	445mm

5. Force Thirteen during 2016

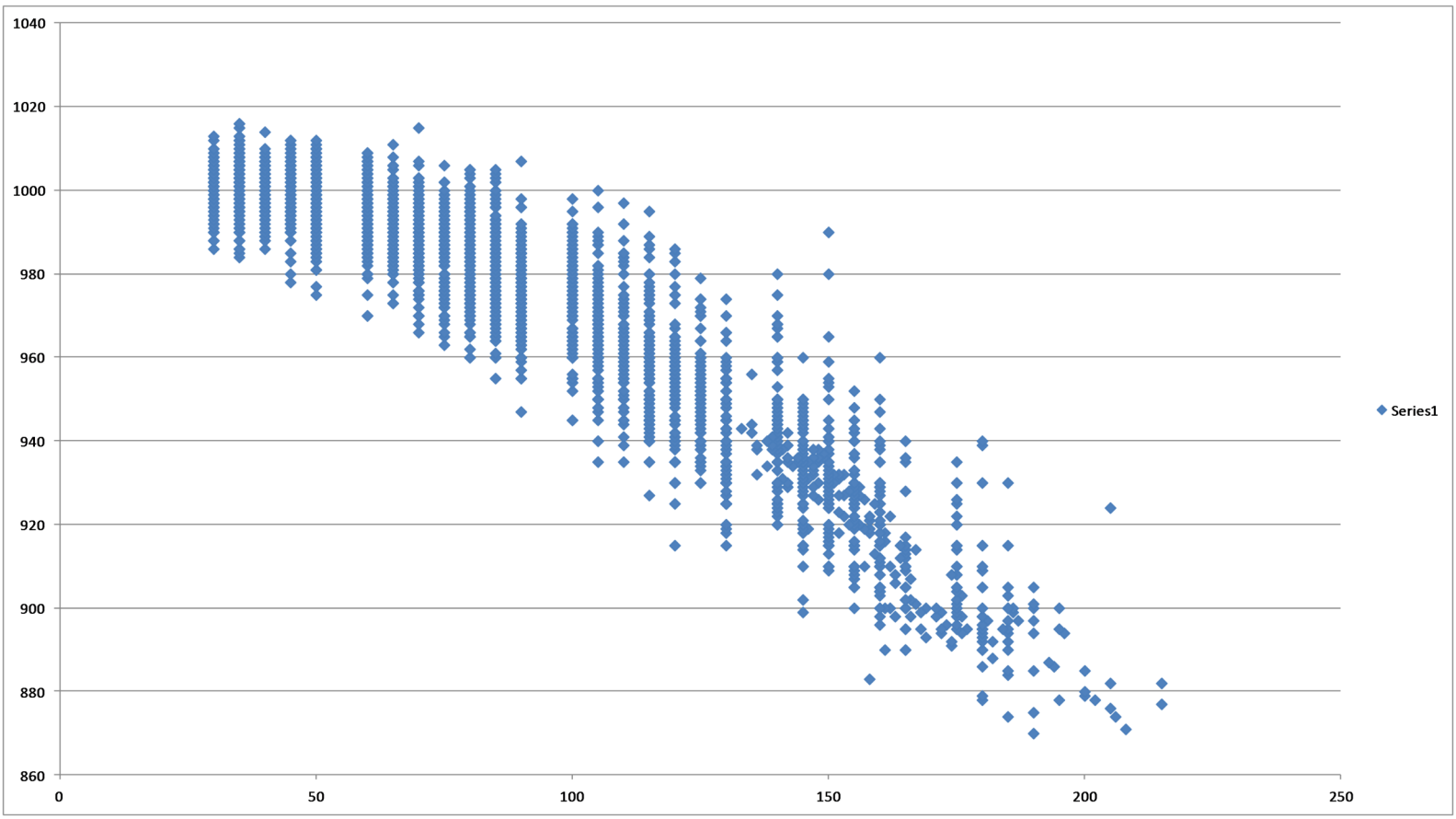


Image: One of Force Thirteen's projects examines the trend between the wind-pressure relationships of storms at peak, based on our database which has so far catalogued over 12,500 storms from 1500-2016.

Another strong year for the project

2016 was the second year in which Force Thirteen had an established team and tracked storms in real time with its live streaming service. This year, the project made breakthroughs in attracting a wider audience, particularly during its coverage of Hurricane Matthew, and with other cyclones worldwide. Additionally, new ideas and team members have contributed greatly to the format, presentation, and quality of the coverage that we have shown in 2016.

As a broadcaster, our reach is important, though we never go out of our way to attain peak numbers at the expense of quality broadcasting. In any case, 2016 sets a new record for amount of views on the Force Thirteen YouTube channel. The website was continually worked on throughout the year, and became very useful at times, with the implementation of the Storm Early Warning Service, the operational tracker, UK and Philippine weather warning charts, and usage during Hurricane Week 2016.

In 2016, the Force Thirteen YouTube channel received a 95% approval rating.

All of these aspects, and a critique of our actual coverage, will be covered in further detail in this section of the report.

5.1 Forecasting Critique and Storm Coverage

In total, there were 354 videos uploaded on the Force Thirteen main channel throughout 2016, which was 20 less than in 2015 due to less storm activity. There were also 14 video updates on Force Thirteen Xtra, 2 on Force Thirteen UK & Ireland, 26 on Force Thirteen AU & Oceania, 6 on Force Thirteen US & Caribbean, 6 on Space Thirteen, and 132 on Force Thirteen's Tropical Archive.

Most storms were covered satisfactorily, building upon the progress of last year. The Force Thirteen tracker was automated in 2015 and was always up to date throughout 2016. Video uploads were issued in a timely manner when conditions warranted on the vast majority of occasions.

In August 2016, Force Thirteen HQ personnel took a vacation, coinciding with the formation of Hurricane Earl. However, unlikely previous occasions in 2015, coverage was satisfactory during the life of Earl.

The most impressive part of the year was during Force Thirteen's streaming service, when the team broadcasted for 104 consecutive hours during the life of Hurricane Matthew. This was received very well by the public, some of whom regarded us as invaluable for our dissemination of information.

Force Thirteen's targets remain well defined. Our primary targets consist of these:
- To provide social media and website updates about every storm on a regular basis
- To provide at least 12 hourly video updates during a significant landfall event (Category 1+)
- To provide at least 6 hourly, but preferably live streaming video updates during critical landfall events (Category 3+)
- To respond to concerned members of the public with their queries on all mediums that we have a platform on. These are via direct e-mail, the Force Thirteen website, Facebook, Twitter, YouTube, Soundcloud, WhatsApp, QQ Messenger, WeChat, and face to face interaction.
- To create annual animations of the season passed, in all world basins except the South Atlantic.

Force Thirteen's targets and priorities do NOT include the following:
- Hypothetical Hurricane Seasons
- Past season animations
- South Atlantic animations
- What might have been animations
- Anything else not covered in the targets

Public opinion, to our knowledge, has been very positive. Our approval rating on videos in 2016 was 94% in the United States; 97% in the United Kingdom, and 99% in Australia.

Our storm coverage could be improved by the following:
- Continued improvements with graphics during updates
- Backup for Jason with website programming and design, as well as on the streaming page
- More natural and experienced presenters and storm experts

Other parts of the project could be improved, as stated on our Operations page:
http://www.force-13.com/operations.html

5.2 Viewing Statistics

2016 had approximately 1,111,740 views on the channel during the year. This figure may be inaccurate by up to 2,000 each way.
By comparison, 2015 finished with 612,519 views, barely half of what was seen in 2016.
2016 also set new records for most views received in a single day—115,202—which occurred on October 5th during Hurricane Matthew. The days before and after also beat the previous record, with 71,997 and 88,333 views respectively.

2016 also set a new record for most days in a row with over 1,000 views, which is still in progress as of January 1, 2017. Every day from May 25, 2016 to January 1, 2017 has received over 1,000 views, beating the previous record of 30 days.

In terms of watch time (amount of minutes viewers spent viewing the videos), 2016 also comes out on top, with at least 4,050,972 minutes of viewing time, collectively. In 2015, this number was only 1,499,886 , and 1,266,345 in 2014.

In 2016, approval rate also reached a new record, with 7030 likes compared to 3372 last year. Typically, as videos enter a more mainstream focus, the disapproval rate has also been the highest on record this year, with 367 dislikes compared to 247 last year.

In 2016, comments on YouTube videos amounted to 102,659, compared to 16,311 in 2015. This is nearly a ten-fold increase upon last year, which in itself was a near ten-fold increase upon 2014.

The subscriber base has grown by 2,469 in 2016, compared to 966 in 2015. Most of this growth can be attributed to the development of Hurricane Matthew. Indications show that had Matthew not occurred, growth would have been similar to what was seen in 2015.

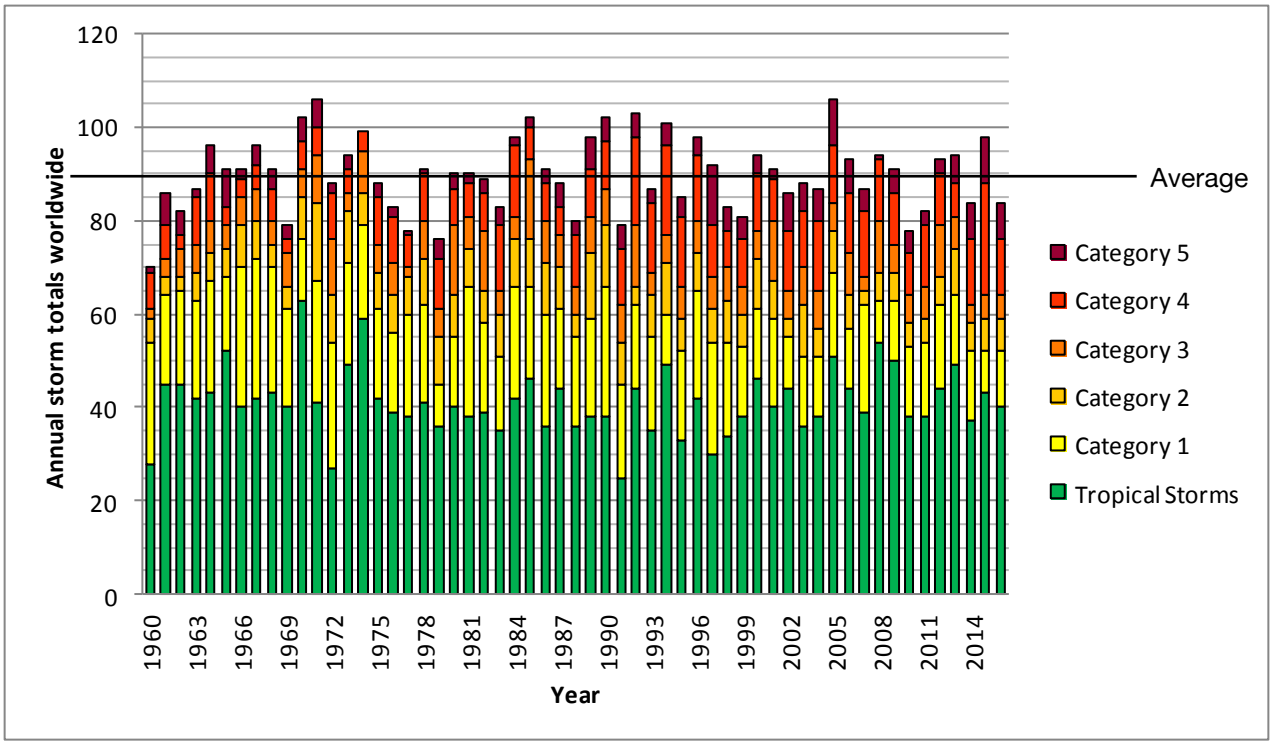
The Force Thirteen website saw 79,798 views from 23,686 visitors throughout the year.

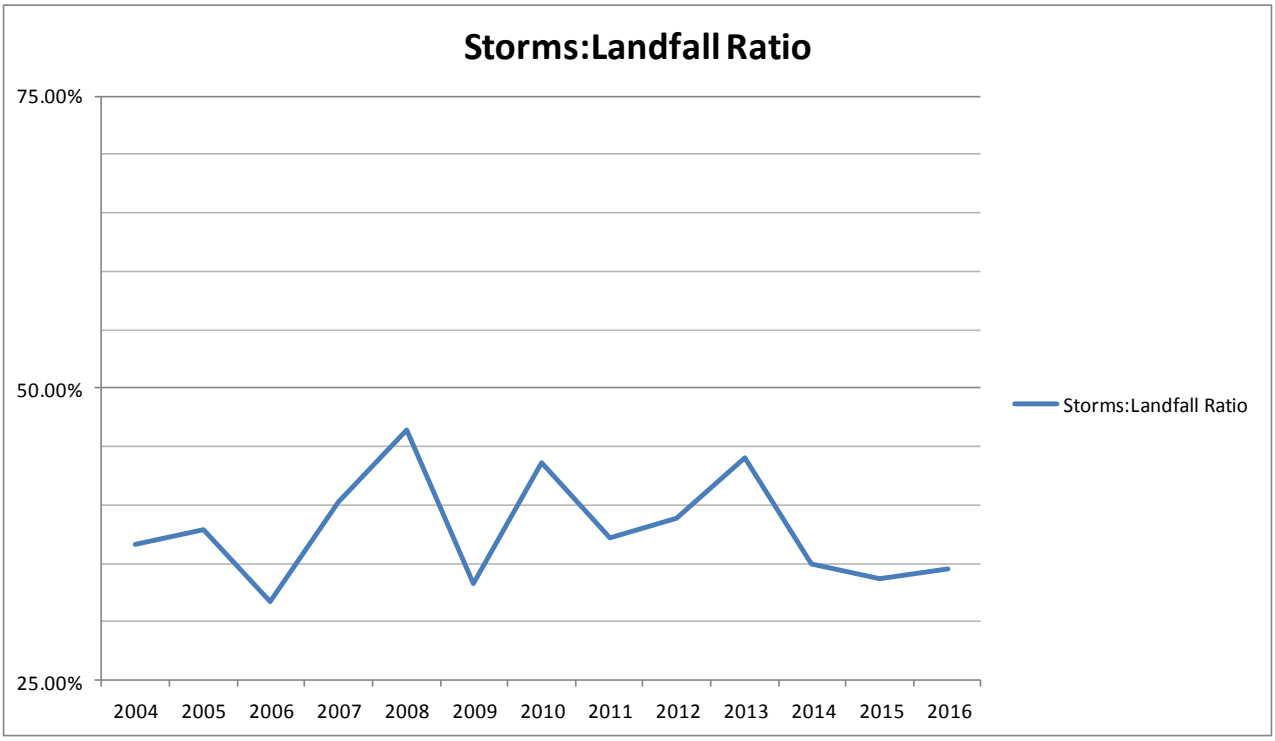
Below shows a table of the top ten countries by viewing numbers compared to 2015.

Country	2016	2015
United States	600,701	221,297
Philippines	86,258	77,049
United Kingdom	52,676	35,298
Canada	32,505	17,342
Puerto Rico	25,508	6,064
Mexico	19,993	18,466
Australia	17,155	20,824
Dominican Republic	16,929	1,809
Jamaica	14,692	755
Taiwan	14,016	8,977

6. Long Term Trends

2016 finished with a total of 87 tropical storms, which is slightly below the long-term average of 90.8
2016 also finished with 25 major hurricanes (or local equivalent), slightly above the 1970-2010 average of 23.





The lower graphic shows the storm to landfall ratio from 2004-2016. Typically, there is between a 35-45% chance of any given storm making landfall during its lifetime.

7. Ways to contact Force Thirteen

There are many ways to contact Force Thirteen. If you are seeking to contact a particular person on the team, please send an e-mail to force-13@hotmail.co.uk

E-mail address: force-13@hotmail.co.uk
Website: www.force-13.com
YouTube: Forcethirteen
Facebook: ForceThirteen
Twitter: @ForceThirteen
Skype: Fool13
Soundcloud: Sound Thirteen