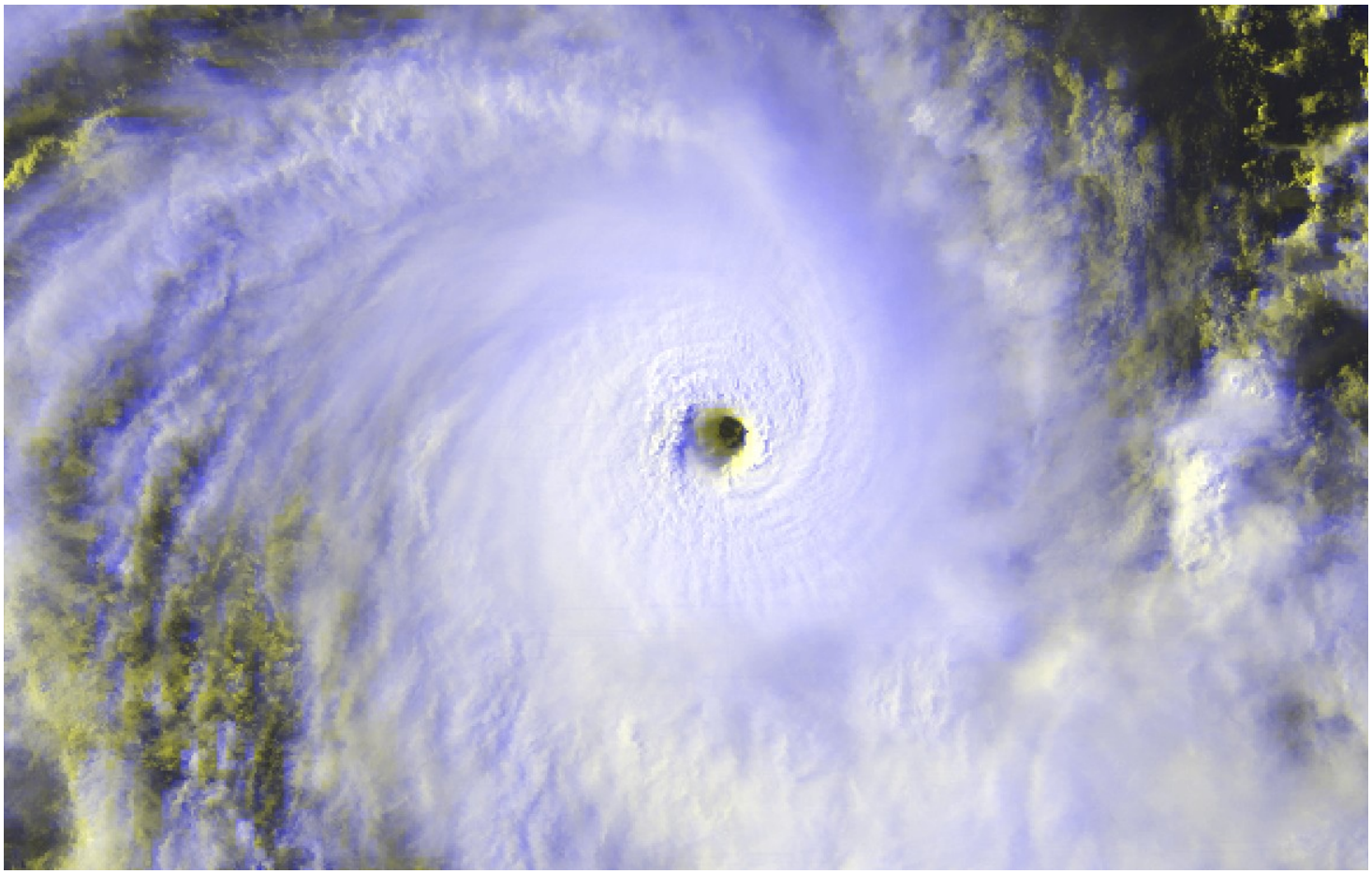
2017 Force Thirteen World Cyclone Report



A report on all cyclones that formed in 2017, with detailed season statistics and records that were achieved worldwide this year.

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Cover photo: Himawari-8 Visible-RGB image of Cyclone Ernie at peak intensity on April 7, 2017
Below photo: GOES-16 True Color image of Hurricane Jose whilst stalling off the US East Coast on September 20, 2017.

Contents

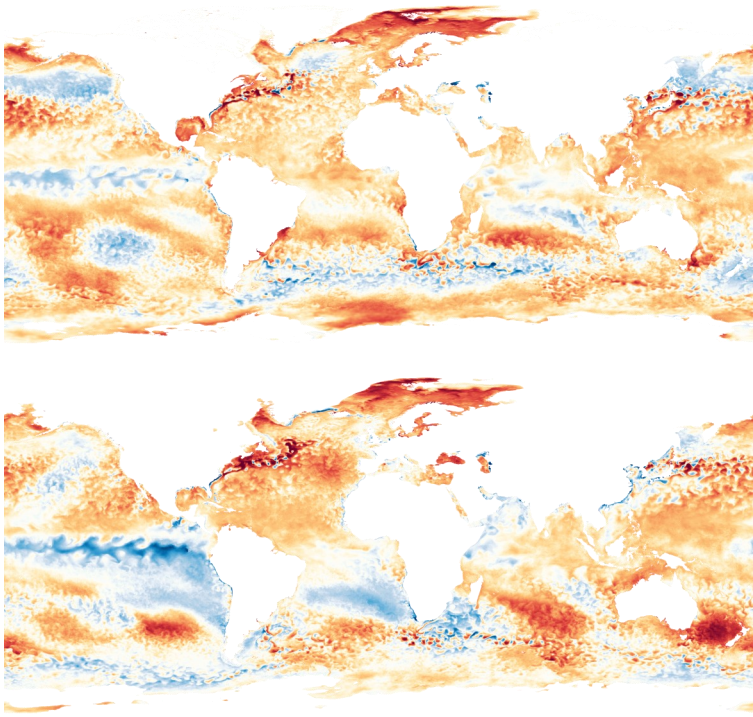
1.1. 2017 in Summary

Activity in 2017 has been near average, influenced by neutral ocean temperature anomalies to begin with, developing into a La Nina event late on in the year. Worldwide storm numbers have been slightly below average.
The West Pacific ocean suffered from these conditions, much as it did in 2010 and 1998. Conversely, the Atlantic benefitted, producing the 7th highest ACE (Accumulated Cyclone Energy) recorded in the basin.

This year saw 96 tropical cyclones, of which 87 were tropical storms, 41 of hurricane strength, and 21 of major hurricane strength.
This compares to 94, 87, 47 and 25 last year, a slight change to what was reported in last year's report due to reanalysis.

Water temperatures and climatological analog years suggested an uptick in activity in the Atlantic Main Development Region, the Philippine Sea, and the South China Sea. The former and latter clearly verifying with a number of intense Atlantic storms, and record high activity in the South China Sea. The Philippine Sea, whilst not as productive, did serve reliably as a cyclonegenesis region, breeding eight cyclones.

The year began incredibly slowly, not seeing its first nameable storm until January 27, and the first storm not being named until February 4. By some criteria, it was the latest formation date for the first storm of the year since 1928.
By February 27, worldwide ACE was the lowest to-date since 1931, before it began to recover.



Top image: Sea Surface Temperature anomalies in January 2017, versus the lower image, showing SST anomalies in December 2017. The images best show the development of the La Nina from the beginning to the end of the year.

March became a pivotal month of the year, when two landfalling major cyclones—Enawo and Debbie—impacted Madagascar and eastern Australia. In April, Cyclone Ernie was the world's only major cyclone, explosively intensifying into a Category 5 storm, but losing its intensity just as quickly. The month of May saw major cyclone Donna threaten Vanuatu and New Caledonia, where significant damage was reported in more isolated localities.

Near the end of May, Force Thirteen released its predictions for the year, calling for 15 named storms in each the Atlantic and Eastern Pacific basins. Both basins exceeded this prediction by three. In the Western Pacific, 25 storms were expected, and 5 in the North Indian Ocean. The predictions also called for a 95% chance of above average activity in the South China Sea, and a high chance of significant storm activity on one or both sides of Mexico.

The rest of the year is probably best mentioned independently of the first five months, as activity levels drastically increased. In the Atlantic, six hurricanes in a row caused serious issues in the Caribbean and United States, mostly in the form of Hurricane Harvey, Irma, and later on by Maria.
Hurricane Harvey delivered devastating flooding to Texas after making landfall as a Category 4 in August, becoming one of the costliest cyclones on record.
Hurricane Irma delivered 8 Category five landfalls throughout the Caribbean, more than any other cyclone in history, and accounting for over a quarter of all Category five landfalls worldwide in the last twenty years.
Hurricane Irma made the most intense known landfall on any of the Lesser Antilles when it arrived in Barbuda, narrowly surpassing a hurricane that struck Guadeloupe in 1825. Along with Maria, it is the first time that two major hurricanes have struck the Lesser Antilles since 1899, and the second time since 1780.
Hurricane Ophelia, later in the year, came within 12 hours of striking Ireland as a fully tropical hurricane, but lost its status shortly before arriving. It maintained much of its strength, however, and caused a severe impact.

In the Eastern Pacific, Hurricane Dora became the first hurricane to be captured by the new GOES-16 satellite which was launched earlier in the year. This was followed by two major hurricanes, including the strongest of the year, Fernanda, which almost reached Category 5 status.

Other major hurricanes of the year in the Eastern Pacific were Kenneth and Otis, which explosively intensified in an unlikely location without supportive sea surface temperatures. Landfalling storms of the year were Beatriz, Calvin, Lidia, Max, and Selma.

The Western Pacific saw no less than twenty-one tropical cyclones enter the South China Sea, believed to be the highest number recorded and certainly the highest in the satellite era. Thirty-four cyclones formed in total in the basin, with eleven becoming typhoons. The strongest storms were Typhoon Noru, whose erratic track lasted for nearly three weeks including a brief Category 5 peak; and Typhoon Lan, which became the strongest storm of the year as it traversed northwards out at sea, eventually reaching Japan.

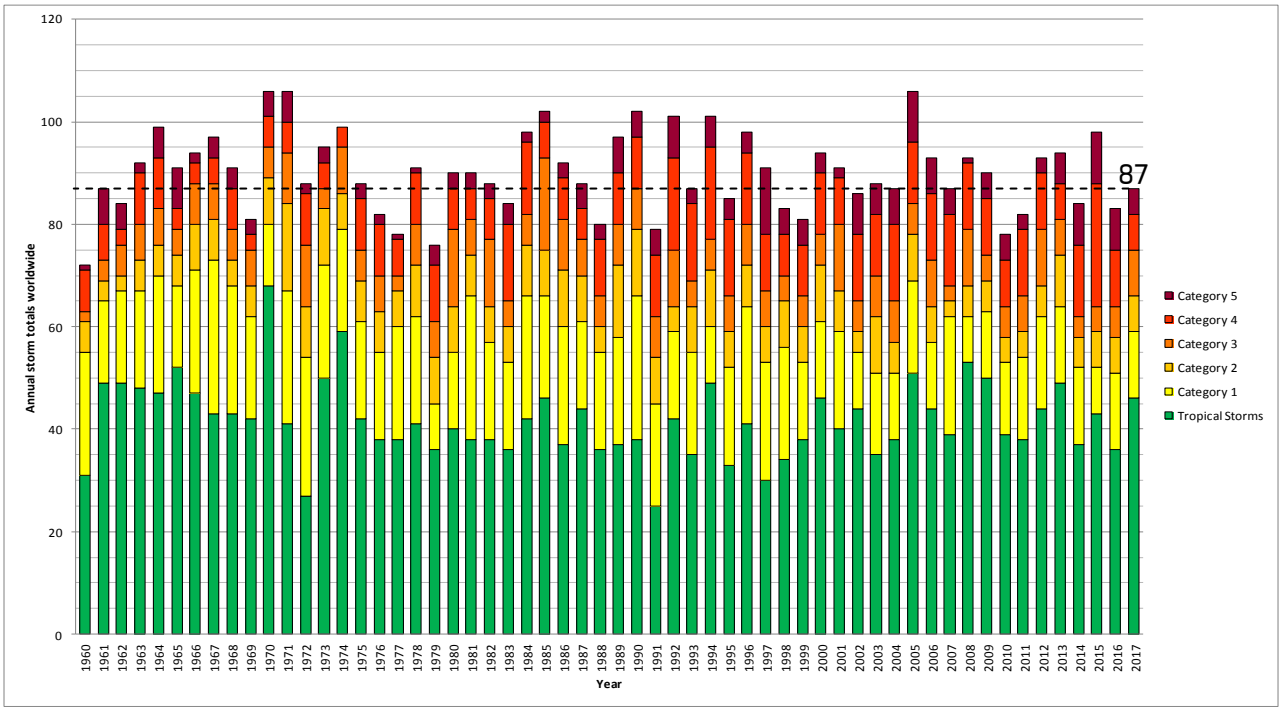
Despite the activity in the Atlantic this year, it was much less deadly than last year, but still the second deadliest since 2008. The North Indian Ocean saw its deadliest year since 2009, since 2004 in the South Indian, and 1986 in the Australian region. Approximately 2,448 were killed in all cyclones this year, compared to 2,933 last year and a ten-year average of 17,537. Overall, approximately 3.6 million people have been killed by tropical cyclones in recorded history.

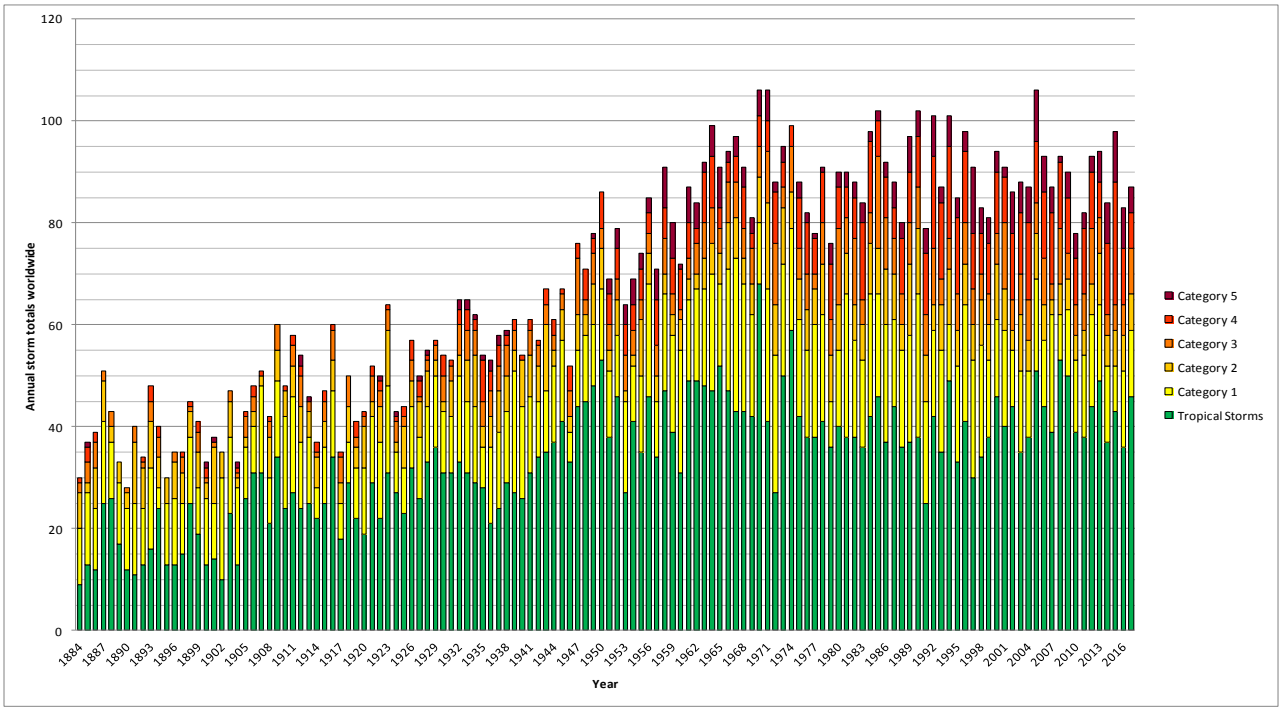
With an estimated 449,104 buildings damaged or destroyed by Atlantic hurricanes, in real terms 2017 is the most devastating season in the Atlantic Ocean, ahead of 1998 (383,524). Overall, approximately 29.4 million buildings have been damaged or destroyed by tropical cyclones in recorded history.

In 2017, there were 70 tropical cyclone landfalls, the highest since 2008. There were a total of 42 landfalling storms, the highest since 1996.

1.2. Historical Perspective

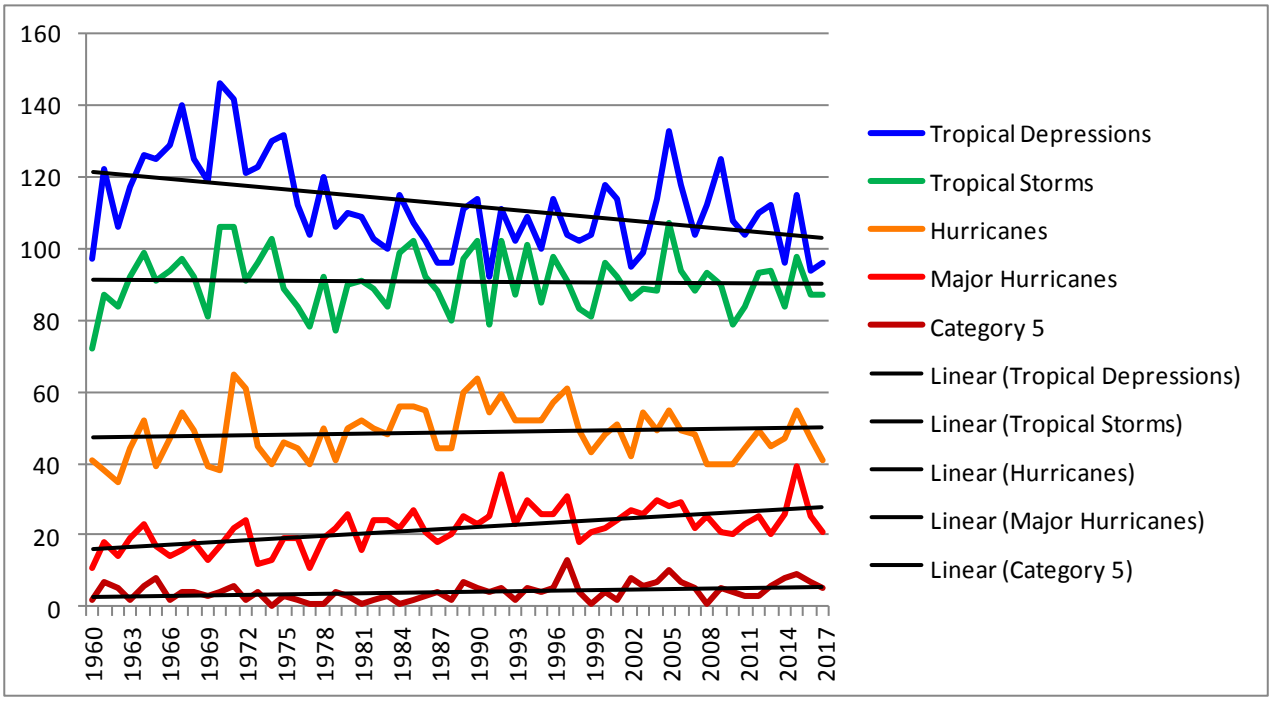
With 87 total storms, 2017 ends with a fairly average total. The 1960-2017 average now stands at 90.7. Due to lack of satellite imagery, years prior to the 1960s are not typically included in the data, however, since the data is readily available, the 1884-2017 chart has also been included below the 1960-2017 chart.





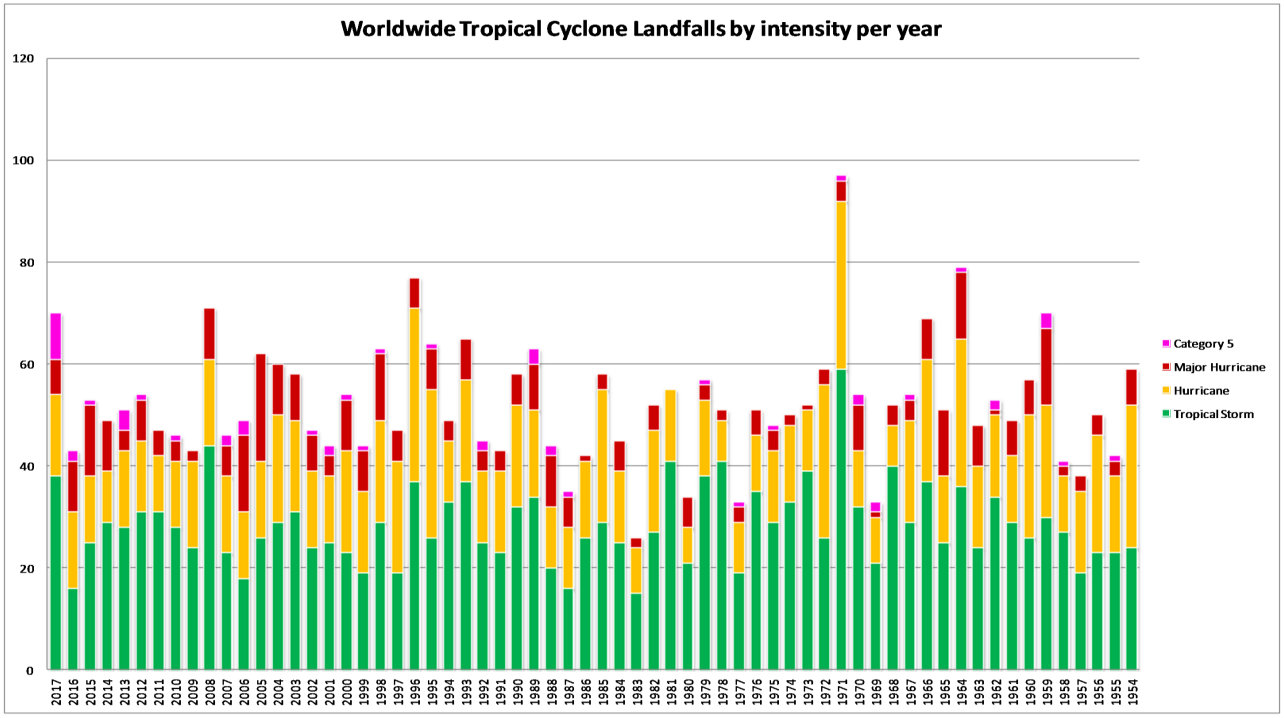
In 1884, only ship and land reports existed resulting in the lower numbers reported. These numbers gradually increased as shipping lanes handled more traffic in storm prone areas and communications were improved. Aircraft first intercepted cyclones in the 1940s, coinciding with a slight increase in numbers, possibly due to the beginning of air patrols after the war. Polar orbiting satellites started operating in the 1960s but often had gaps in their coverage, until geostationary satellites covered the Atlantic and Pacific by the mid 1970s. Since then, numbers have stabilised and have generally been on a slight downward trend overall.

The following chart shows the trend with number of tropical depressions, storms, hurricanes, majors, and Category 5 storms. In the early years of satellite imagery, more tropical depressions were recognised, potentially due to the lack of quality of the images and more stringent criteria in place today. The reverse effect is likely true for the stronger storms, with primitive satellite imagery failing to detect or sufficiently justify a more intense storm. Until the late 1970s, satellite imagery was vastly inferior to reconnaissance planes in estimating a mature storm's intensity.

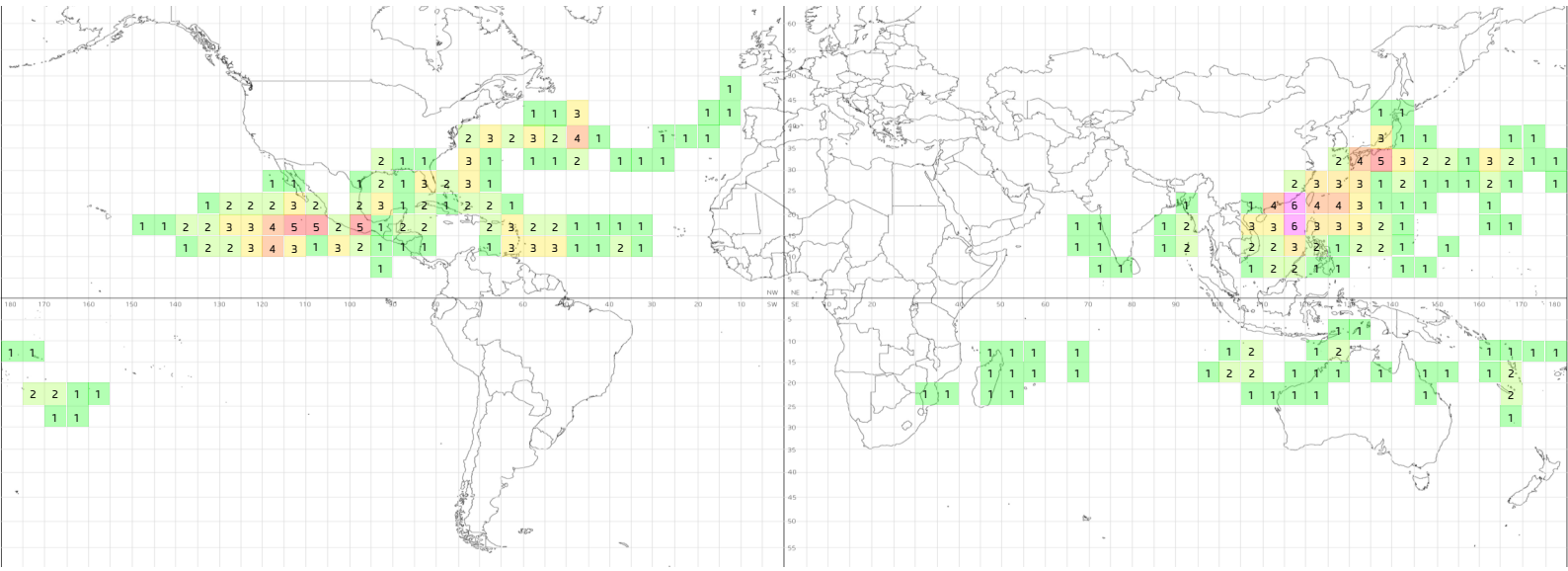


Rank	Year	Tropical Storms	Hurricanes	Major Hurricanes	Category 5
1	2005	107	55	28	10
2	1970	106	38	17	4
=	1971	106	65	22	6
4	1974	103	40	13	0
5	1985	102	56	27	2
=	1990	102	64	23	5
=	1992	102	59	37	5
8	1994	101	52	30	5
9	1964	99	52	23	6
=	1984	99	56	22	1
11	1996	98	57	26	5
=	2015	98	55	39	9
13	1967	97	54	16	4
=	1989	97	60	25	7
15	1973	96	45	12	4
=	2000	96	48	22	4
17	1966	94	47	14	2
=	2006	94	49	29	7
=	2013	94	45	20	6
20	2008	93	40	25	1
=	2012	93	49	25	3
22	1963	92	44	19	2
=	1968	92	49	18	4
=	1978	92	50	19	1
=	1986	92	55	21	3
=	2001	92	51	24	2
27	1958	91	44	21	8
=	1965	91	39	17	8
=	1972	91	61	24	2
=	1981	91	52	16	1
=	1997	91	61	31	13
	1970-2010 Avg	**91**	**50**	**23**	**4**
32	1980	90	50	26	3
=	2009	90	40	21	5
	1960-2000 Avg	**90**	**41**	**30**	**4**
34	1975	89	46	19	3
=	1982	89	50	24	2
=	2003	89	54	26	6
37	1987	88	44	18	4
=	2004	88	49	30	7
=	2007	88	48	22	5
40	1961	87	38	18	7
=	1993	87	52	23	2
=	2016	87	47	25	7
=	2017	87	41	21	**5**

Additionally, this year we have provided landfall statistics for the preceding 63 years. A landfall is defined as the point in which the center of a cyclone moves over a landmass—this still applies when an eye is present, although some agencies define a landfall as the edge of the eye moving over land. An incidence of the storm's eyewall making landfall is usually defined as a *direct hit*.



Also provided below is a map indicating where the storm activity has occurred this year, in terms of how many cyclones existed within each 5x5 degree square.



2. The 2017 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
Irma	AL	2017	8	30	2017	9	12	185	914	5	160	924
Maria	AL	2017	9	16	2017	9	30	175	908	5	160	924
Lan	WP	2017	10	16	2017	10	23	175	915	5		
Ernie	SI	2017	4	6	2017	4	10	165	934	5		
Noru	WP	2017	7	20	2017	8	8	160	935	5	120	945
Enawo	SI	2017	3	3	2017	3	10	155	925	4		
Jose	AL	2017	9	5	2017	9	22	155	938	4	90	967
Fernanda	EP	2017	7	12	2017	7	22	155	938	4	130	953
Harvey	AL	2017	8	18	2017	9	1	140	938	4	50	994
Kenneth	EP	2017	8	18	2017	8	23	140	948	4		
Banyan	WP	2017	8	11	2017	8	16	130	950	4	105	965
Otis	EP	2017	9	11	2017	9	19	130	955	4		
Talim	WP	2017	9	8	2017	9	18	125	935	3		
Donna	SP	2017	5	2	2017	5	10	125	950	3		
Debbie	SP	2017	3	24	2017	3	28	120	943	3		
Doksuri	WP	2017	9	11	2017	9	15	120	955	3		
Lee II	AL	2017	9	22	2017	9	30	120	960	3	90	980
Hato	WP	2017	8	20	2017	8	23	120	960	3		
Ophelia	AL	2017	10	9	2017	10	16	115	960	3		
Gert	AL	2017	8	13	2017	8	17	115	965	3		
Eugene	EP	2017	7	7	2017	7	12	115	966	3		
Khanun	WP	2017	10	12	2017	10	16	105	955	2		
Katia	AL	2017	9	5	2017	9	9	105	972	2		
Sanvu	WP	2017	8	28	2017	9	2	100	955	2		
Cook	SP	2017	4	8	2017	4	11	100	962	2		
Hilary	EP	2017	7	21	2017	7	30	100	973	2	70	992
Dora	EP	2017	6	25	2017	6	28	100	974	2		
Ockhi	NI	2017	11	29	2017	12	5	100	976	2		
Nesat	WP	2017	7	26	2017	7	30	90	960	1		
Damrey	WP	2017	11	1	2017	11	4	90	970	1		
Nate	AL	2017	10	4	2017	10	8	90	981	1		

		Formed			Dissipated			Intensity				
Name	Basin	Year	M	D	Year	M	D	Peak mph	Low mb	SSHS	Sec mph	Sec mb
Irwin	EP	2017	7	22	2017	8	1	85	980	1	65	996
Franklin	AL	2017	8	7	2017	8	10	85	981	1	60	998
Saola	WP	2017	10	19	2017	10	29	75	975	1	60	985
Carlos	SI	2017	2	4	2017	2	11	75	976	1		
Dineo	SI	2017	2	13	2017	2	16	75	977	1		
Mora	NI	2017	5	27	2017	5	30	75	978	1		
Frances	SI	2017	4	27	2017	4	30	75	980	1		
Ella	SP	2017	5	9	2017	5	14	75	980	1		
Max	EP	2017	9	13	2017	9	15	75	985	1		
Norma	EP	2017	9	13	2017	9	15	75	985	1		
Tembin	WP	2017	12	20	2017	12	26	70	975	TS	60	985
Nanmadol	WP	2017	7	2	2017	7	4	70	985	TS	45	995
Merbok	WP	2017	6	11	2017	6	12	65	985	TS		
Pakhar	WP	2017	8	24	2017	8	27	65	985	TS	45	996
Lidia	EP	2017	8	29	2017	9	3	65	987	TS		
Talas	WP	2017	7	15	2017	7	16	60	985	TS		
Blanche	SI	2017	3	5	2017	3	6	60	990	TS		
Mawar	WP	2017	8	31	2017	9	3	60	990	TS		
Cindy	AL	2017	6	20	2017	6	23	60	992	TS		
Rina	AL	2017	11	6	2017	11	9	60	995	TS		
Alfred	SP	2017	2	16	2017	2	20	60	995	TS		
Greg	EP	2017	7	17	2017	7	26	60	1000	TS	50	1003
Dahlia	SI	2017	12	2	2017	12	3	50	985	TS		
Hilda	SI	2017	12	27	2017	12	28	50	985	TS		
Haitang	WP	2017	7	28	2017	7	31	50	985	TS	40	998
Nalgae	WP	2017	8	1	2017	8	5	50	990	TS		
03S	SI	2017	1	27	2017	1	29	50	991	TS		
Maarutha	NI	2017	4	15	2017	4	16	50	992	TS		
Arlene	AL	2017	4	20	2017	4	21	50	993	TS		
Bart	SP	2017	2	21	2017	2	22	50	995	TS		
08P	SP	2017	2	22	2017	2	22	50	996	TS		
Kai-Tak	WP	2017	12	13	2017	12	22	50	996	TS	40	1002
Philippe	AL	2017	10	28	2017	10	29	50	997	TS		
Adrian	EP	2017	5	9	2017	5	11	45	994	TS		
Caleb	SI	2017	3	23	2017	3	27	45	995	TS		
Fernando	SI	2017	3	8	2017	3	10	45	998	TS		
Haikui	WP	2017	11	10	2017	11	12	45	998	TS		
Beatriz	EP	2017	5	31	2017	6	2	45	1001	TS		
Pilar	EP	2017	9	23	2017	9	25	45	1002	TS		

		Formed			Dissipated			Intensity				
Name	Basin	Year	M	D	Year	M	D	Peak mph	Low mb	SSHS	Sec mph	Sec mb
Ramon	EP	2017	10	4	2017	10	5	45	1002	TS		
Kulap	WP	2017	7	21	2017	7	26	45	1002	TS		
Bret	AL	2017	6	19	2017	6	21	45	1005	TS		
Emily	AL	2017	7	31	2017	8	2	45	1005	TS		
Don	AL	2017	7	17	2017	7	19	45	1009	TS		
Sonca	WP	2017	7	21	2017	7	25	40	994	TS		
Greg	SI	2017	5	1	2017	5	1	40	997	TS		
Cempaka	SI	2017	12	1	2017	12	1	40	998	TS		
14P	SP	2017	4	5	2017	4	6	40	998	TS		
Guchol	WP	2017	9	4	2017	9	6	40	1000	TS		
Kirogi	WP	2017	11	18	2017	11	19	40	1000	TS		
Muifa	WP	2017	4	24	2017	4	27	40	1001	TS		
Roke	WP	2017	7	21	2017	7	22	40	1002	TS		
Jova	EP	2017	8	12	2017	8	13	40	1003	TS		
Calvin	EP	2017	6	11	2017	6	13	40	1004	TS		
Selma	EP	2017	10	27	2017	10	28	40	1004	TS		
Lee	AL	2017	9	15	2017	9	18	40	1007	TS		
23W	WP	2017	10	8	2017	10	10	35	1000	TD		
01W	WP	2017	1	7	2017	1	16	35	1002	TD		
22W	WP	2017	9	23	2017	9	25	35	1002	TD		
11E	EP	2017	8	4	2017	8	5	35	1006	TD		
02W	WP	2017	4	14	2017	4	15	35	1006	TD		
29W	WP	2017	11	6	2017	11	7	35	1006	TD		
08E	EP	2017	7	18	2017	7	20	35	1007	TD		
26W	WP	2017	10	18	2017	10	19	30	1002	TD		
04L	AL	2017	7	5	2017	7	7	30	1009	TD		

These intensity values are based upon existing information and our own analysis and is correct to our best estimations as of January 2, 2018. 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.

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
Irma	AL	2017	8	30	2017	9	12	10
Philippe	AL	2017	10	28	2017	10	29	4
01W	WP	2017	1	7	2017	1	16	4
Kai-Tak	WP	2017	12	13	2017	12	22	4
Nanmadol	WP	2017	7	2	2017	7	4	4
Talim	WP	2017	9	8	2017	9	18	4
Harvey	AL	2017	8	18	2017	9	1	3
Nate	AL	2017	10	4	2017	10	8	3
Bret	AL	2017	6	19	2017	6	21	2
Franklin	AL	2017	8	7	2017	8	10	2
Maria	AL	2017	9	16	2017	9	30	2
Cook	SP	2017	4	8	2017	4	11	2
22W	WP	2017	9	23	2017	9	25	2
Haitang	WP	2017	7	28	2017	7	31	2
Khanun	WP	2017	10	12	2017	10	16	2
Nesat	WP	2017	7	26	2017	7	30	2
Noru	WP	2017	7	20	2017	8	8	2
Pakhar	WP	2017	8	24	2017	8	27	2
Saola	WP	2017	10	19	2017	10	29	2
Cindy	AL	2017	6	20	2017	6	23	1
Emily	AL	2017	7	31	2017	8	2	1
Katia	AL	2017	9	5	2017	9	9	1
Beatriz	EP	2017	5	31	2017	6	2	1
Calvin	EP	2017	6	11	2017	6	13	1
Lidia	EP	2017	8	29	2017	9	3	1
Max	EP	2017	9	13	2017	9	15	1
Selma	EP	2017	10	27	2017	10	28	1
Maarutha	NI	2017	4	15	2017	4	16	1
Mora	NI	2017	5	27	2017	5	30	1
Alfred	SP	2017	2	16	2017	2	20	1
Blanche	SI	2017	3	5	2017	3	6	1
Debbie	SP	2017	3	24	2017	3	28	1
Hilda	SI	2017	12	27	2017	12	28	1
Dineo	SI	2017	2	13	2017	2	16	1

2.2. Storms listed by amount of landfalls (continued)

Only storms that made landfalls are shown below.

Enawo	SI	2017	3	3	2017	3	10	**1**
23W	WP	2017	10	8	2017	10	10	**1**
Damrey	WP	2017	11	1	2017	11	4	**1**
Doksuri	WP	2017	9	11	2017	9	15	**1**
Hato	WP	2017	8	20	2017	8	23	**1**
Kirogi	WP	2017	11	18	2017	11	19	**1**
Lan	WP	2017	10	16	2017	10	23	**1**
Merbok	WP	2017	6	11	2017	6	12	**1**
Sonca	WP	2017	7	21	2017	7	25	**1**
Talas	WP	2017	7	15	2017	7	16	**1**
Tembin	WP	2017	12	20	2017	12	26	**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
Irma	AL	2017	8	30	2017	9	12	10
Maria	AL	2017	9	16	2017	9	30	3
Nate	AL	2017	10	4	2017	10	8	3
Philippe	AL	2017	10	28	2017	10	29	3
Doksuri	WP	2017	9	11	2017	9	15	3
Bret	AL	2017	6	19	2017	6	21	2
Franklin	AL	2017	8	7	2017	8	10	2
Harvey	AL	2017	8	18	2017	9	1	2
Ophelia	AL	2017	10	9	2017	10	16	2
Mora	NI	2017	5	27	2017	5	30	2
Cook	SP	2017	4	8	2017	4	11	2
Carlos	SI	2017	2	4	2017	2	11	2
22W	WP	2017	9	23	2017	9	25	2
Haitang	WP	2017	7	28	2017	7	31	2
Khanun	WP	2017	10	12	2017	10	16	2
Nesat	WP	2017	7	26	2017	7	30	2
Pakhar	WP	2017	8	24	2017	8	27	2
Talas	WP	2017	7	15	2017	7	16	2
Cindy	AL	2017	6	20	2017	6	23	1
Emily	AL	2017	7	31	2017	8	2	1
Katia	AL	2017	9	5	2017	9	9	1
Beatriz	EP	2017	5	31	2017	6	2	1
Calvin	EP	2017	6	11	2017	6	13	1
Lidia	EP	2017	8	29	2017	9	3	1
Max	EP	2017	9	13	2017	9	15	1
Pilar	EP	2017	9	23	2017	9	25	1
Selma	EP	2017	10	27	2017	10	28	1
Maarutha	NI	2017	4	15	2017	4	16	1
Ockhi	NI	2017	11	29	2017	12	5	1
Alfred	SP	2017	2	16	2017	2	20	1
Blanche	SI	2017	3	5	2017	3	6	1
Debbie	SP	2017	3	24	2017	3	28	1
Hilda	SI	2017	12	27	2017	12	28	1
Donna	SP	2017	5	2	2017	5	10	1

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Countries
Dineo	SI	2017	2	13	2017	2	16	1
Enawo	SI	2017	3	3	2017	3	10	1
01W	WP	2017	1	7	2017	1	16	1
23W	WP	2017	10	8	2017	10	10	1
29W	WP	2017	11	6	2017	11	7	1
Damrey	WP	2017	11	1	2017	11	4	1
Hato	WP	2017	8	20	2017	8	23	1
Kai-Tak	WP	2017	12	13	2017	12	22	1
Kirogi	WP	2017	11	18	2017	11	19	1
Lan	WP	2017	10	16	2017	10	23	1
Mawar	WP	2017	8	31	2017	9	3	1
Merbok	WP	2017	6	11	2017	6	12	1
Nanmadol	WP	2017	7	2	2017	7	4	1
Noru	WP	2017	7	20	2017	8	8	1
Saola	WP	2017	10	19	2017	10	29	1
Sonca	WP	2017	7	21	2017	7	25	1
Talim	WP	2017	9	8	2017	9	18	1

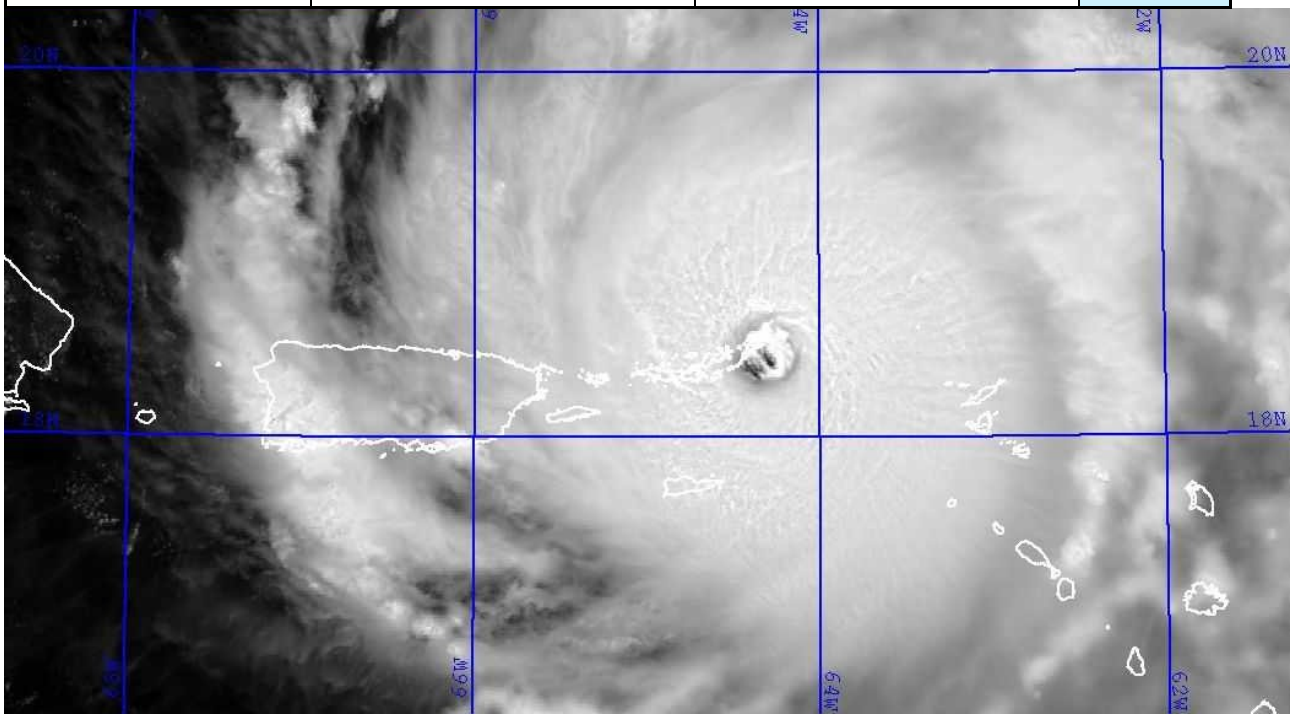


Image: NEXSAT imagery of Hurricane Irma affecting the British Virgin Islands on September 6, 2017. Irma made ten landfalls and affected at least ten different countries in the Caribbean and beyond.

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 January 2, 2018.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Fatalities
Tembin	WP	2017	12	20	2017	12	26	**195**
Irma	AL	2017	8	30	2017	9	12	**134**
Maria	AL	2017	9	16	2017	9	30	**129**
Enawo	SI	2017	3	3	2017	3	10	**99**
Harvey	AL	2017	8	18	2017	9	1	**91**
Kai-Tak	WP	2017	12	13	2017	12	22	**91**
Hato	WP	2017	8	20	2017	8	23	**33**
Sonca	WP	2017	7	21	2017	7	25	**32**
Cempaka	SI	2017	12	1	2017	12	1	**25**
Lidia	EP	2017	8	29	2017	9	3	**7**
Dineo	SI	2017	2	13	2017	2	16	**7**
Cindy	AL	2017	6	20	2017	6	23	**3**
Katia	AL	2017	9	5	2017	9	9	**3**
Bret	AL	2017	6	19	2017	6	21	**2**
Gert	AL	2017	8	13	2017	8	17	**2**
Noru	WP	2017	7	20	2017	8	8	**2**
Jose	AL	2017	9	5	2017	9	22	**1**
Khanun	WP	2017	10	12	2017	10	16	**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 January 2, 2018.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Injured
Enawo	SI	2017	3	3	2017	3	10	**253**
Irma	AL	2017	8	30	2017	9	12	**119**
Kai-Tak	WP	2017	12	13	2017	12	22	**78**
Maria	AL	2017	9	16	2017	9	30	**6**
Harvey	AL	2017	8	18	2017	9	1	**4**
Bret	AL	2017	6	19	2017	6	21	**2**
Cindy	AL	2017	6	20	2017	6	23	**2**
Emily	AL	2017	7	31	2017	8	2	**1**

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 January 2, 2018.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Missing
Tembin	WP	2017	12	20	2017	12	26	**163**

2.4. Storms listed by monetary damages

At present, only Atlantic storm damages are listed in the table. These are current estimates as of January 2, 2018. It is acknowledged that the data could change significantly as more information arrives.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Damages $m
Harvey	AL	2017	8	18	2017	9	1	**75000**
Irma	AL	2017	8	30	2017	9	12	**47940**
Maria	AL	2017	9	16	2017	9	30	**33180**
Bret	AL	2017	6	19	2017	6	21	**3**
Cindy	AL	2017	6	20	2017	6	23	**1**
Emily	AL	2017	7	31	2017	8	2	**0.2**

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. Information is assumed correct as of January 2, 2018.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Buildings dmg.
Harvey	AL	2017	8	18	2017	9	1	185062
Irma	AL	2017	8	30	2017	9	12	131960
Maria	AL	2017	9	16	2017	9	30	84878
Dineo	SI	2017	2	13	2017	2	16	20000
Kai-Tak	WP	2017	12	13	2017	12	22	16585
Sonca	WP	2017	7	21	2017	7	25	4186
Tembin	WP	2017	12	20	2017	12	26	1009
Hato	WP	2017	8	20	2017	8	23	754
Bret	AL	2017	6	19	2017	6	21	505
Nesat	WP	2017	7	26	2017	7	30	114
Khanun	WP	2017	10	12	2017	10	16	17
Cindy	AL	2017	6	20	2017	6	23	7
Emily	AL	2017	7	31	2017	8	2	5
Franklin	AL	2017	8	7	2017	8	10	5
Katia	AL	2017	9	5	2017	9	9	5
01W	WP	2017	1	7	2017	1	16	4

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. Information is assumed correct as of January 2, 2018.

		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Destroyed
Irma	AL	2017	8	30	2017	9	12	**23053**
Maria	AL	2017	9	16	2017	9	30	**14210**
Harvey	AL	2017	8	18	2017	9	1	**9011**
Dineo	SI	2017	2	13	2017	2	16	**8000**
Kai-Tak	WP	2017	12	13	2017	12	22	**3062**
Tembin	WP	2017	12	20	2017	12	26	**1654**
Bret	AL	2017	6	19	2017	6	21	**401**
Nesat	WP	2017	7	26	2017	7	30	**52**
Haikui	WP	2017	11	10	2017	11	12	**5**
Emily	AL	2017	7	31	2017	8	2	**2**
Khanun	WP	2017	10	12	2017	10	16	**2**

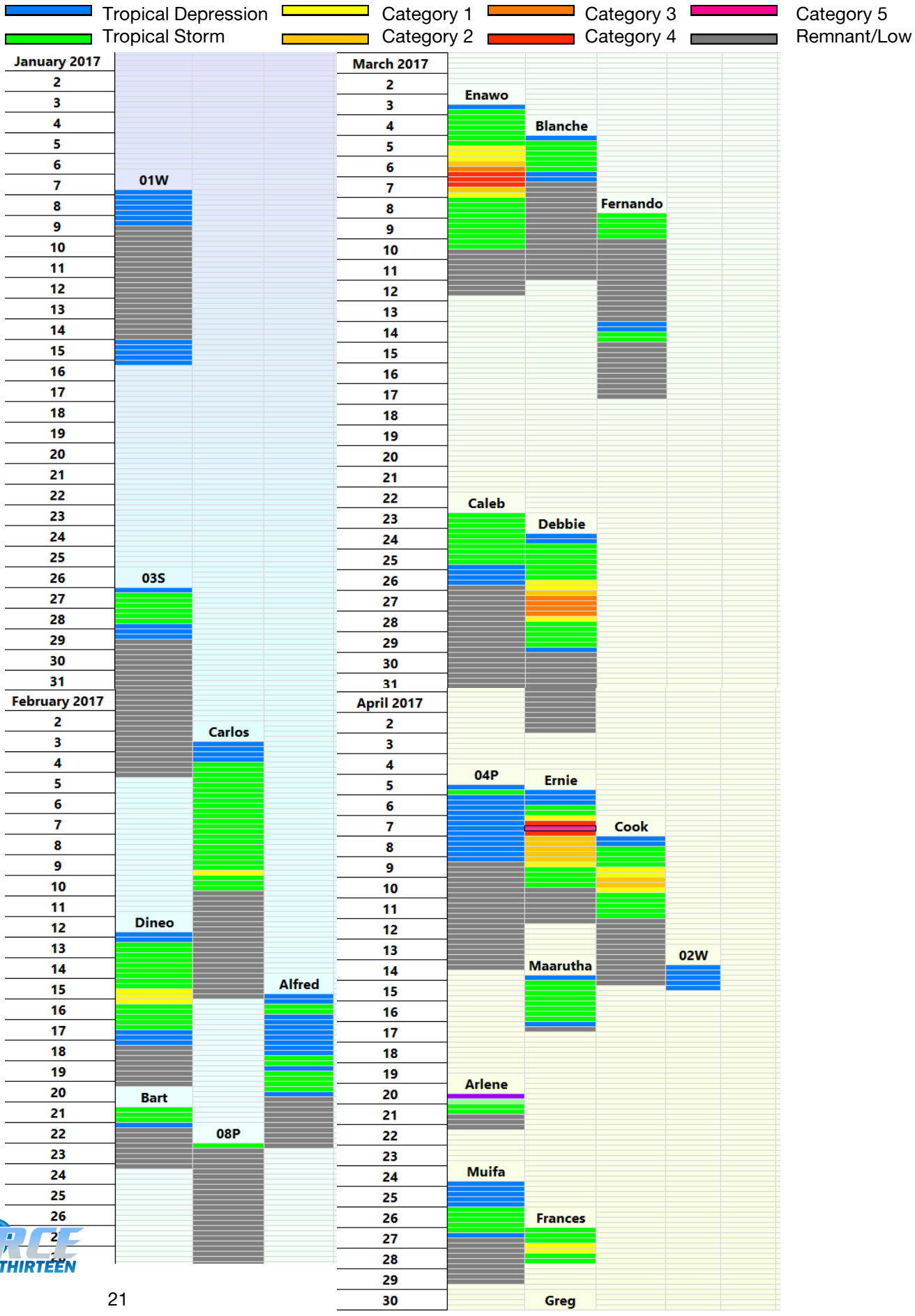
2.6. Storms listed by evacuees

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. Information is assumed correct as of January 2, 2018.

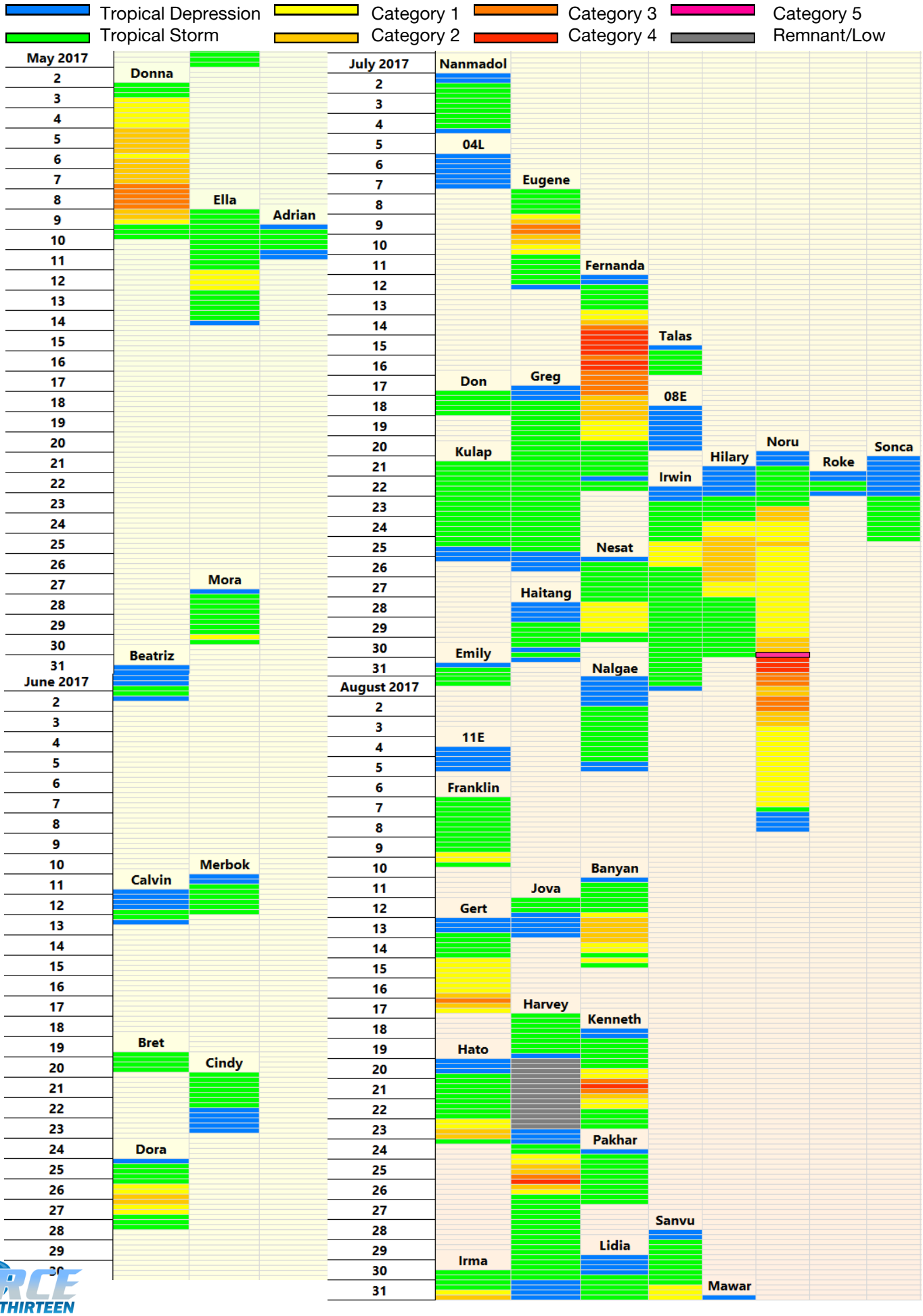
		Formed			Dissipated			
Name	Basin	Year	M	D	Year	M	D	Evacuees
Irma	AL	2017	8	30	2017	9	12	1961709
Harvey	AL	2017	8	18	2017	9	1	504337
Enawo	SI	2017	3	3	2017	3	10	110000
Nesat	WP	2017	7	26	2017	7	30	70000
Jose	AL	2017	9	5	2017	9	22	17000
01W	WP	2017	1	7	2017	1	16	7206
Franklin	AL	2017	8	7	2017	8	10	4092
Katia	AL	2017	9	5	2017	9	9	4000
Maria	AL	2017	9	16	2017	9	30	4000
Haikui	WP	2017	11	10	2017	11	12	20

2.7. 2017 Storm Timeline

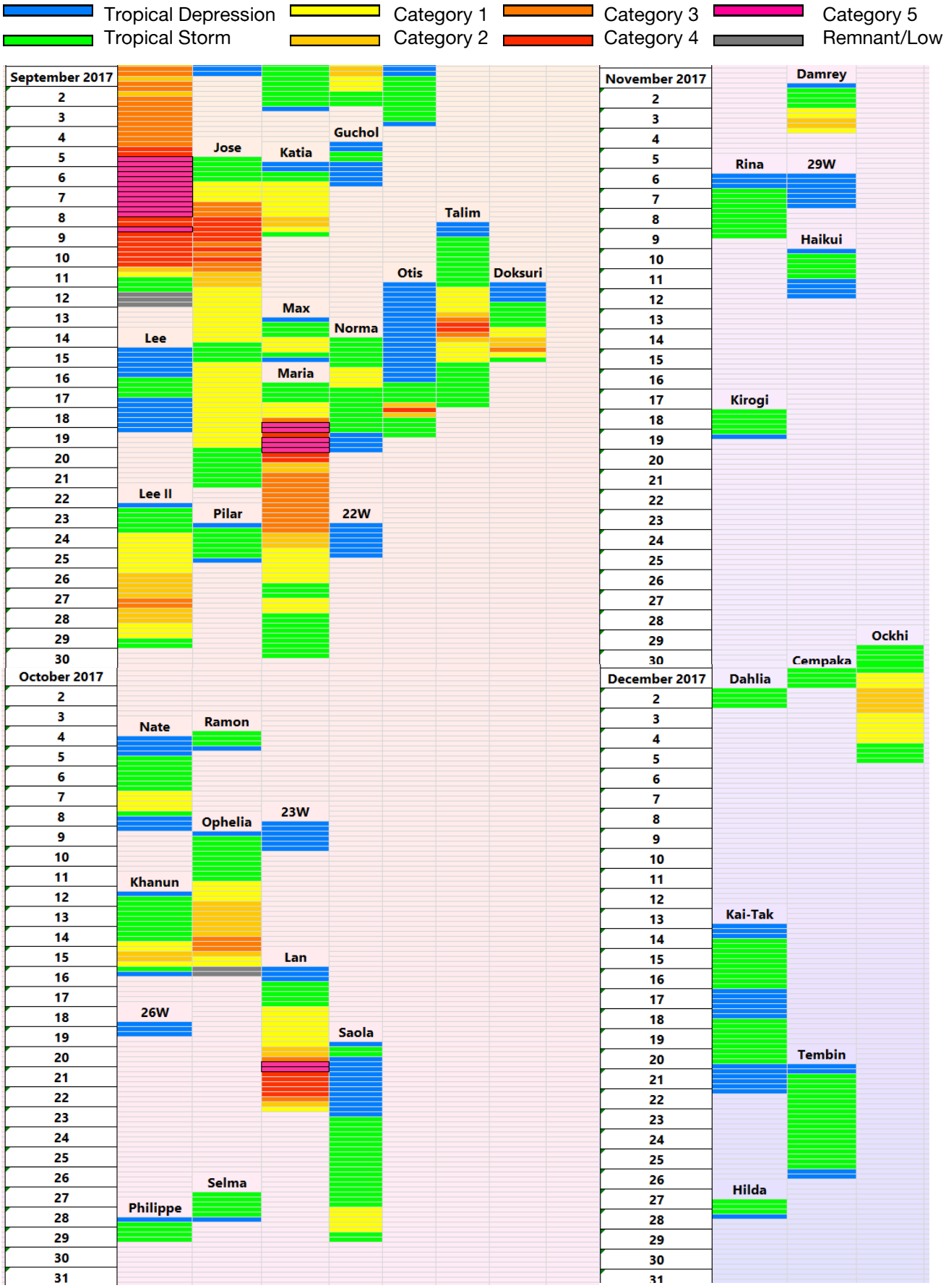
Below shows the progression at six-hourly intervals of worldwide tropical cyclone activity in 2017.
All intensity categories are in correspondence with the Saffir-Simpson Hurricane Wind Scale.



2017 Storm Timeline



2017 Storm Timeline



3. Notable Storms of 2017

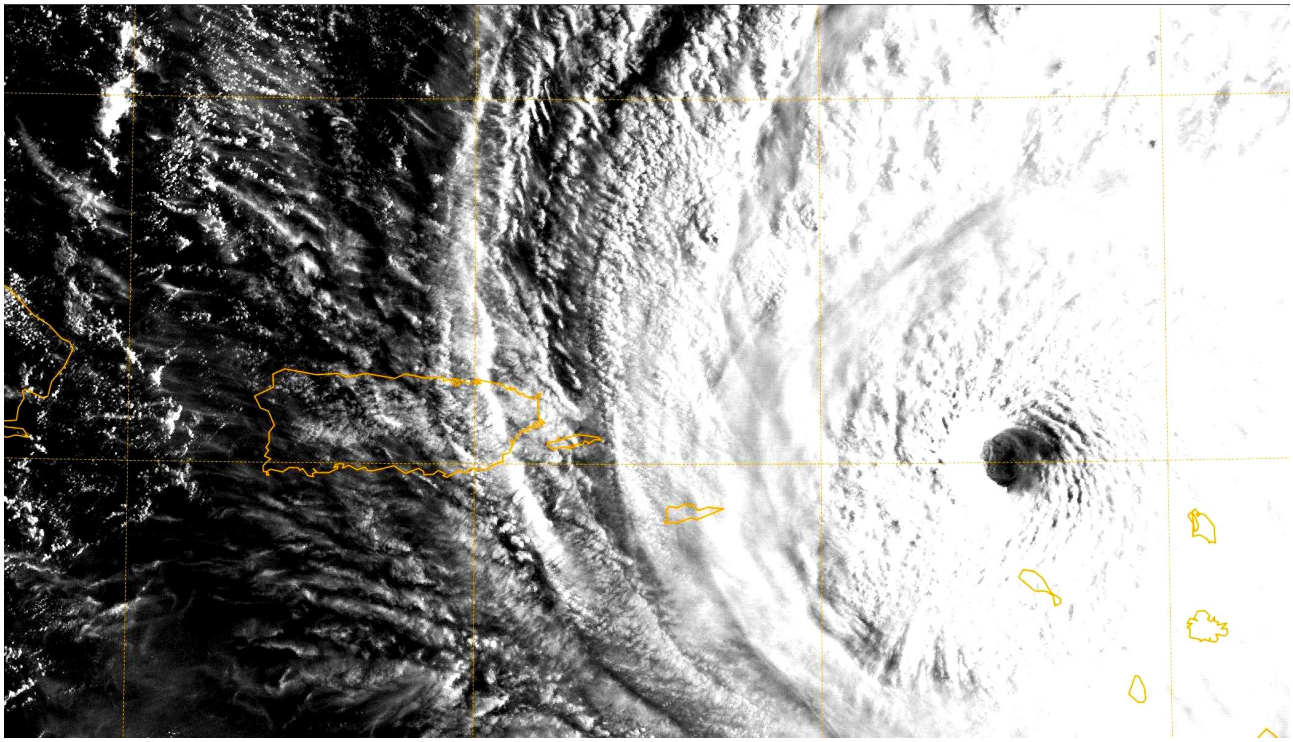
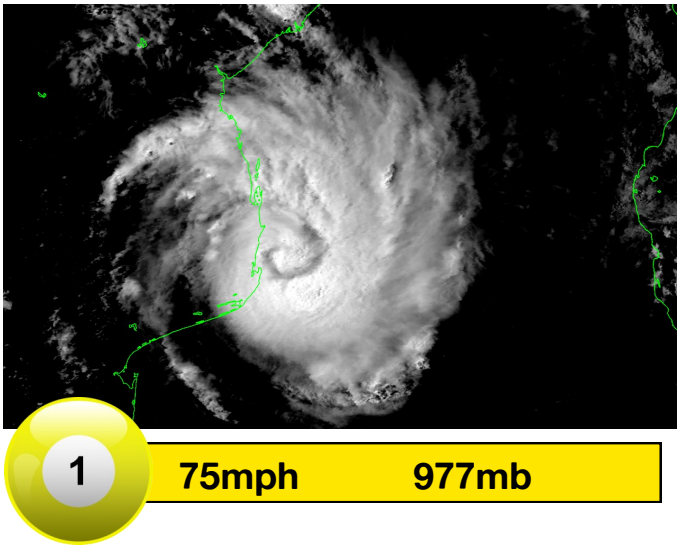


Image: GOES-16 visible imagery of Hurricane Irma passing through the Leeward Islands in September 2017.

This section contains more detailed reports and analysis on a selection of 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. Cyclone Dineo



Cyclone Dineo was the first cyclone to strike Mozambique since Subtropical Storm Dando in 2012. It was also the second furthest south tropical cyclone landfall in eastern Africa, after Domoina of 1984, which made landfall just six miles further south. However, Dineo is the most southerly hurricane strength landfall on the continent.

As well as this notable point, another is how far the storm travelled inland whilst remaining a tropical cyclone. It retained tropical storm status until 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, and no other storms to date have been traceable as its own entity from one side of the African continent to the other.

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.

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. Over 20,000 buildings were damaged, mostly in the form of de-roofing. Around 8,000 buildings were destroyed. Water supplies to several cities in Mozambique were cut for some days, but had returned by February 20th.

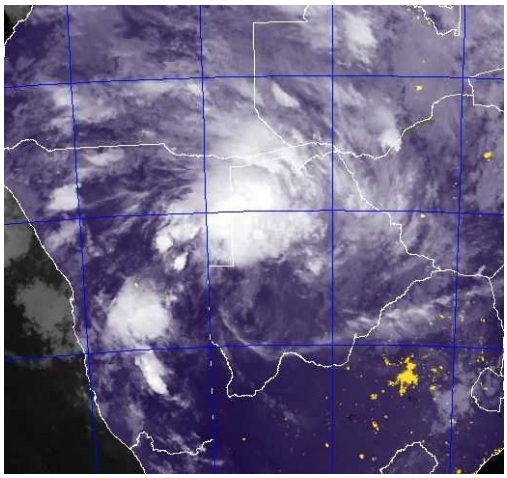
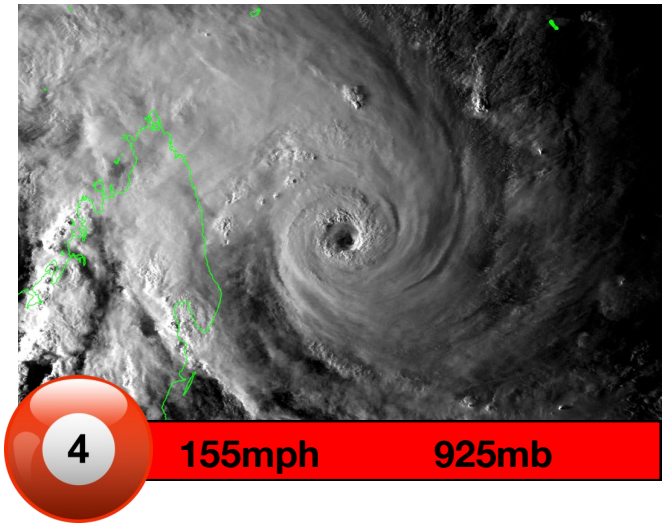


Image: Cyclone Dineo surviving as a tropical depression over the Botswana/ Namibia border
U.S. Navy

3.2. Cyclone Enawo



Cyclone Enawo was the strongest storm to make landfall in Madagascar since Cyclone Gafilo of 2004. Enawo was the 25th most intense storm in the basin.

Operationally, Enawo was designated a Category 5 cyclone by Force Thirteen, but was revised downwards after the fact due to the storm not maintaining the required characteristics for enough time.

At one time, Enawo threatened to impact Madagascar at peak intensity, but developed complications with its western eyewall and slowed down before landfall, taking approximately 10 hours to traverse the final 100 miles. By this time, rapid weakening had begun. In the first few hours after landfall, Enawo executed a tight clockwise loop in its track, briefly emerging once more off the coast. The center of the storm remained well defined as it moved inland during the day, not straying too far from the coastline.

Enawo briefly regained tropical storm intensity after moving off the southern coast of Madagascar, and attained 60mph winds before turning extratropical and merging with another storm on March 12th.

Initially, computer models predicted that the storm would move much further east than it did, affecting the Mascarene islands as a significant storm. Models trended west in the days before Enawo was named. Notable model runs came from the GFS, which at one point predicted that Enawo would reach a pressure of 871mb. The GFDL was an early leader in the model runs, predicting a Madagascar landfall as early as March 2nd.

By March 16, 51 had been confirmed dead in Madagascar. This number eventually reached 99, with at least 238 injured. The storm affected 250,000 people, with 110,000 evacuated at the height of the storm's aftermath.
Some inland locations of Madagascar reached rainfall totals of up to 250mm (10 in). Most locations along the east coast received over 75mm (3 in).

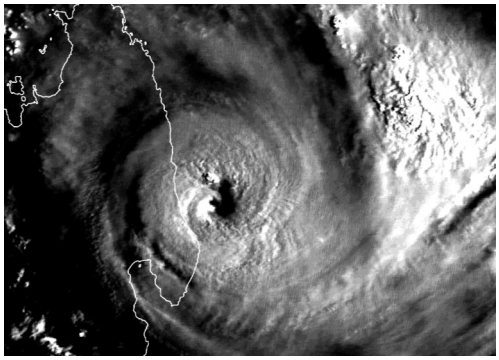
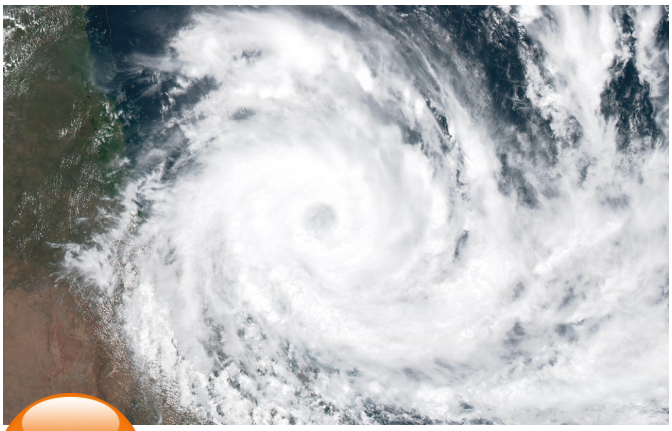


Image: Cyclone Enawo just before landfall in Madagascar.

3.3. Cyclone Debbie

Cyclone Debbie was the first major cyclone to impact Australia since Cyclone Marcia of 2015, and was the second major cyclone of 2017 worldwide.



3 120mph 943mb

Late on March 24th, the system acquired tropical storm force winds, and was named Debbie. The first significant weather from the storm occurred over the Cape York Peninsula early on March 25th, producing significant rainfall.

Late on March 25th, Debbie's preliminary band reached the coast of Australia and extended from Bowen to Fraser Island. However, the storm failed to strengthen significant until the next day when new convection wrapped around the center of the cyclone.

Signs of an eye were beginning to appear but no meaningful gains were made until late on March 26th, when an apparent ragged eye had collapsed and a possible eyewall replacement cycle took place. This had been completed within a few hours and a new, more well defined albeit still fairly ragged eye appeared within Debbie. By the early hours of March 27th, Debbie's significant bands were beginning to impact areas west of the storm, in Bowen and Townsville in particular. Debbie's eye, at times, began to look particularly impressive, and for a short period on March 27th reached an eye temperature of around 0 degrees Celsius, couled with cloud tops of less than –70 degrees Celsius inclusive. This would typically correlate to a mid-range Category 4 storm on the Saffir-Simpson Hurricane Wind Scale, though its appearance was so fleeting that such an intensity designation would seem unreasonable within the wider context.

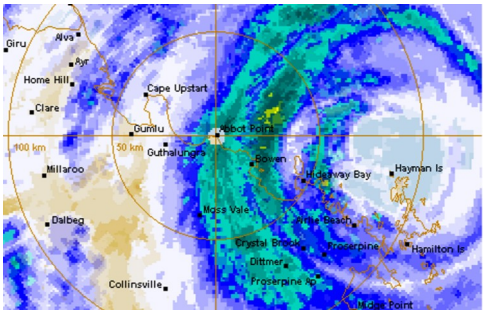


Image: Cyclone Debbie making its first probable landfall on Hayman Island on March 28th. *Bureau of Meteorology*

Late on March 27th, Debbie briefly turned towards the west and completed a tight clockwise loop over the course of a one hour period, making landfall at around 00:00 UTC on March 28th over Hayman Island, and again at around 01:45 UTC three miles northwest of Airlie Beach. Both of these landfalls occurred with winds of at least 120mph, corresponding to a Category 3 storm on the Saffir-Simpson Hurricane Scale, and a Category 4 storm on the Australian Cyclone Scale.

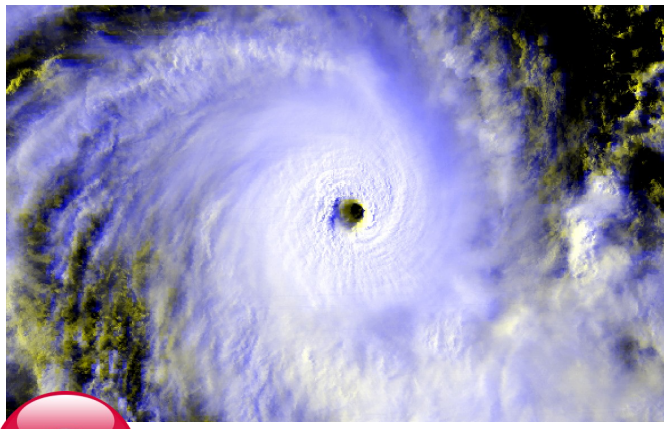
Debbie's eye collapsed within two hours of landfall, and convection began to transfer from the center of the storm to its still prominent northern band, which flared up immensely for an 8 hour period on March 28th, and again for around 12 hours on March 29th, offshore.

Cyclone Debbie produced rainfall totals of over 250mm (10 in) in some parts of Queensland, leading to flooding not seen since the remnants of Cyclone Oswald in 2013. Additionally, winds of near 120mph were recorded on Hamilton Island, gusting to 160mph. Before Debbie landed, an indirect fatality was attributed to the storm in a vehicle accident in Proserpine, a town which would go on to record the second lowest pressure from the storm. One other fatality is thought to have occurred in Queensland.

Throughout Queensland, hundreds of schools were closed and thousands along the coastal area from Bowen to Mackay were advised to evacuate. Power outages impacted on tens of thousands of customers, and the storm downed many trees and deroofed numerous houses near the coast. Flooding plagued parts of New South Wales from the remnants of Debbie, killing three.

3.4. Cyclone Ernie

One of the biggest deviations between Force Thirteen's analysis and those of the BOM and JTWC was with Cyclone Ernie, which became the strongest southern hemisphere cyclone of the year.

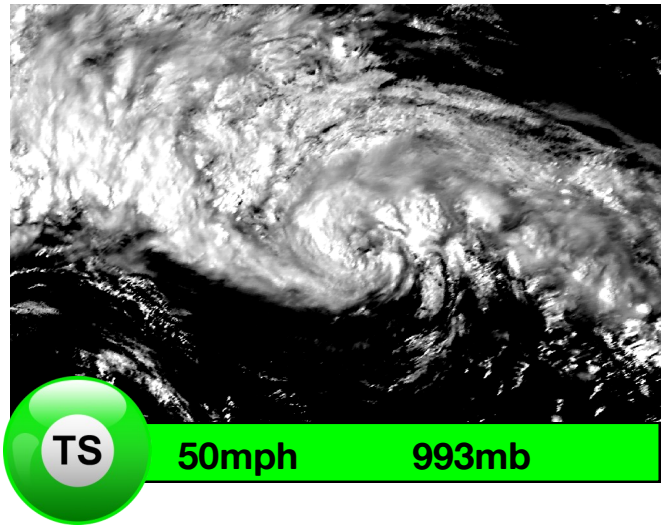


Beginning as a tropical disturbance near the Indonesian island of Sumba in the first days of April, Ernie intensified in remarkable fashion from late on April 5th until the morning of April 7th, when a well defined eye appeared with eye temperatures entering the +10s Celsius, surrounded by cloud tops no higher than –72 degrees Celsius, typically a benchmark for designating a Category 5 storm on the Saffir Simpson Hurricane Wind Scale.

Indeed, an area of –80 Celsius cloud tops appeared on the western half of the storm for a brief period, and estimated wind speeds reached 165mph according to satellite presentation estimates.
Hereafter, Ernie rapidly weakened but continued to show an energetic display of very cold cloud tops, wrapping around a reforming eye which ultimately never reached its potential, and a secondary peak with winds of 110mph occurred on April 8th. By the next day, the storm completely capitulated and by the end of April 9th, Ernie was barely a tropical storm. It would lose this status on April 10th and lose its residual circulation two days later.

Ernie's intensification rate over a 24 hour period is tied with Hurricane Patricia of 2015, with both storms increasing wind speed by 120mph over that time. Ernie even eclipsed Patricia over the course of 12 hours, when its winds increased by 85mph as opposed to 70mph from Patricia and 70mph from Hurricane Matthew in 2016, both record setters for their respective years.

3.5. Tropical Storm Arlene



Tropical Storm Arlene was the first cyclone to form in the North Atlantic Ocean in 2017, and marked three successive years in which the first storm formed before the official start of the basin's season.

Arlene began as an extratropical cyclone in the Western Atlantic, and arrived in the central part of the ocean and slowed down. The storm gradually weakened from its initial extratropical peak of 60mph, and lost gale force winds on April 20th, just before transitioning into a subtropical depression and numbered 01L by the National Hurricane Center.

The cyclone then, according to them, turned tropical as a depression and then strengthened into a tropical storm as it curved northwest. Our own analysis supposes that Arlene had turned tropical slightly later, and was initially a subtropical storm.

Halfway through the 21st, Arlene battled higher wind shear under the influence of another extratropical cyclone, and lost tropical characteristics shortly after. It was traceable as a remnant low for several more days as it moved south and then eastwards over the open Atlantic.

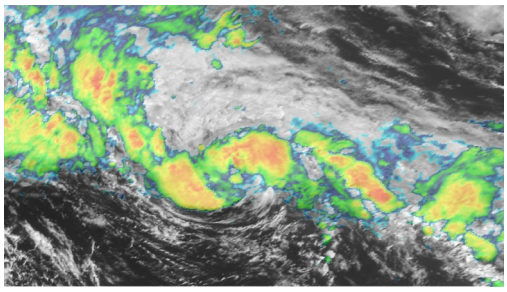
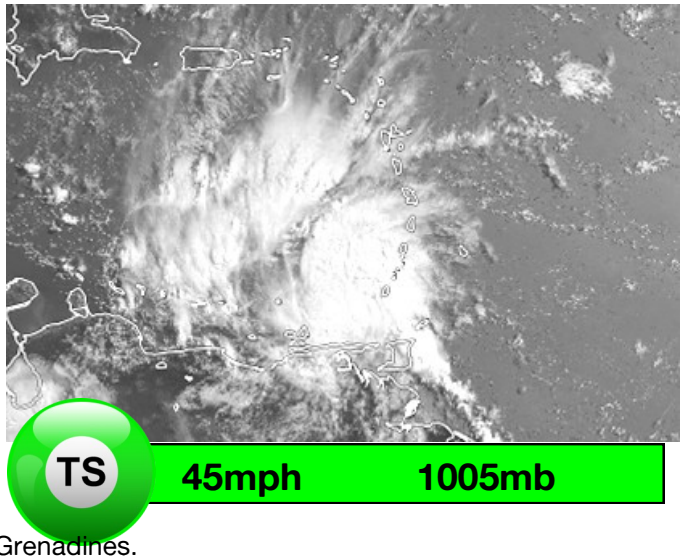


Image: Visible and Infrared overlay of Arlene as it was turning tropical.
GOES-16

3.6. Tropical Storm Bret



Tropical Storm Bret was a low latitude cyclone throughout its life, and was the first storm to make landfall on Trinidad and Tobago since Tropical Storm Bret of 1993.

The storm's origins can be traced back to the coast of Africa late on June 12th, and dipped further south after emerging over the Atlantic, slowing to a crawl between June 14-16.

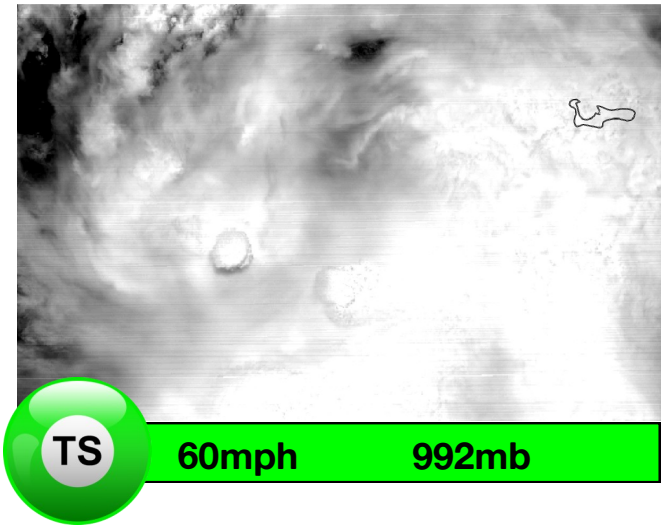
Force Thirteen first issued advisories on its SEWS (Storm Early Warning Service) page at 15:00 UTC on June 16th, predicting a tropical storm landfall on Trinidad. The National Hurricane Center issued their first advisory on Potential Tropical Cyclone 02L at 21:00 UTC on June 18th, when warnings were issued for Barbados and St Vincent and the Grenadines.

Early on June 19, Force Thirteen recognised the system as a tropical storm, although some doubt remained over whether it had the circulation required. The National Hurricane Center classified it as Tropical Storm Bret 12 hours later, after reconnaissance aircraft confirmed the requisite characteristics.

Bret made landfall at approximately 04:05 UTC on June 20th, on the southern coast of Trinidad, and made a second landfall some hours later in Venezuela. The storm then threatened the ABC islands but lost momentum and dissolved into a remnant low before reaching Aruba.

3.7. Tropical Storm Cindy

In June 2017, a new system formed just off the coast of Honduras, and initial forecasts predicted that it would strike the Florida Panhandle with intensities ranging from tropical depression to Category 1 hurricane.



At first, the storm struggled to consolidate a center, and was believed to have relocated on at least one occasion in the western Caribbean. For a time, it appeared that Cindy may have repeated the events of Colin in 2016, but earnestly developed into a tropical storm on June 20th.

By this time, its forecasted track became rather clear, with a landfall expected in western Louisiana or eastern Texas. Whilst it was approaching the coast, however, convection was struggling to remain around the storm and subtropical characteristics were appearing, along with multiple vortices in the center of the storm.

For a short time, five such vortices were circulating around the center of Cindy, separated by approximately 100 miles at greatest distance.

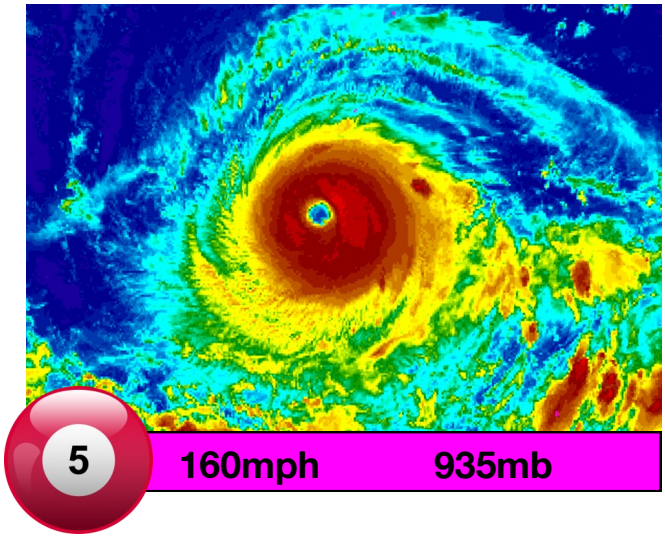
Ultimately, Cindy made landfall as a weakening tropical storm near the Texas/Louisiana border, with a noticeably dry southern side by this time.

3.8. Typhoon Noru

Typhoon Noru was the longest lived storm of the Western Pacific typhoon season in 2017, and second strongest in the basin. It maintained typhoon intensity for no less than sixteen days, and rapidly intensifying to become the second Category 5 storm of the year worldwide.

Another notable aspect of the storm was some of the model runs that occurred ahead of the storm's peak. The GFS model in particular was bullish about the storm, predicting peak pressures in the 870s on multiple occasions, and one particular occasion where it predicted an 865mb pass near Japan, which was clearly an unthinkable scenario.

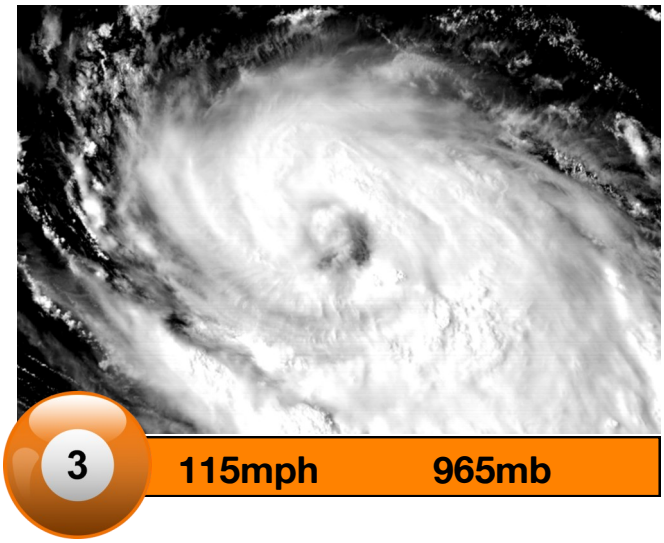
In the end, Noru weakened and developed a large eye on approach to Japan, and affected the islands as a Category 1 typhoon.



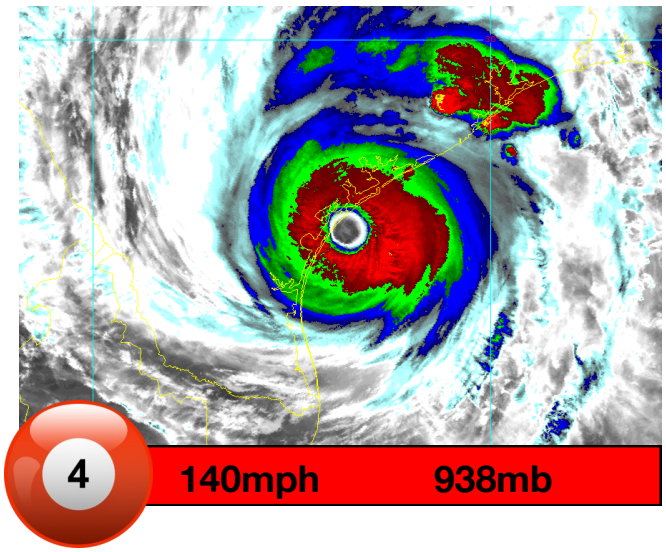
3.9. Hurricane Gert

Gert was the second hurricane to form in the Atlantic in 2017, and according to Force Thirteen's reanalysis, the first major hurricane to occur that year.

The storm formed in the Western Atlantic on August 13, and gradually developed as it curved out to sea over the following days. By August 16, the storm was accelerating off to the northeast, well clear of the US East Coast, and briefly reached Category 3 status according to Force Thirteen's satellite observations. Gert eventually turned extratropical on August 17th.



3.10. Hurricane Harvey



Hurricane Harvey was the eighth named storm of the 2017 Atlantic hurricane season, and was the first storm to make a major hurricane landfall in the United States since 2005, ending the longest such gap in United States history. Harvey is also tied for the fourth strongest hurricane landfall along the coast of Texas.

After a first life in the Caribbean as a struggling tropical storm, it was redesignated as a tropical depression in the Bay of Campeche on August 23rd. Early on the 24th, Harvey generated deep convection that sustained itself throughout the day, and an eye began to clear out as it progressed towards the northwest. Hurricane Watches had already been issued for Texas, and by 6pm UTC the storm reached winds of 80mph. Regular reconnaissance plane coverage saw Harvey's pressure continually drop, generally at a rate of 1mb per hour until more rapid intensification began to occur on August 25th in the run up to landfall. That afternoon, the eye temperature entered positive temperatures, indicating a significantly strong hurricane, by which point cold cloud tops had wrapped around most of the eye. This process continued until later in the day, with Harvey peaking as it was making landfall, with winds likely of 140mph and a pressure in the 930s in millibars.

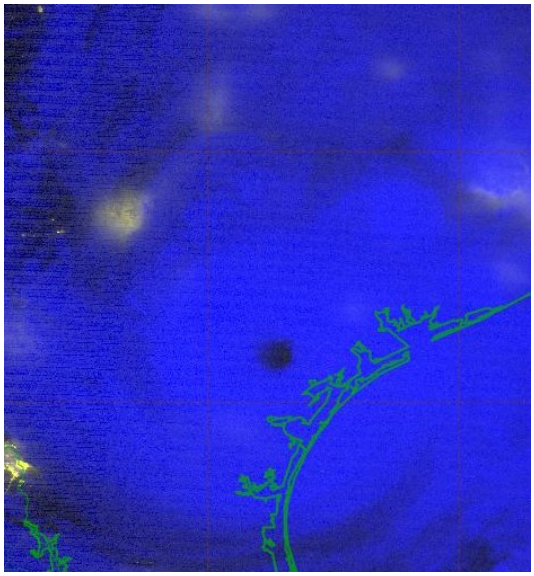
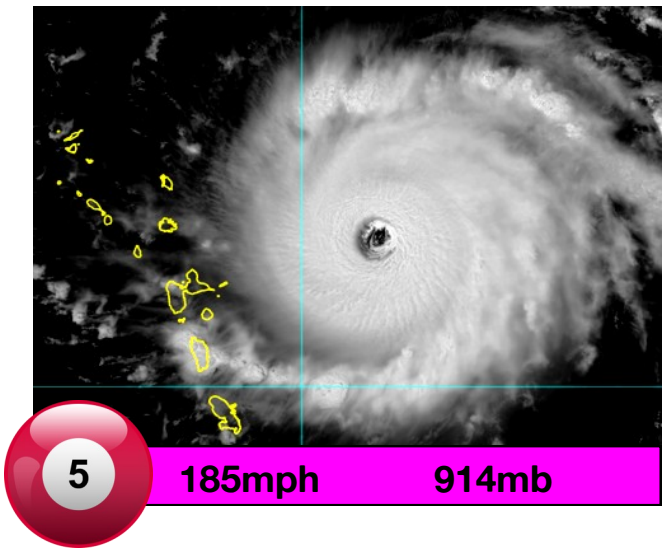


Image: Night-time visible image of Harvey four hours after landfall, with city lights visible. *GOES-16*

Harvey made landfall northeast of Corpus Christi, Texas, who as a whole avoided hurricane force winds, but locations to the northeast such as Rockport and Port Aransas saw more severe consequences.
Harvey's eye remained for eight hours after landfall before disappearing entirely, and rapid weakening took place as the storm continued north, slowing down and then stalling over inland Texas, and delivering unprecedented storm rainfall totals to the region.

At least 504,337 evacuated from the storm, which delivered over 1500mm of rainfall and caused severe flooding in large parts of southeastern Texas, including in Houston. At least 185,000 buildings were damaged, 9,000 destroyed, and monetary damages are estimated to be at a minimum of $75bn, awaiting more concrete numbers.

3.11. Hurricane Irma



Hurricane Irma was the ninth named storm of the 2017 Atlantic hurricane season, and was the strongest storm to strike any of the Leeward Islands since at least 1780, and the most intense storm recorded on the Lesser Antilles, marginally eclipsing a hurricane in 1825. Irma was officially tied 2nd strongest hurricane in the North Atlantic (tied 3rd on the Force Thirteen database), and tied 12th most intense (13th on the Force Thirteen database). Irma caused catastrophic damage across the Lesser Antilles, Turks and Caicos Islands, Cuba, and Florida in September 2017.

Traceable back to August 26th over the African continent, the disturbance that became Irma left the coast the next day, and progressively organised and presented spiral bandings and a closed center of circulation by August 30th.

Based on satellite observations, the system was classified as a tropical storm and named Irma by the National Hurricane Center. The storm then underwent a period of rapid intensification and developed an eye, becoming the furthest east major hurricane since Julia of 2010.

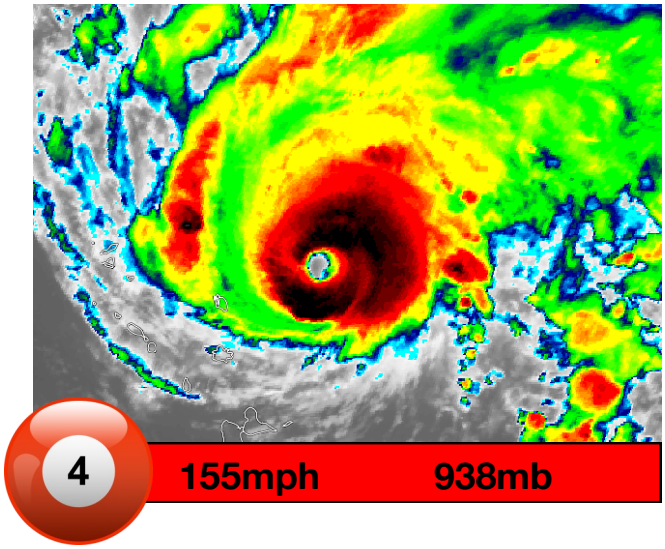
Irma kept moving to the west-southwest as its intensity fluctuated between Category 2 and 3 intensities, due to several eyewall replacement cycles between September 2-4, and the first hurricane watches were issued in many parts of the Leeward Islands at 21:00 UTC on September 3, when the storm was still 790 miles away.

Irma then entered extremely favourable conditions on September 4 and rapidly intensified once more, with the storm's structure becoming more circular and symmetric, along with cloud tops of –75 Celsius and a clear 20nm wide eye. Reconnaissance planes confirmed that Irma had intensified to Category 5 status, with winds of 175mph, but soon rose even further to 185mph by the afternoon.

Irma's eye passed directly over Barbuda, St Barthelemy, St Martin and the British Virgin Islands in the Leeward islands, with the center of the eye making landfall on Barbuda, St Martin, southern Virgin Gorda and northern Tortola. This occurred over a 12 hour period on September 6. Additionally, Irma's eye also moved over parts of the Turks and Caicos Islands, grazed the coast of Cuba, the Middle Florida Keys, and made its final landfall on Marco Island, Florida, as a Category 4 hurricane.

Damages from the storm were catastrophic in the Caribbean, with total damage for some areas and the potential for some of the islands to become uninhabitable as a result. So far, minimum damage costs are estimated to be at $43bn, awaiting further information.

3.12. Hurricane Jose



Hurricane Jose was the third successive major hurricane in the Atlantic, and the third strongest storm of the year.

A compact storm, Jose still caused major concern when it rapidly intensified in the main development region of the Atlantic, and places in the Leeward Islands that had been devastated by Hurricane Irma just three days prior, were again placed under Hurricane Warnings.

Jose intensified steadily throughout two or three days until September 8, when the storm peaked with a symmetrical eye, an eye temperature of around 16 Celsius, and maximum cloud tops of around –70 Celsius in the eyewall, correlating to a borderline Category 5 hurricane. However, this presentation didn't sustain itself for long enough to classify Jose as a Category 5 storm.

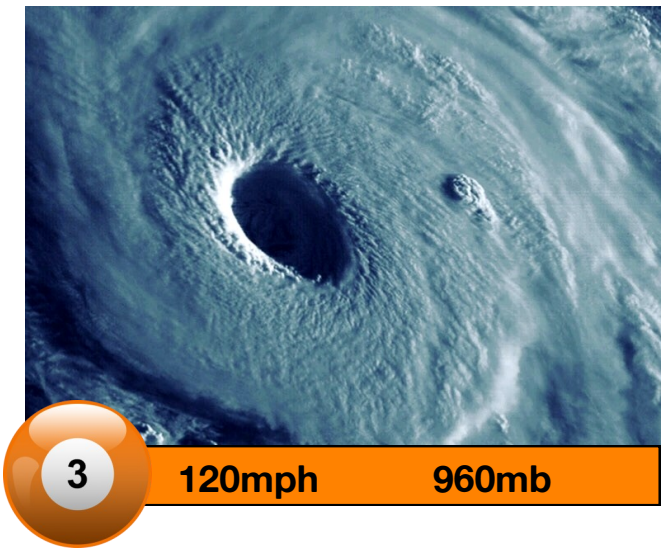
The storm then fluctuated in intensity as it made its closest approach to the Leeward Islands, who survived owing to Jose's small size. After some more bursts of intensification which didn't last, Jose's eye gave out late on September 10th, and the storm exploded with convective outbursts without an eye for the following four days as it completed an elongated loop east to west over the Western Atlantic.

Jose continued to struggle as a weak hurricane as it moved further north, and by September 19th began to show a large eye feature once more, but poor convective activity resulted in weakening to tropical storm intensity.

Jose then stalled just off the coast of New England, and convection reduced to a mere whimper by September 22, at which point Jose became a remnant low.

Image: True-colour visible image of Jose as it began to stall off the US East Coast. *GOES-16*

3.13. Hurricane Lee



One of the most intriguing phenomena of the Atlantic season was Hurricane Lee, operationally named as one system by the National Hurricane Center. However, reanalysis by Force Thirteen shows that Lee was in fact two different systems, with the first one still fading away whilst the new system formed much further north.

The initial cyclone was a weak tropical storm in the eastern Atlantic, which completely lost is convection on September 21 whilst the system was located at approximately 20 degrees north, 49 degrees west.

The new system formed on September 22nd, near 31 degrees north, 49 degrees west, and was initially very small, allowing it to intensify fairly rapidly as it took on an erratic track in the north Atlantic. An eye appeared on September 24, replaced by a new one the next day, and peak intensity being reached during the afternoon of the 27th. By this time, the storm had an eye temperature of around 10 Celsius, with cloud tops of –65 Celsius. Whilst typically translating to a Category 2 storm, its high latitude was a factor in declaring Lee a Category 3 hurricane with winds of 120mph as it curved towards the north.

Lee then accelerated towards the northeast, accompanied by what became its close neighbour, Maria, as both systems turned extratropical.

No land areas were affected, although Lee's remnants went on to affect western Europe.

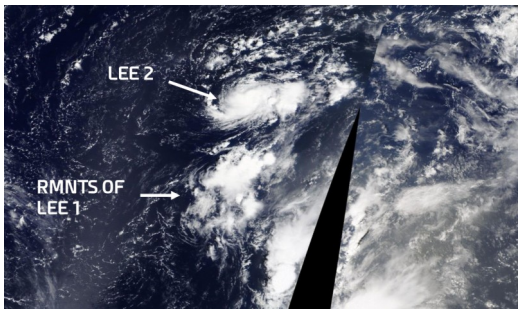
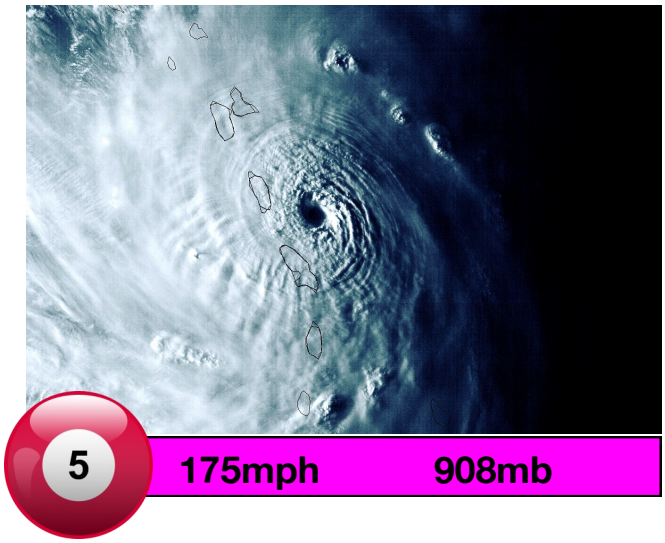


Image: Image depicting the two systems that were named Lee.
NASA

3.14. Hurricane Maria

Hurricane Maria was one of the fastest intensifying storms of the year, beginning as a moderate tropical storm late on September 17th, and becoming a Category 5 hurricane 24 hours later as it was approaching Dominica.



Maria made landfall in Dominica as a Category 5 hurricane, with an eye temperature of around 15 Celsius shortly beforehand.

Land interaction didn't weaken Maria by much, and the storm reintensified and reached its peak intensity on September 19, whilst it was just southwest of the islands that were devastated by Hurricane Irma. At peak, Maria reached winds of 175mph backed by satellite observations, and reached an air pressure of 908mb, the most intense of the year worldwide.

Maria weakened only modestly before landfall in Puerto Rico, still striking the island as a strong Category 4 storm and crippling the territory. The storm caused severe flooding, destroyed the power and communications networks, and caused tens of billions of dollars in damage.

Maria struggled as it continued towards the north, recurving off the coast of the United States and turning post-tropical on September 29.

Damages from Maria are thought to be at least $33bn, with at least 84,878 buildings damaged, 14,210 destroyed, and at least 129 fatalities from the storm.

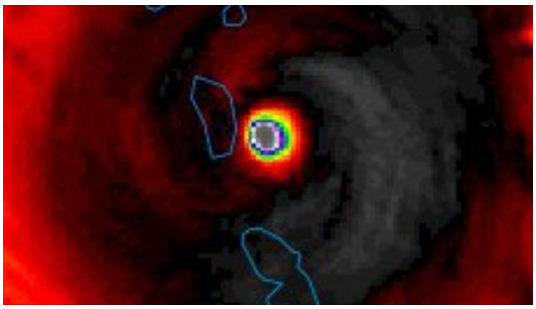
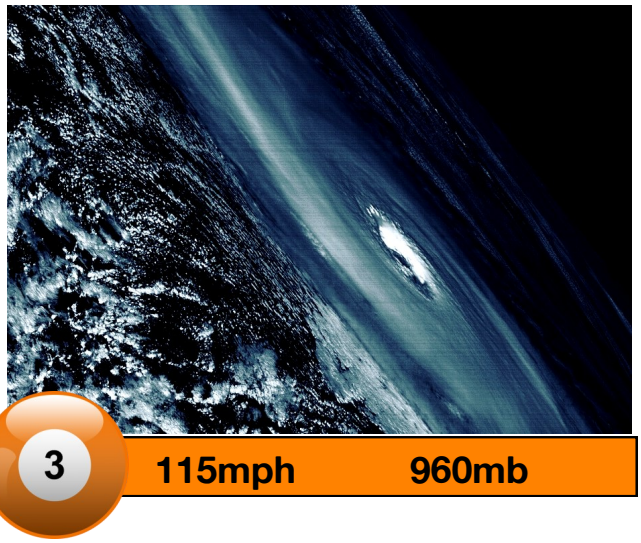


Image: Hurricane Maria near its first peak intensity, shortly before landfall in Dominica on September 18.
NOAA

3.15. Hurricane Ophelia



Hurricane Ophelia was the final major hurricane of the Atlantic hurricane season, and stretched the limits of the basin with a track that hadn't been seen since before the age of geostationary satellites.

Through the middle days of October, Ophelia formed in the central Atlantic and after stalling at first, gradually developed over the course of four days and four eyewall replacement cycles, until reaching peak intensity as a Category 3 storm to the south of the Azores on October 14. Whilst most hurricanes disintegrate or turn post-tropical by this stage, Ophelia continued to accelerate as a tropical cyclone to the northeast, and was still surviving as a Category 1 hurricane by the time it reached 45 degrees north, barely 300 miles off the western coast of Spain.

No warnings were issued by the National Hurricane Center, and Force Thirteen issued their own warnings for the storm, putting southern Ireland under a tropical storm warning. This marked the first time that the British Isles had been seriously threatened by a tropical cyclone since the 1960s.

Ophelia lost hurricane status only twelve hours before making landfall in southern Ireland as an extratropical cyclone with winds of at least 80mph, and straddled the western coast of the country before moving into Scotland and weakening rapidly.

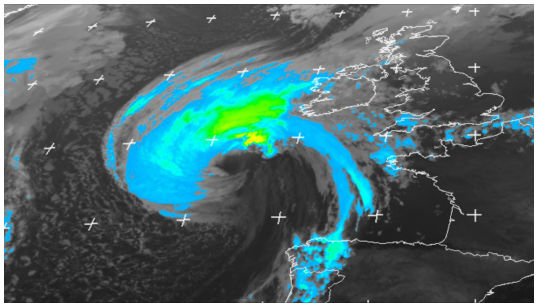
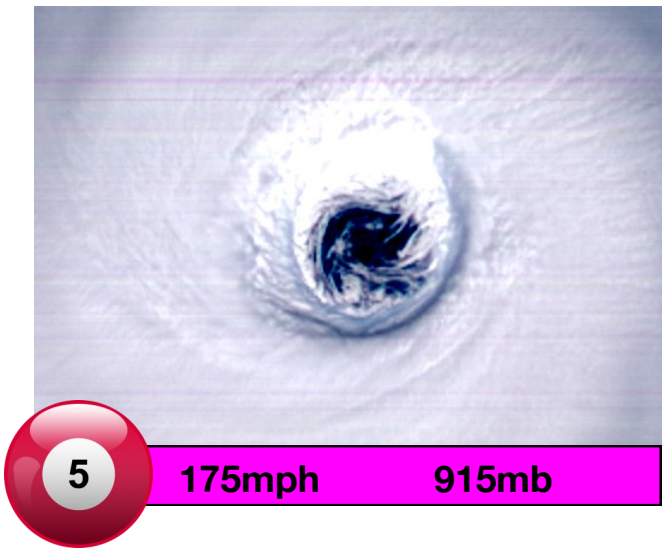


Image: Hurricane Ophelia shortly after turning post-tropical, on approach to Ireland. *EUMETSAT*

3.16. Typhoon Lan



According to Force Thirteen's analysis, Typhoon Lan was the strongest storm of the Western Pacific season in 2017, due to its satellite appearance which was maintained for several hours near its peak intensity.

Lan began life near Palau as a broad area of disturbed weather, and gradually moved towards the northwest, struggling to organise significantly until October 20th, although exhibited an energetic display of abundant convection.

A large eye appeared later that day, and cleared out in the evening. The eye continued to warm and by late evening, the storm appeared to peak with an eye temperature of around 16 Celsius, and maximum cloud top temperatures of around –78 Celsius in the eyewall, with minimum temperatures near –84 Celsius, corresponding to a clear Category 5 typhoon.

Lan also contained the largest windfield of the year, with a purported 565nm wide windfield, although JMA numbers suggest a gale diameter of up to 900nm.

The storm had a second peak on October 21st, potentially of Category 5 intensity but of at least strong Category 4 intensity, before capitulating spectacularly the next morning on its final hours before landfall in Japan. Very little remained of the storm's inner structure by the time it did make landfall in Honshu, accelerating at a rapid pace. Although, winds were still thought to be in the Category 2 range by this time.

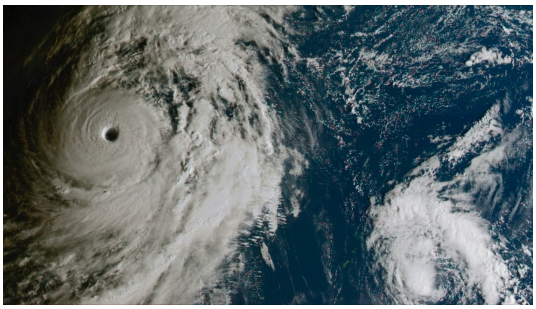
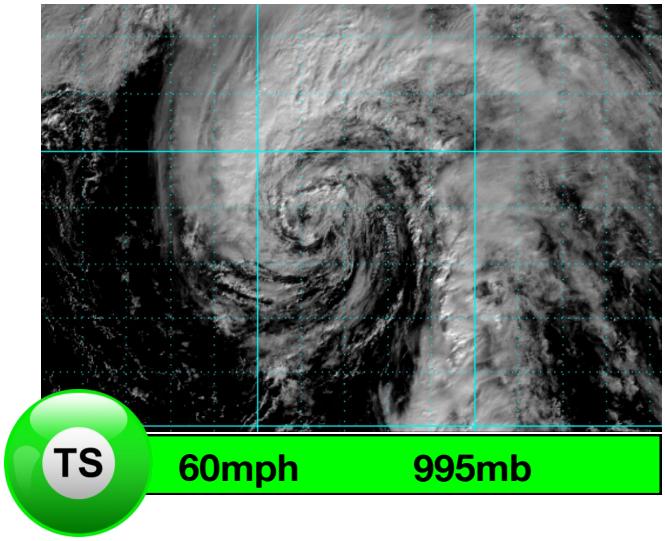


Image: Visible image of Typhoon Lan and size comparison with the developing Tropical Storm Saola to the east. *Himawari-8*

3.17. Tropical Storm Rina and Mediterranean Storm

Rina was the final storm of the 2017 Atlantic hurricane season, forming on November 6th in the open north Atlantic, and generally moved towards the north and completed a fairly straight-forward evolution towards extratropical status by November 8th. However, part of Rina's energy later entered Europe and eventually the Mediterranean, accompanied with another cyclone that entered from the North Sea.



The new system moved through Italy and eventually arrived off the eastern coast of Sicily, where it acquired subtropical characteristics and became a subtropical storm on November 16. The storm slowly cruised towards the north and intensified off the coast of southern mainland Italy, and even acquired some tropical characteristics in the process. Whether the cyclone became tropical is still under review. The cyclone then moved eastwards into Greece, with the remnants affecting the eastern Greek islands and Turkey.

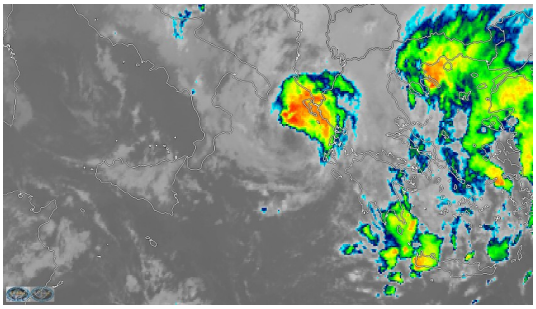


Image: Infrared image of the "Medicane" near peak intensity.

4. 2017 Records

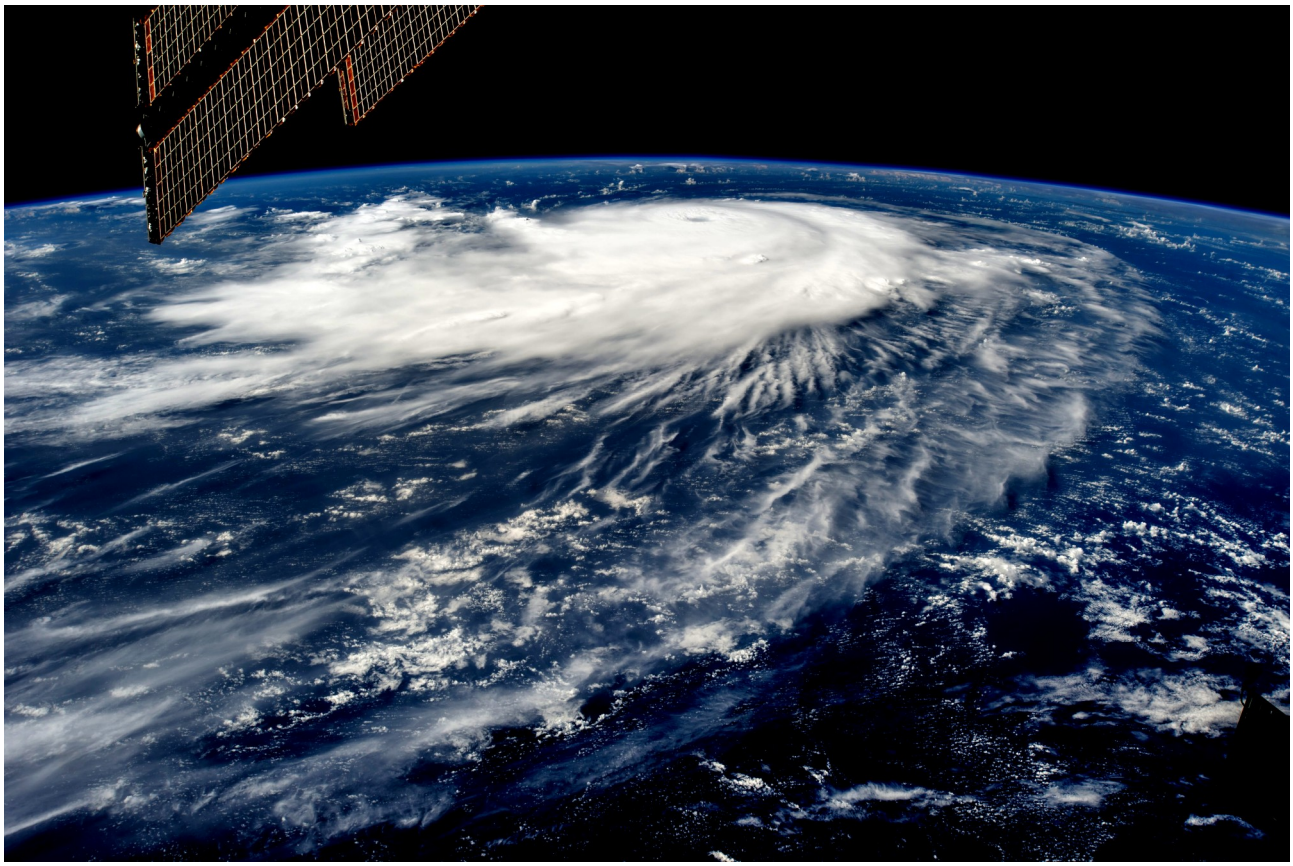


Image: Force Thirteen enhanced image of Hurricane Jose in the Atlantic, captured by the International Space Station

Intensity and Longevity Records

The next page will show all the records set in 2017 for intensity and longevity. In the records section of this report, all storms that set their record in 2017 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. Hurricane Maria	908mb
2. Hurricane Irma	914mb
3. Typhoon Lan	915mb

Atlantic

1. Hurricane Maria	908mb
2. Hurricane Irma	914mb
3. Hurricane Jose	938mb
=. Hurricane Harvey	938mb

Eastern Pacific (includes Central)

1. Hurricane Fernanda	938mb
2. Hurricane Kenneth	948mb
3. Hurricane Otis	955mb

Western Pacific

1. Typhoon Lan	915mb
2. Typhoon Noru	935mb
3. Typhoon Banyan	950mb

North Indian Ocean

1. Cyclone Ockhi	976mb
2. Cyclone Mora	978mb
3. Cyclone Maarutha	992mb

South Indian Ocean

1. Cyclone Enawo	925mb
2. Cyclone Ernie	934mb
3. Cyclone Carlos	976mb

South Pacific Ocean

1. Cyclone Debbie	943mb
2. Cyclone Donna	950mb
3. Cyclone Cook	962mb

Strongest Wind Speeds

World

1. Hurricane Irma	185mph
2. Hurricane Maria	175mph
=. Typhoon Lan	175mph

Atlantic

1. Hurricane Irma	185mph
2. Hurricane Maria	175mph
3. Hurricane Jose	155mph

Eastern Pacific (includes Central)

1. Hurricane Fernanda	155mph
2. Hurricane Kenneth	140mph
3. Hurricane Otis	130mph

Western Pacific

1. Typhoon Lan	175mph
2. Typhoon Noru	160mph
3. Typhoon Banyan	130mph

North Indian Ocean

1. Cyclone Ockhi	100mph
2. Cyclone Mora	75mph
3. Cyclone Maarutha	50mph

South Indian Ocean

1. Cyclone Ernie	165mph
2. Cyclone Enawo	155mph
3. Cyclone Carlos	75mph
=. Cyclone Dineo	75mph

South Pacific Ocean

1. Cyclone Donna	125mph
2. Cyclone Debbie	120mph
3. Cyclone Cook	100mph

Most intense Category 4 storms

World

1. Cyclone Enawo	925mb
2. Hurricane Jose	938mb
=. Hurricane Fernanda, Hurricane Harvey	

Strongest 24 hour average wind

World

1. Hurricane Irma	184mph
2. Hurricane Maria	164mph
3. Typhooon Lan	160mph

Most intense Category 3 storms

World

1. Typhoon Talim	935mb
2. Cyclone Debbie	943mb
3. Cyclone Donna	950mb

Most Intense 24 hour average air pressure

World

1. Hurricane Irma	916mb
2. Hurricane Maria	917mb
3. Typhoon Lan	921mb

Intensity and Longevity Records (continued)

Longest duration as a tropical storm or stronger

World

1. Typhoon Noru	408 hours
2. Hurricane Jose	396 hours
3. Hurricane Maria	342 hours

Atlantic

1. Hurricane Jose	396 hours
2. Hurricane Maria	342 hours
3. Hurricane Irma	306 hours

Eastern Pacific (includes Central)

1. Hurricane Fernanda	234 hours
2. Hurricane Irwin	222 hours
3. Hurricane Hilary	192 hours

Western Pacific

1. Typhoon Noru	408 hours
2. Typhoon Talim	204 hours
3. Typhoon Lan	168 hours

North Indian Ocean

Data not yet available

South Indian Ocean

1. Cyclone Enawo	162 hours
2. Cyclone Carlos	156 hours
3. Cyclone Dineo	120 hours

South Pacific Ocean

1. Cyclone Donna	150 hours
2. Cyclone Debbie	120 hours
3. Cyclone Cook	84 hours

Longest duration as a Category 5 storm

World

1. Hurricane Irma	75 hours
2. Hurricane Maria	30 hours
3. Typhoon Lan	6 hours
=. Typhoon Noru, Cyclone Ernie	

Atlantic

1. Hurricane Irma	75 hours
2. Hurricane Maria	30 hours

Eastern Pacific (includes Central)

None

Western Pacific

1. Typhoon Lan	6 hours
=. Typhoon Noru	

North Indian Ocean

None

South Indian Ocean

1. Cyclone Ernie	6 hours

South Pacific Ocean

None

Longest duration at sub-900mb

World

Longest duration at Category 4 or stronger

World

1. Hurricane Irma	144 hours
2. Hurricane Maria	54 hours
3. Typhoon Lan	42 hours

Longest duration at sub-920mb

World

1. Hurricane Irma	30 hours
2. Hurricane Maria	12 hours
3. Typhoon Lan	6 hours

Longest duration at Category 1 or stronger

World

1. Typhoon Noru	360 hours
2. Hurricane Jose	288 hours
3. Hurricane Irma	264 hours

Longest duration at Category 4 without strengthening

World

1. Hurricane Jose	42 hours
=. Hurricane Fernanda	
3. Cyclone Enawo	18 hours

Longest duration at Category 3 without strengthening

World

1. Cyclone Donna	30 hours
2. Cyclone Debbie	24 hours
3. Hurricane Ophelia	18 hours

Longest duration at Category 2 without strengthening

World

1. Typhoon Banyan	54 hours
=. Hurricane Hilary	
3. Multiple storms	12 hours

Longest duration at Category 1 without strengthening

World

1. Typhoon Nesat	36 hours
=. Typhoon Tembin	
3. Hurricane Irwin, Max	30 hours

Intensity and Longevity Records (continued)

Longest duration at Tropical Storm w/o strengthening

World

1. Tropical Storm Greg	180 hours
2. Tropical Storm Kai-Tak	120 hours
3. Tropical Storm Kulap	102 hours

Shortest Duration

World

1. Tropical Storm 08P	6 hours
2. Tropical Depression 26W	12 hours
3. Multiple storms	24 hours

Coldest Cloud Tops (major cyclones only)

World

1. Typhoon Lan	-89.0°C (-128°F)
2. Cyclone Donna	-88.0°C (-126°F)
=. Hurricane Harvey	-88.0°C (-126°F)

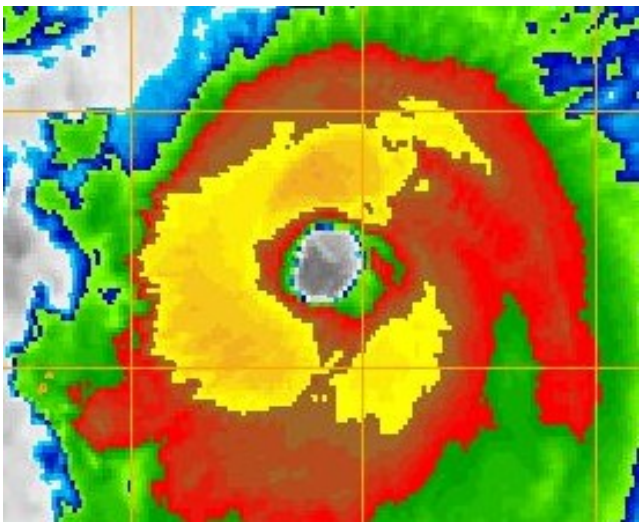


Image: Infrared image of Typhoon Lan near peak intensity.
Colder cloud tops indicate thunderstorm activity extending to higher elevations of the atmosphere, and is a significant indicator of how intense an individual thunderstorm is (for storms weaker than Category 3), or an indicator of how strong the 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 23-25
=. Six, on September 16-17
3. Five, on July 29-30

Atlantic

1. Three, on September 6-9
=. Three, on September 16-17
3. Two, on August 30

Eastern Pacific (includes Central)

1. Three, on July 23-25

Western Pacific

1. Three, on July 22
=. Three, on July 23-25
=. Three, on July 29-30

North Indian Ocean

1. One, on multiple occasions

South Indian Ocean

1. Two, on March 5-6
=. Two, on March 8-9

South Pacific Ocean

1. Two, on May 9-10

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

World

1. Nineteen, from July 22-August 21
2. Eighteen, from July 16-August 15
=. Eighteen, from July 25-August 24

Atlantic

1. Seven, from August 30-September 29
=. Seven, from September 9-October 9
3. Six, from August 10-September 9
=. Six, from August 17-September 16

Eastern Pacific (includes Central)

1. Six, from July 22-August 21
1. Five, on multiple occasions

Western Pacific

1. Eight, from July 22-August 21
=. Eight, from August 14-September 13

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 September 14
2. Three, on multiple occasions

Most hurricanes active in a 30-day period

World

1. Thirteen, from August 22-September 21
2. Twelve, from August 25-September 24

Most Category 3 storms active simultaneously

World

1. Two, on September 7-9

Most Category 3s active in 30-day period

World

1. Eight, from August 21-September 20

Most Category 4 storms active simultaneously

World

1. Two, on September 8-9
=. Two, on September 10

Most Category 4s active in 30-day period

World

1. Seven, from August 21-September 20

Most consecutive days with a tropical storm active

World

1. Fifty, from August 11-September 30
2. Thirty-five, from July 7-August 10
3. Fourteen, from May 1-14

Most consecutive days with two tropical storms active

World

1. Seventeen, from September 5-21
2. Sixteen, from July 17-August 1

Activity Records (continued)

Most consecutive days with a hurricane active **World** 1. Thirty, from August 31-September 29 2. Sixteen, from July 23-August 7	Most consecutive days with two hurricanes active **World** 1. Five, from September 6-11 =. Five, from September 24-29
Most consecutive days with a major hurricane active **World** 1. Eleven, from September 1-11 2. Seven, from September 18-24	Most consecutive days with two major hurricanes active **World** 1. Four, from September 7-11

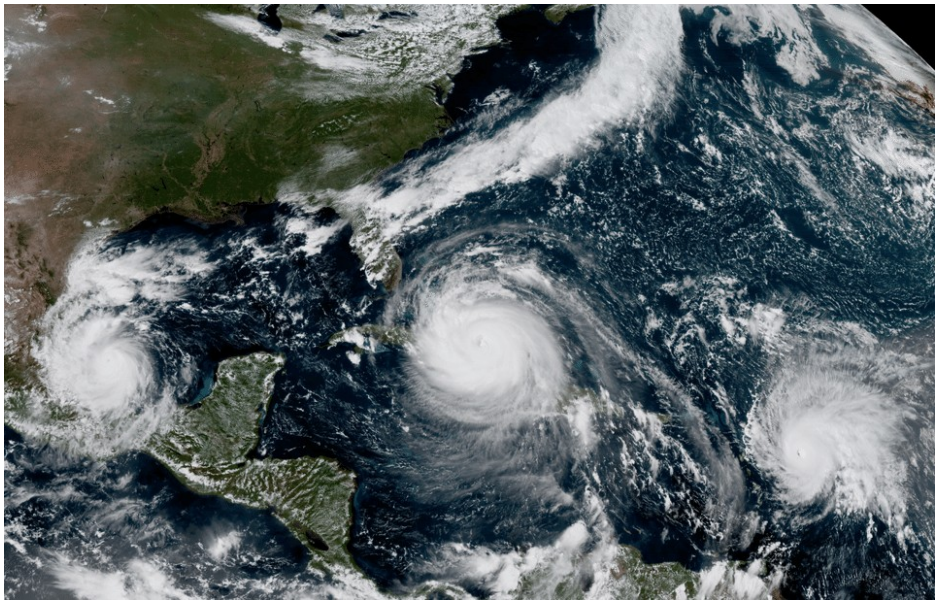


Image: True colour visible imagery of Hurricanes Katia, Irma and Jose (left to right) in the Atlantic in September 2017.
GOES-16

4.3. Landfall Records

Strongest landfalls

World

1. Hurricane Irma 185mph
2. Hurricane Maria 160mph
3. Cyclone Enawo 155mph

Most landfalls

World

1. Hurricane Irma 10
2. Tropical Storm Philippe 4

=. Tropical Depression 01W, Tropical Storm Kai-Tak, Tropical Storm Nanmadol, Typhoon Talim

Most hurricane landfalls

World

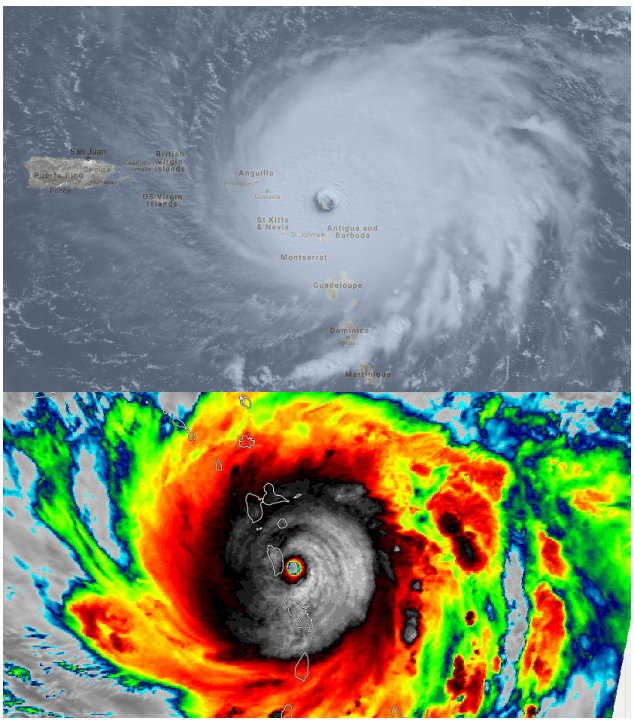
1. Hurricane Irma 10
2. Hurricane Nate 2

=. Typhoon Noru, Typhoon Saola, Hurricane Maria

Most major hurricane landfalls

World

1. Hurricane Irma 10
2. Hurricane Maria 2
3. Multiple storms 1



Images: Visible image of Hurricane Irma (top) during its first and strongest landfall in Barbuda, the strongest landfall worldwide in 2017. Infrared image of Hurricane Maria (bottom) shortly before its strongest landfall in Dominica as a Category 5 storm.
SSEC/NASA

Landfall totals for 2017 compared to previous years

World							
Year	Tot. Landfalls	TS	HU	MAJ	C5	Landfalling Storms	Storms:Landfall Ratio
2017	70	38	16	7	9	42	60.00%
2016	43	16	15	10	2	30	69.77%
2015	53	25	13	14	0	31	58.49%
2014	49	29	10	10	0	28	57.14%
2013	51	28	15	4	3	37	72.55%
2012	54	31	14	8	1	33	61.11%

4.4. Eye and Size Records

Largest Eyes

World

1. Hurricane Maria	139nm
2. Typhoon Noru	113nm
3. Hurricane Jose	85nm

Smallest Eyes

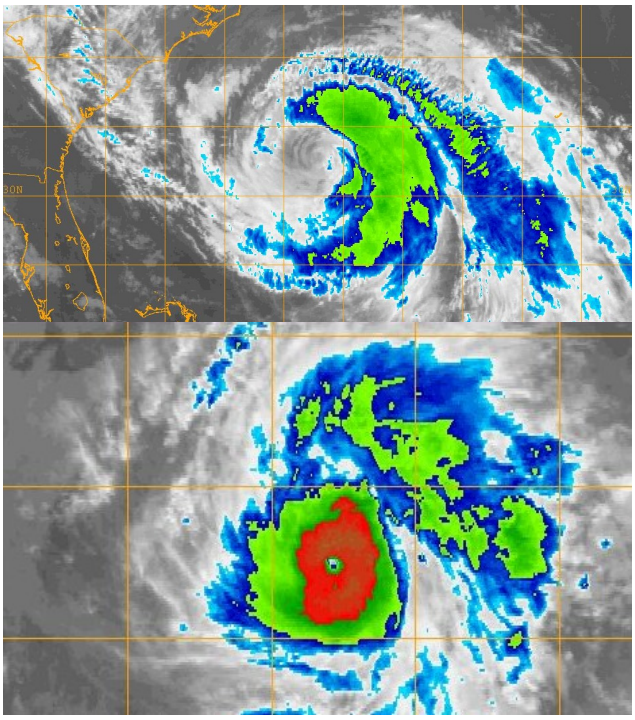
World

1. Hurricane Otis	3nm
1. Hurricane Jose	9nm
1. Hurricane Maria	10nm

Warmest Eyes

World

1. Hurricane Irma	18.0°C (64.4°F)
2. Hurricane Fernanda	17.0°C (62.6°F)
2. Hurricane Harvey	16.0°C (60.8°F)



Images from top to bottom:
1. Infra-red image of Hurricane Maria after its secondary peak, displaying a 139nm wide eye.
2. Infra-red image of Hurricane Otis near its peak intensity, displaying a 3nm wide eye.
U.S. Navy

Largest Storm Size

World

1. Typhoon Lan	565nm
2. Cyclone Donna	390nm
1. Typhoon Talim	325nm
1. Hurricane Ophelia	290nm
=. Cyclone Debbie	290nm

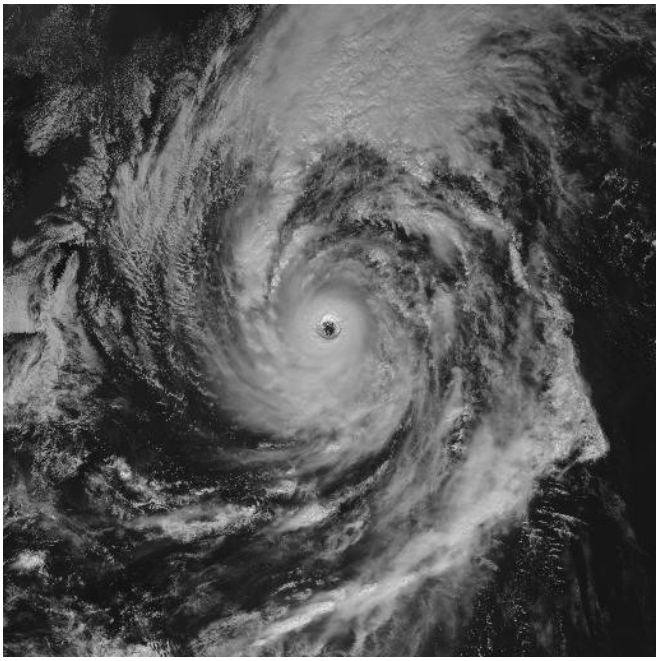


Image: Visible image of Typhoon Lan, believed to have the largest wind radius in 2017.
Digital Typhoon

4.5. Intensification Records

Fastest over a 12 hour period

World

1. Cyclone Ernie	+85mph
2. Hurricane Maria	+80mph
=. Hurricane Otis	+80mph
=. Typhoon Noru	+80mph

Fastest over a 24 hour period

World

1. Cyclone Ernie	+120mph
2. Hurricane Otis	+100mph
3. Hurricane Maria	+95mph
4. Typhoon Noru	+90mph

Fastest time to increase wind speeds by 100mph

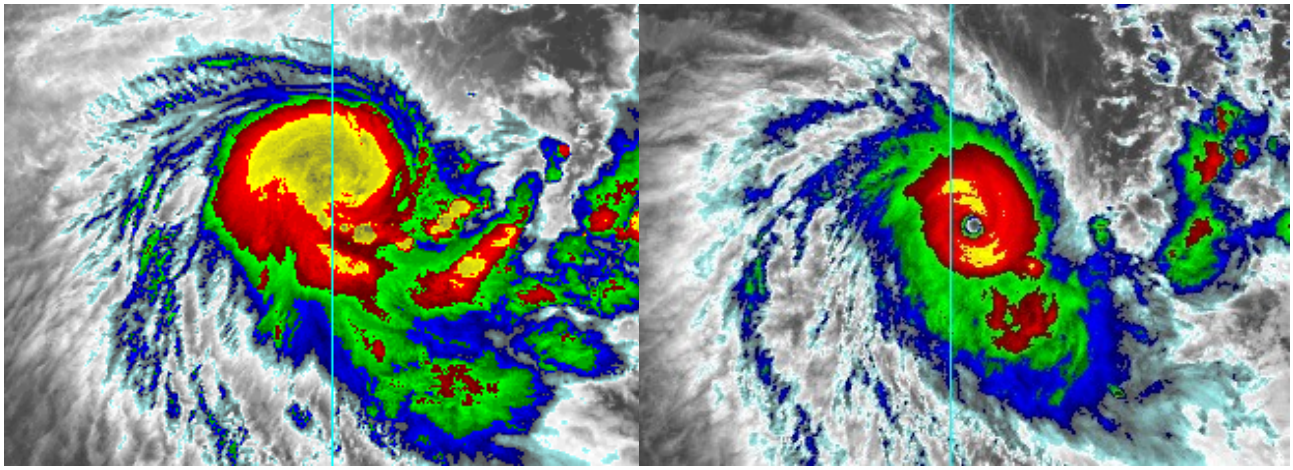
World

1. Cyclone Ernie	18 hours
2. Hurricane Maria	24 hours
3. Hurricane Harvey	48 hours

Fastest time to decrease pressure by 100mb

World

1. Hurricane Maria	90 hours



Above: Comparison images of Cyclone Ernie late on April 6 and early on April 7. These images are taken twelve hours apart, during which time Ernie gained an estimated 85mph of wind speed, the highest of any storm this year.

5. Force Thirteen during 2017

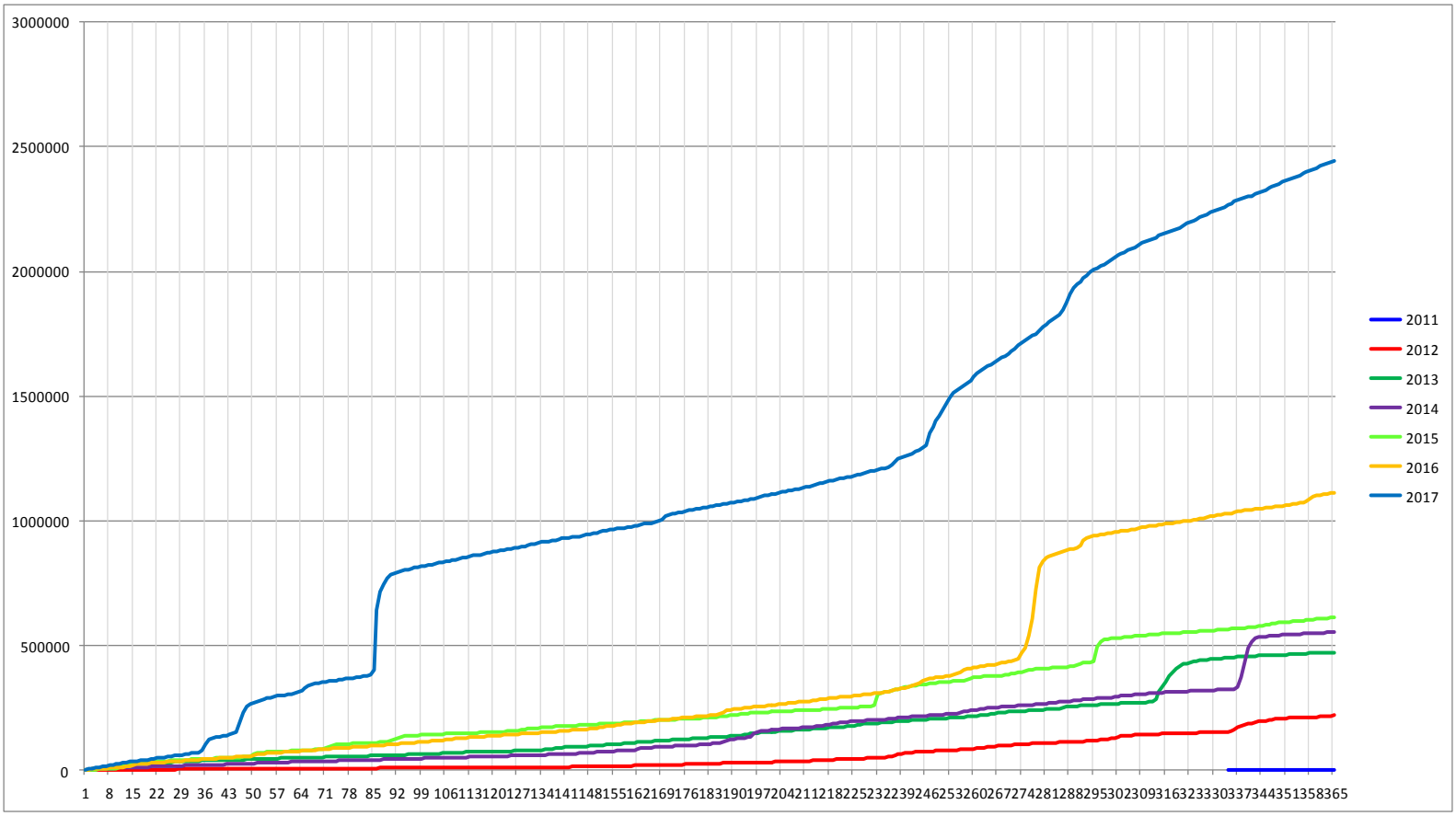


Image: Cumulative viewing figures by year on the Force Thirteen main YouTube channel.

2017 was the third 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 great leaps with its visual presentation, and reached wider and more varied audiences than ever before. Further work is needed in 2018 to maintain a good quality reliable service.

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, 2017 sets another new record for amount of views on the Force Thirteen YouTube channel, surpassing 2016's total before the end of July. The website, however, remained mostly dormant throughout the year, and is a large priority for 2018.

In 2017, the Force Thirteen YouTube channel received a 95.4% 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 452 videos uploaded on the Force Thirteen main channel throughout 2017, which was 98 more than in 2016. There were also 9 videos on Force Thirteen Xtra, 9 on Force Thirteen UK & Ireland, 245 on Force Thirteen AU & Oceania, 52 on Force Thirteen US & Caribbean, 15 on Space Thirteen, and 129 on Force Thirteen's Tropical Archive.

Most storms were covered satisfactorily, building upon the quality of last year. The Force Thirteen tracker was automated in 2015 and was up to date throughout 2017 during the website's up-time. Video uploads were issued in a timely manner when conditions warranted on the vast majority of occasions.
In May 2017, complications with a restructuring of the force-13.com website resulted in the formation of force-13.co.uk, which was to be used temporarily until the original site returned. Due to activities in the latter part of the year, neither website reached their potential, and is set as a priority in 2018 to retain the force-13.com website as it formerly was, and to use force-13.co.uk as a UK orientated branch.

Limited capacities resulted from staff shortages during late August and early September, and again in November and December.

The most impressive part of the year was arguably Force Thirteen's coverage on Cyclone Debbie in Australia. However, the team also rose to the occasions of Hurricane Harvey, Irma and Maria in the Atlantic, with multiple team members producing solo updates for the first time.

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, 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 2017 was 96% in the United States; 97% in the United Kingdom, and 93% 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

2017 had approximately 2,440,202 views on the channel during the year. This figure may be inaccurate by up to 5,000 each way.
By comparison, 2016 finished with 1,112,600 views, less than half of what was seen in 2017.
2017 also set new records for most views received in a single day—242,575—which occurred on March 27th during Cyclone Debbie. Additionally, 2017 set a new weekly views record of 407,793, and also claimed 3rd spot for the same criteria. Also, 2017 set new 2nd, 3rd, 4th, and 5th highest monthly viewing records, although the highest number still belongs to October 2016.

2017 also continued the record streak for most days in a row with over 1,000 views, which is still in progress as of January 4, 2018. Every day from May 25, 2016 to January 4, 2018 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), 2017 also comes out on top, with at least 5,400,325 minutes of viewing time, collectively. This is over a million more than in 2016.

In 2017, approval rate also reached a new record, with 17,994 likes compared to 7,030 last year. Typically, as videos enter a more mainstream focus, the disapproval rate has also been the highest on record this year, with 870 dislikes compared to 367 last year.

In 2017, comments on YouTube videos amounted to 58,672, compared to 102,659 in 2016. The higher number in 2016 is primarily due to the coverage on Hurricane Matthew

The subscriber base has grown by 3,925 in 2017, compared to 2,469 in 2016.

Below shows a table of the top ten countries by viewing numbers compared to 2016.

Country	2017	2016
United States	1,090,676	600,701
Australia	346,300	17,155
South Africa	134,010	1,569
Philippines	111,658	86,258
United Kingdom	87,656	52,676
Canada	60,124	32,505
Mauritius	55,001	3,157
Vietnam	37,709	12,985
India	28,441	8,922
Hong Kong	27,851	13,641

5.2 Viewing Statistics

Channel	2017 Viewcount	2016 Viewcount
Main Channel	2,440,202	1,112,600
Force Thirteen Xtra	3,670	14,347
Force Thirteen UK & Ireland	2,283	2,350
Force Thirteen AU & Oceania	18,761	1,827
Force Thirteen US & Caribbean	2,562	945
Space Thirteen	1,467	353
Force Thirteen's Tropical Archive	89,400	65,627
Total	**2,558,345**	**1,198,049**

Channel	2017 Approval %	2016 Approval %
Main Channel	95% (18867 ratings)	95% (7453 ratings)
Force Thirteen Xtra	96% (26 ratings)	81% (115 ratings)
Force Thirteen UK & Ireland	93% (14 ratings)	85% (13 ratings)
Force Thirteen AU & Oceania	92% (197 ratings)	100% (35 ratings)
Force Thirteen US & Caribbean	98% (122 ratings)	100% (14 ratings)
Space Thirteen	95% (21 ratings)	100% (5 ratings)
Force Thirteen's Tropical Archive	97% (632 ratings)	99% (464 ratings)

6. 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 contact@force-13.co.uk

E-mail address: contact@force-13.co.uk
Website: www.force-13.com
YouTube: Forcethirteen
Facebook: ForceThirteen
Twitter: @ForceThirteen
Skype: Fool13
Discord: Fool13#9094
Soundcloud: Sound Thirteen