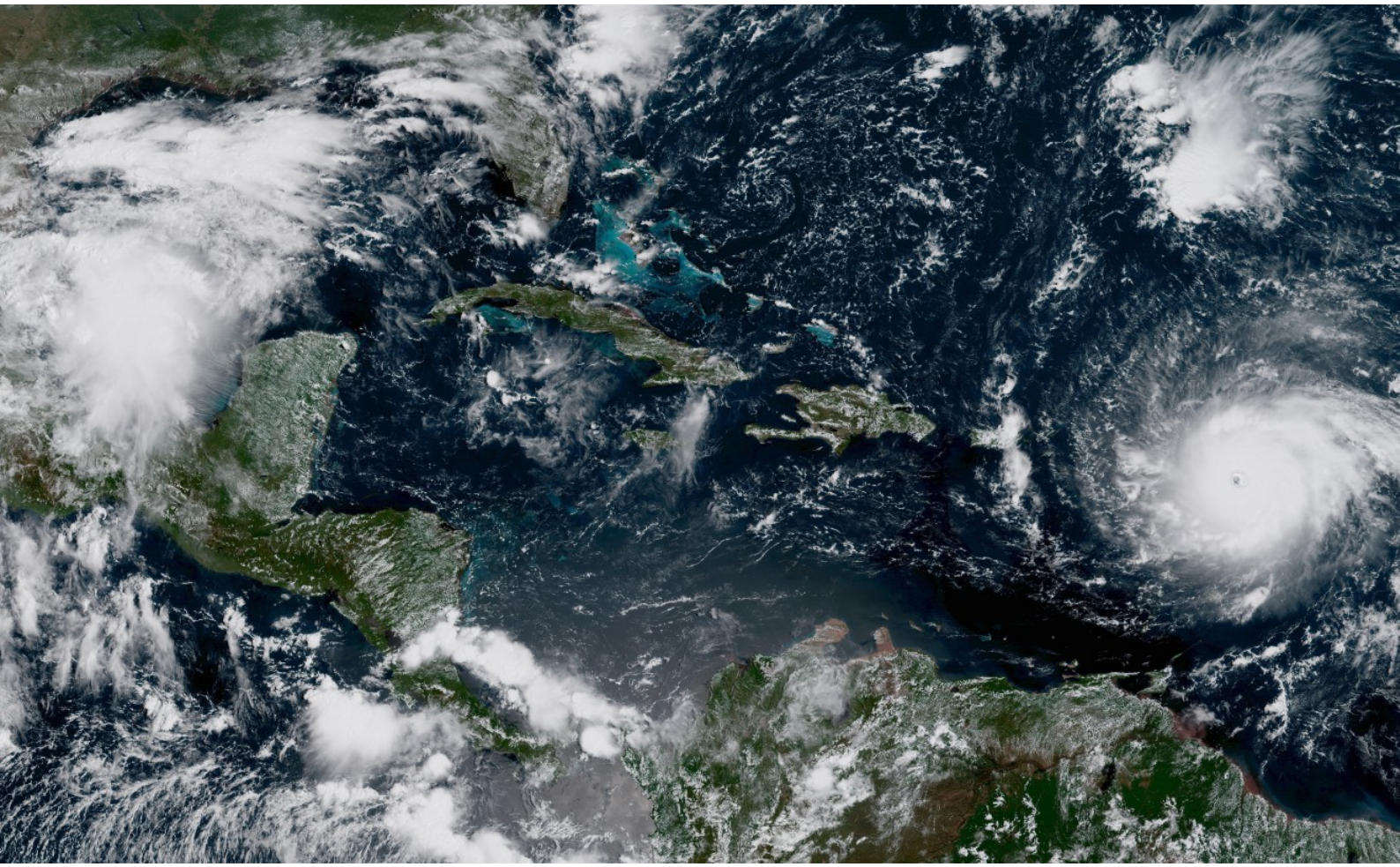
2017

Force Thirteen Cyclone Reports

Hurricane Irma (11L)



Hurricane Irma was the ninth named storm of the 2017 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 Force Thirteen's database), and tied 12th most intense (13th on Force Thirteen's database). Irma caused catastrophic damage across the Lesser Antilles, Turks and Caicos Islands, Cuba, and Florida in September 2017.

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September 17, 2017
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FORCE THIRTEEN

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1.1. Synoptic History

On August 26, a new tropical disturbance formed over the center of the African continent moving generally to the south-west until leaving land on the 27th, entering the Atlantic Ocean. Gradual organisation took place on the disturbance, showing signs of a circulation that became progressively better defined in the following days.

The disturbance presented spiral bandings and a closed center of circulation on August 30, and based on satellite observations, it was classified as a Tropical Storm by the National Hurricane Center, naming it Irma.

Shortly after being named the storm underwent a period of rapid Intensification as an Anticyclone appeared above the system as well a Central Dense Overcast and the appearance of an eye. At one stage, Irma was a 70mph strong Tropical Storm and in a mere of 12 hours it became a Category 3 Major Hurricane with winds of 115mph on August 31st. Irma was the first Major Hurricane to form east of 35^{0}W since Hurricane Julia of 2010.

Officially, the hurricane attained an initial peak intensity of 120mph and 964 mbar on September 1st at 17:00 AST (21:00 UTC) before starting to weaken due to an eyewall replacement cycle. At the same time a strengthening subtropical ridge was pushing Irma to the west south-west.

Irma kept moving to the west south-west as its intensity kept fluctuating between Category 2 and Category 3 intensities due to several more Eyewall Replacement Cycles between September 2nd and 4th, and the first hurricane watches were issued in many areas of the Leeward Islands at 17:00 AST (21:00 UTC) on September 3. Irma remained small but it was already representing a danger to those islands that had high chances to receive serious hurricane conditions. The storm was located about 790 miles East of the Leeward Islands when the first watches appeared on the bulletin.

By the morning of September 4 Irma found extremely favorable conditions and started a new phase of Rapid Intensification as it started to move now to the west. Hurricane Warnings began to be issued in the Lesser Antilles and a Hurricane Watch in Puerto Rico at 11:00 AST (15:00 UTC) about 560 miles East of Leeward Islands.

The storm's structure improved gradually on the next day, becoming more circular and symmetric on the satellite imagery, cloud tops of -75^{0}C and a clear symmetric eye of 20 nautical miles wide, confirming that Irma reached Category 5 Hurricane status with winds of 175 mph but with an unusually high pressure of 929 mbar. Irma also presented annular characteristics as it continued to approach the islands. Further intensification occurred and Irma attained its peak wind speed of 185mph by the afternoon.

The powerful hurricane remained with winds of 180 mph or higher for 48 hours in total; during that time the storm made landfall in Barbuda at peak intensity. The storm then struck St Martin/Saint Maarten and the British Virgin Islands at or near the same intensity. Irma marginally eclipsed a hurricane in 1825 to become the most intense storm to make landfall on any of the islands, and is the strongest since at least the Great Hurricane of October 1780.

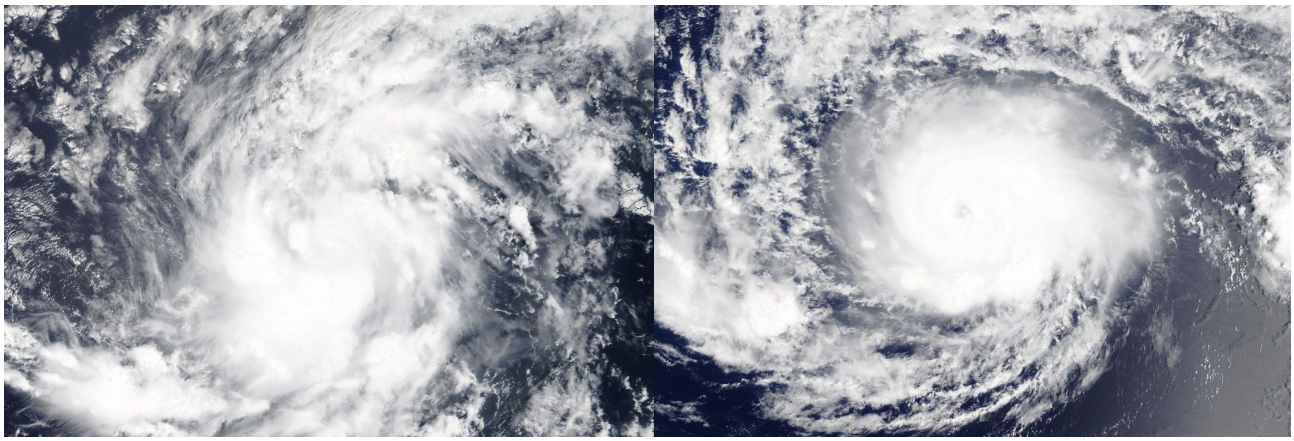
Irma passed north of Puerto Rico and Hispaniola, bringing hurricane-force winds to those islands as it weakened slightly due to another Eyewall Replacement Cycle but maintained Category 5 status as it was moving through the Turks and Caicos Islands.

By September 7, hurricane and storm surge watches and warnings were issued on Cuba and Florida with as Irma's eye passed very close to Great Inagua Island. By September 8th, Irma was nearing the coast of Cuba and briefly reintensified to become a Category 5 storm before making another landfall on Cayo Romano.

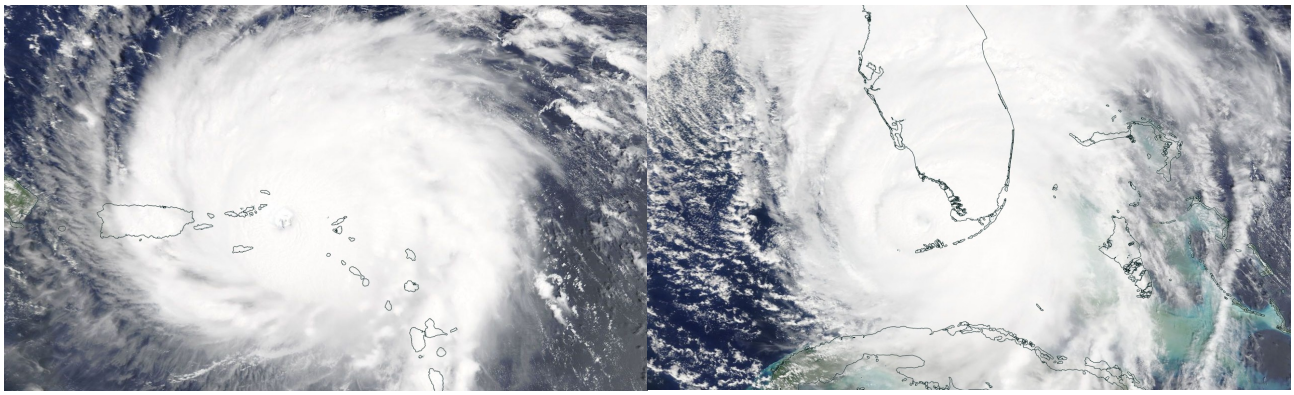
Despite hugging the coast of Cuba for two days, it maintained borderline Category 4 intensity as it progressed towards the Florida Keys, striking Big Pine Key on September 10. It made its final landfall in the latter part of the day on Marco Island, south of Naples.

Irma continued to move north while affecting Florida and neighbouring states of the United States and weakened rapidly due to increasing wind shear. By September 12 Irma moved over Georgia, Alabama and eventually towards Tennessee, becoming a huge remnant low eventually merging with a frontal system over Newfoundland.

1.1. Synoptic History

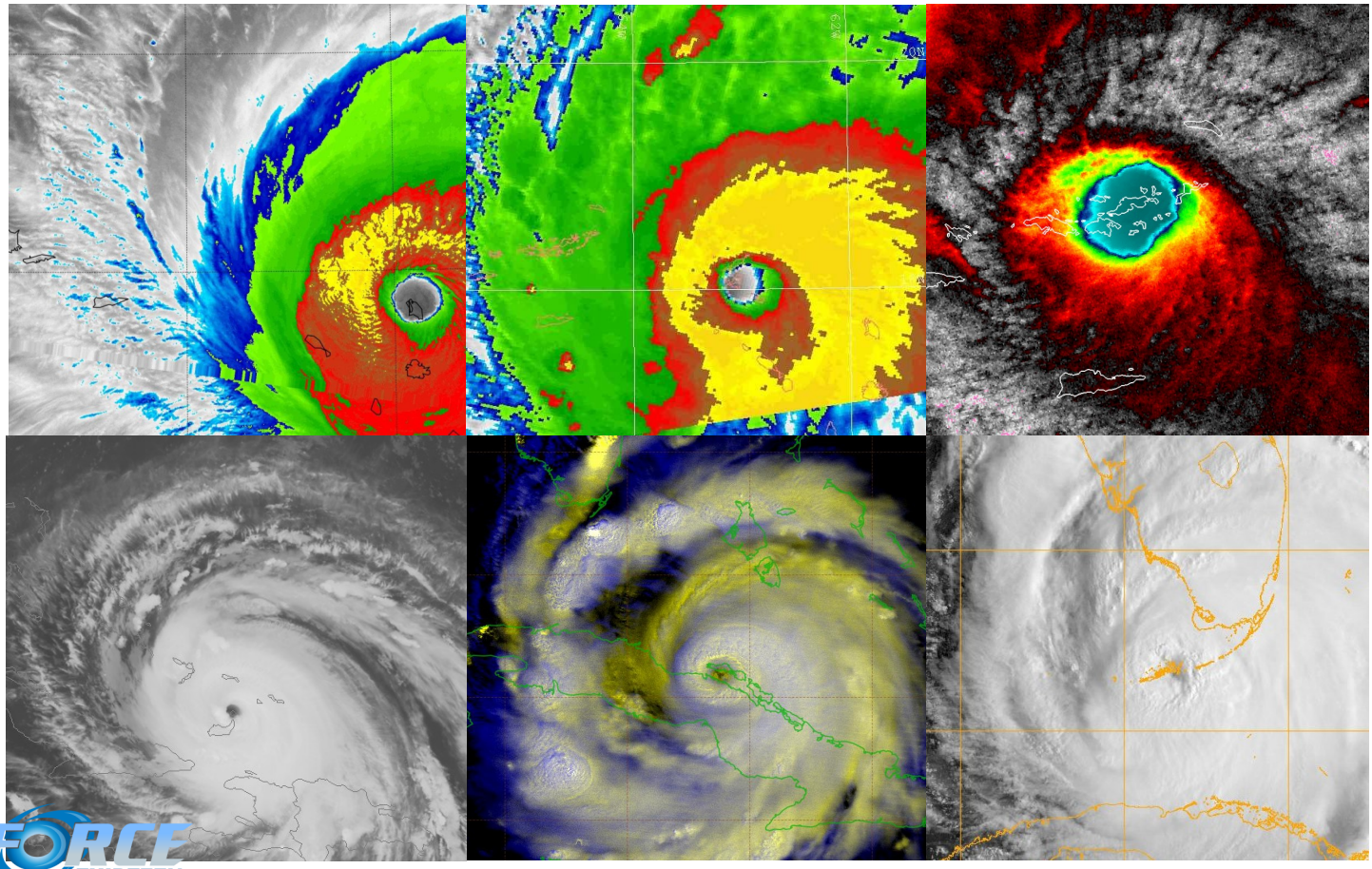


August 30th | September 2nd



September 6th | September 10th

Selected Landfall Images



1.2. Best Track

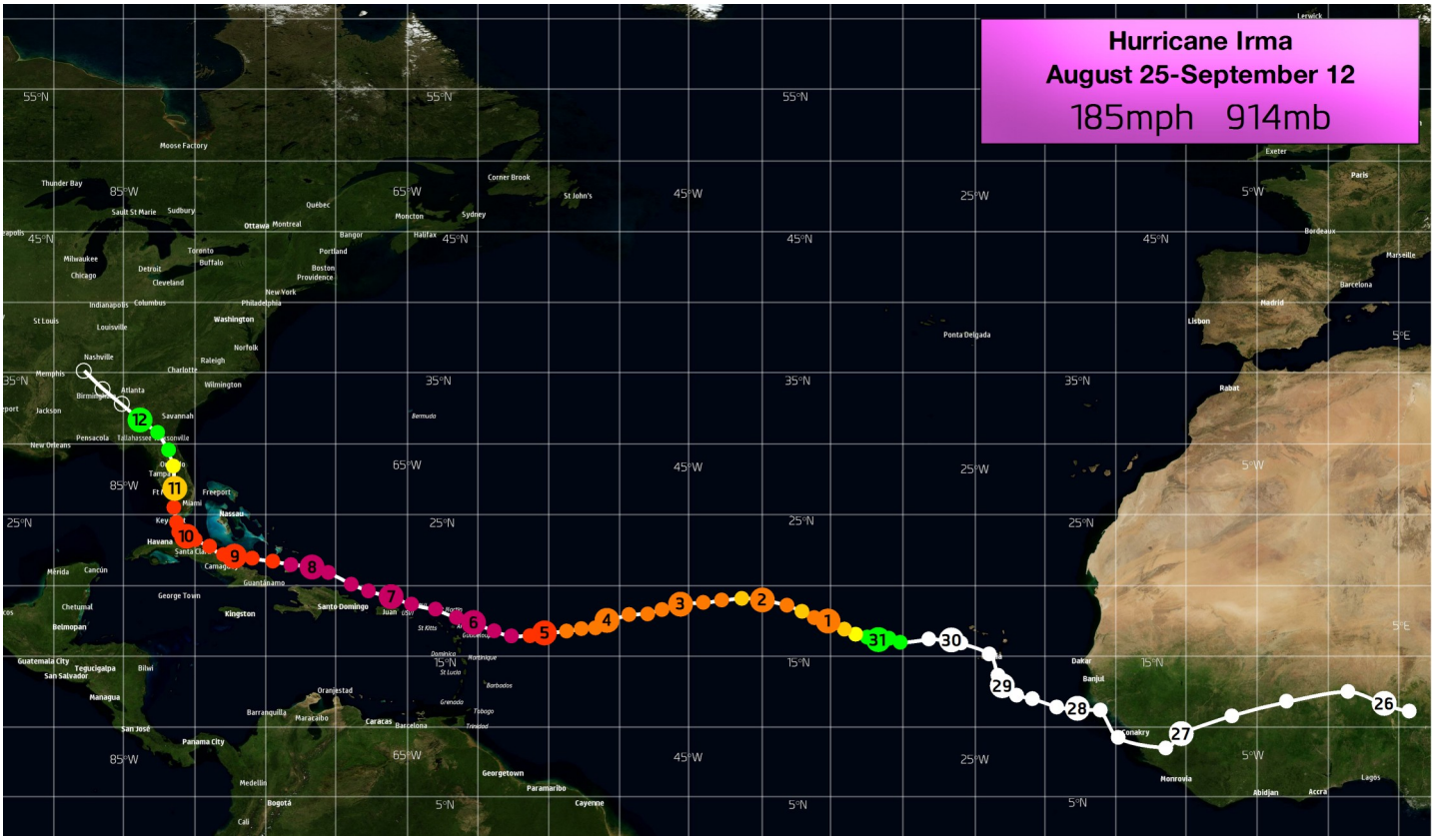
Below is the best track analysis from Force Thirteen, using Force Thirteen's SATOPS—a tool which uses infrared satellite imagery and cloud temperatures to estimate a storm's wind speed and air pressure. SATOPS does not take precedence over surface observations.

Date (dd/mm/yy)	Time	Latitude	Longitude	Wind	Pressure	Stage
25/08/2017	18:00	10.9	5.5	20	1013	Tropical Wave
26/08/2017	00:00	11.8	4.2	20	1013	Tropical Wave
26/08/2017	06:00	12.5	1.2	20	1013	Tropical Wave
26/08/2017	12:00	11.5	-3.5	20	1013	Tropical Wave
26/08/2017	18:00	10.4	-7	20	1013	Tropical Wave
27/08/2017	00:00	9.2	-10.2	20	1012	Tropical Wave
27/08/2017	06:00	8.2	-11.5	20	1012	Tropical Wave
27/08/2017	12:00	9.5	-14.9	20	1012	Tropical Wave
27/08/2017	18:00	11.5	-16	20	1012	Tropical Disturbance
28/08/2017	00:00	11.5	-17.8	20	1012	Tropical Disturbance
28/08/2017	06:00	11.6	-19.3	20	1011	Tropical Disturbance
28/08/2017	12:00	12	-20.8	25	1010	Tropical Disturbance
28/08/2017	18:00	12.1	-22.2	25	1010	Tropical Disturbance
29/08/2017	00:00	12.9	-23.2	25	1010	Tropical Disturbance
29/08/2017	06:00	13.8	-23.4	30	1009	Tropical Disturbance
29/08/2017	12:00	15.2	-24	25	1009	Tropical Disturbance
29/08/2017	18:00	15.8	-26.1	30	1008	Tropical Disturbance
30/08/2017	00:00	16.1	-26.8	30	1007	Tropical Disturbance
30/08/2017	06:00	16.4	-28.3	30	1007	Tropical Disturbance
30/08/2017	12:00	15.8	-30.2	40	1005	Tropical Storm
30/08/2017	18:00	16.3	-30.8	50	1003	Tropical Storm
31/08/2017	00:00	16.1	-31.9	60	1000	Tropical Storm
31/08/2017	06:00	16.5	-32.6	65	998	Tropical Storm
31/08/2017	12:00	16.7	-33.5	80	991	Category 1
31/08/2017	18:00	17.2	-34.3	105	976	Category 2
01/09/2017	00:00	17.5	-35.2	115	970	Category 3
01/09/2017	06:00	17.9	-36.3	115	969	Category 3
01/09/2017	12:00	18.4	-37.4	110	971	Category 2
01/09/2017	18:00	18.7	-38.6	120	965	Category 3
02/09/2017	00:00	19	-40	115	966	Category 3
02/09/2017	06:00	19.1	-41.7	110	970	Category 2
02/09/2017	12:00	19	-42.8	115	968	Category 3
02/09/2017	18:00	18.8	-44.2	115	967	Category 3
03/09/2017	00:00	18.5	-45.8	115	970	Category 3
03/09/2017	06:00	18.1	-47.1	120	965	Category 3
03/09/2017	12:00	17.8	-48.1	115	963	Category 3
03/09/2017	18:00	17.8	-49.6	115	964	Category 3
04/09/2017	00:00	17.2	-50.8	115	959	Category 3
04/09/2017	06:00	16.9	-51.8	115	961	Category 3
04/09/2017	12:00	16.9	-52.6	120	952	Category 3
04/09/2017	18:00	16.8	-54	120	948	Category 3
05/09/2017	00:00	16.7	-55.3	130	944	Category 4
05/09/2017	06:00	16.6	-56.4	150	936	Category 4
05/09/2017	12:00	16.6	-57.9	165	928	Category 5
05/09/2017	18:00	17	-59.3	175	925	Category 5
06/09/2017	00:00	17.4	-60.4	185	915	Category 5
06/09/2017	06:00	17.8	-61.9	185	917	Category 5
06/09/2017	12:00	18.2	-63.5	180	919	Category 5
06/09/2017	18:00	18.6	-64.7	185	916	Category 5

1.2. Best Track

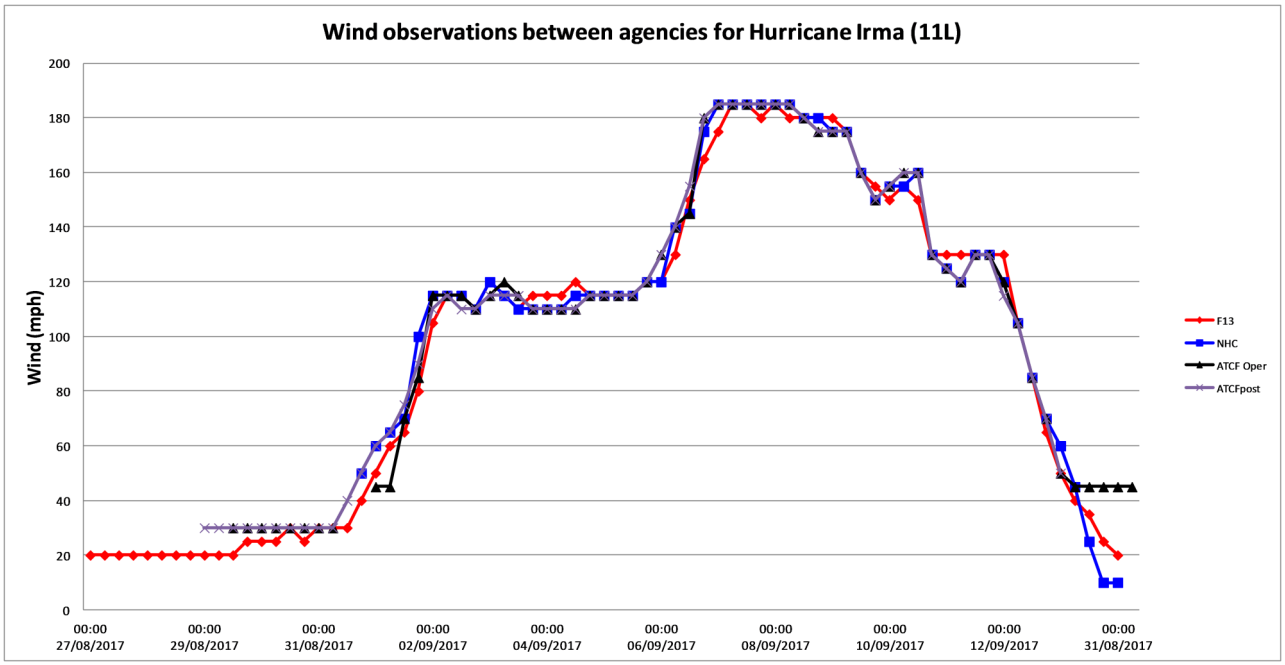
Date (dd/mm/yy)	Time	Latitude	Longitude	Wind	Pressure	Stage
07/09/2017	00:00	19.2	-66	180	914	Category 5
07/09/2017	06:00	19.8	-67.8	180	919	Category 5
07/09/2017	12:00	20.2	-69.1	180	920	Category 5
07/09/2017	18:00	20.9	-70.4	180	922	Category 5
08/09/2017	00:00	21.2	-71.9	175	922	Category 5
08/09/2017	06:00	21.6	-73.4	160	926	Category 5
08/09/2017	12:00	21.8	-74.6	155	927	Category 4
08/09/2017	18:00	22	-76	150	928	Category 4
09/09/2017	00:00	22.1	-77.2	155	923	Category 4
09/09/2017	06:00	22.2	-78	150	929	Category 4
09/09/2017	12:00	22.7	-79.3	130	936	Category 4
09/09/2017	18:00	23.2	-80	130	938	Category 4
10/09/2017	00:00	23.4	-80.5	130	938	Category 4
10/09/2017	06:00	23.8	-81.2	130	934	Category 4
10/09/2017	12:00	24.5	-81.2	130	931	Category 4
10/09/2017	18:00	25.7	-81.6	130	935	Category 4
11/09/2017	00:00	26.8	-81.5	105	943	Category 2
11/09/2017	06:00	28.2	-81.6	85	958	Category 1
11/09/2017	12:00	29.6	-82.2	65	974	Tropical Storm
11/09/2017	18:00	30.9	-83	50	985	Tropical Storm
12/09/2017	00:00	31.9	-84.4	40	993	Tropical Storm
12/09/2017	06:00	33	-85.2	35	997	Post-tropical
12/09/2017	12:00	34.2	-87	25	1001	Post-tropical
12/09/2017	18:00	35.1	-88.2	20	1004	Post-tropical

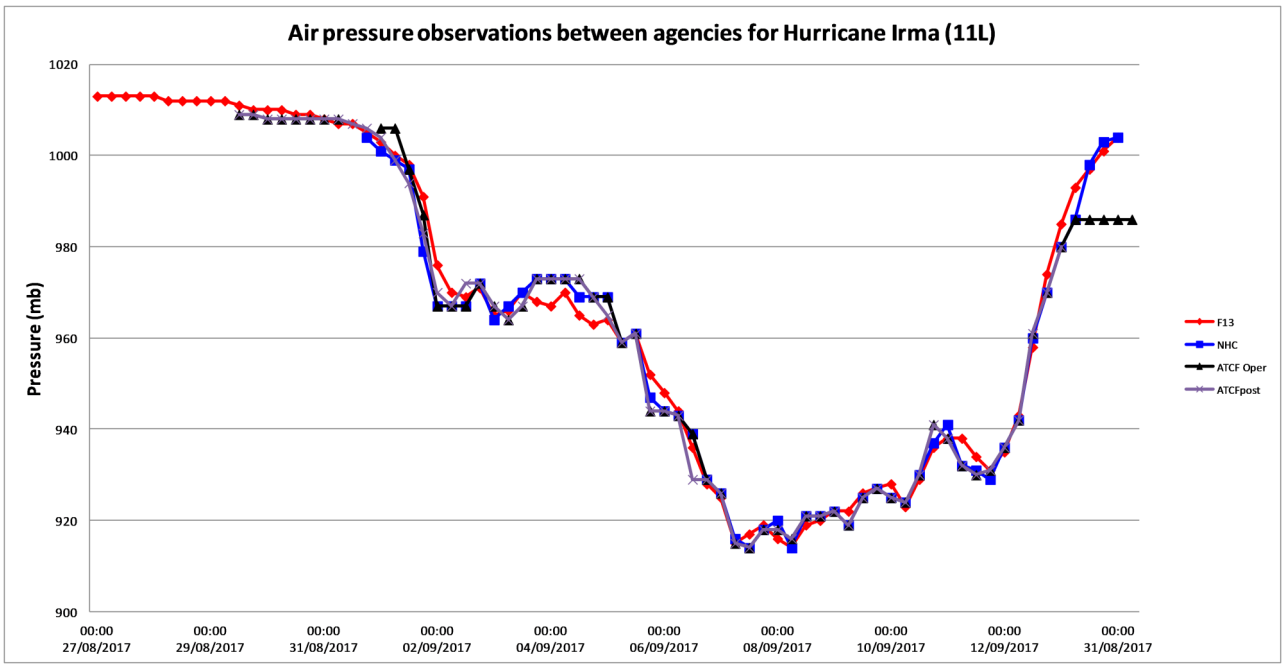
1.3. Track Chart



1.4. Comparison with other agencies

Irma was monitored by the National Hurricane Center in Miami, Florida, and was observed by the US Navy. Below shows comparisons between the agencies, and Force Thirteen's best track.





2. Effects on Land

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 Totola.

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.

At the time of this report, the damages from the storm were still being assessed. However, suffice to say that the damages in Barbuda, St Martin and the British Virgin islands were catastrophic, with total damage for some areas and the potential for some of these islands to become uninhabitable as a result.

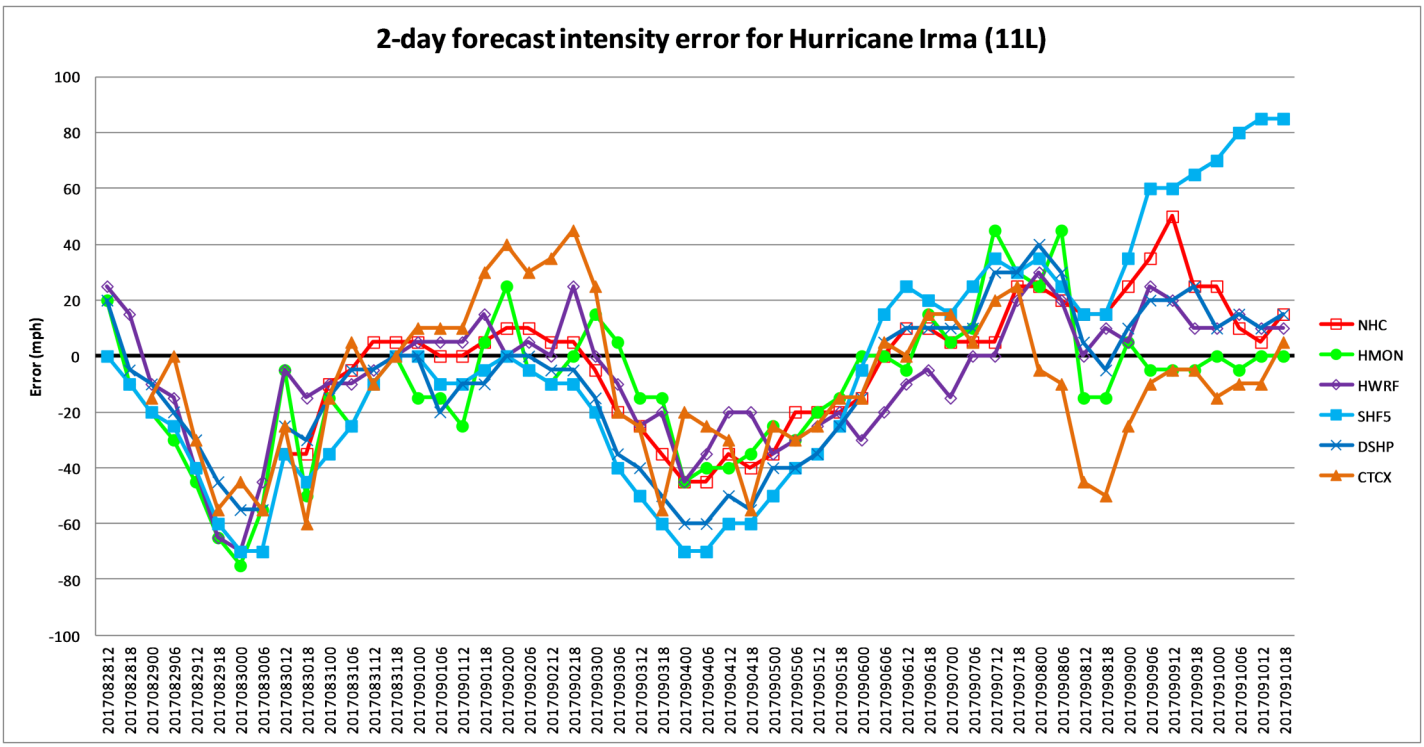
The minimum recorded pressure in Puerto Rico reached 952mb in Culebra, with nearby stations reporting sustained winds of up to 107mph. Nearly 16 inches of rain fell in the US Virgin Islands, and up to 13 in Puerto Rico.

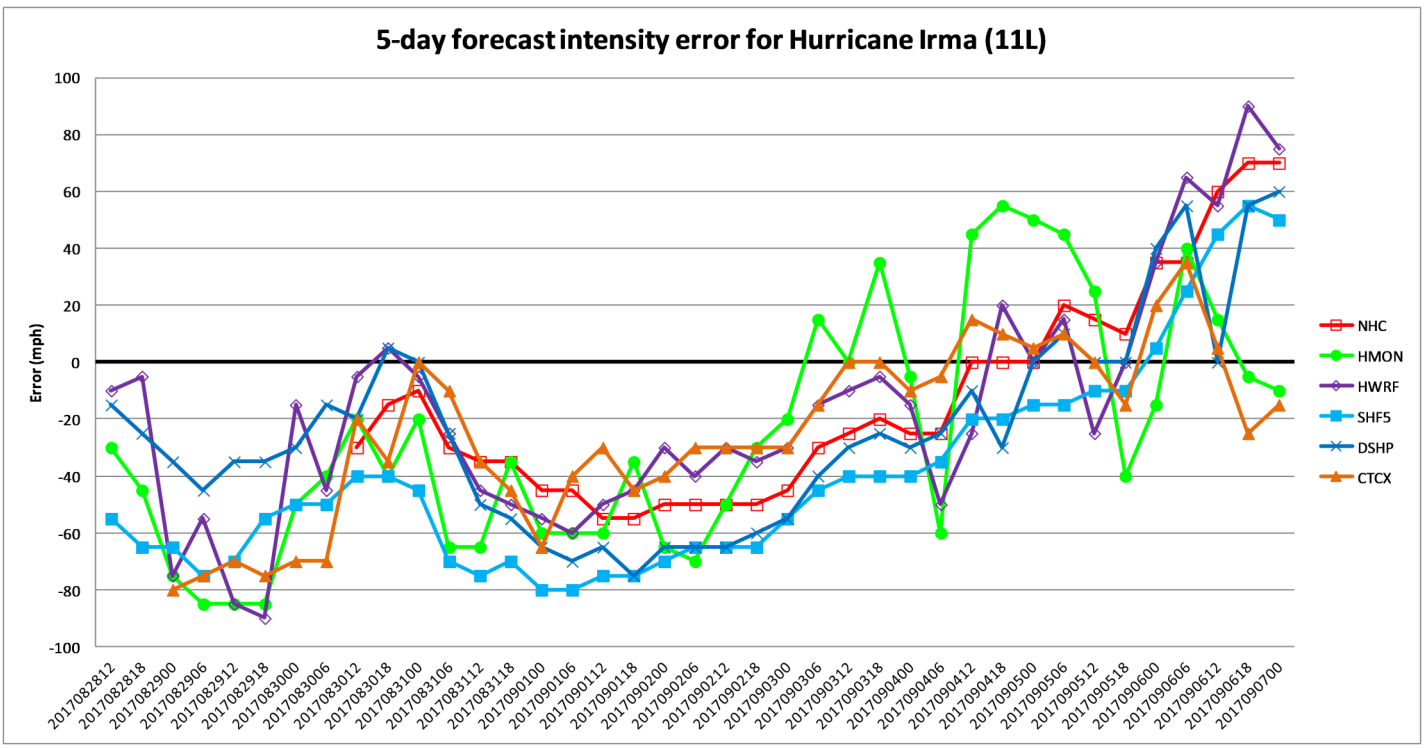
In Florida, the highest rainfall was nearly 16 inches at Fort Pierce, along with state maxima of 10.1 inches at Kingsland, Georgia; 8.7 inches in Charleston, South Carolina; 6.1 inches in Busick, North Carolina, and 4.7 inches at West Point, Alabama.

Peak wind speed gusts reached 142mph near Naples, 130mph at Marco Island, 99mph at Key Biscayne and Miami International Airport, with hurricane force gusts being recorded in one place elsewhere in the United States, at Parris Island, SC. Data for other countries is as yet unknown.

3. Forecasting Critique

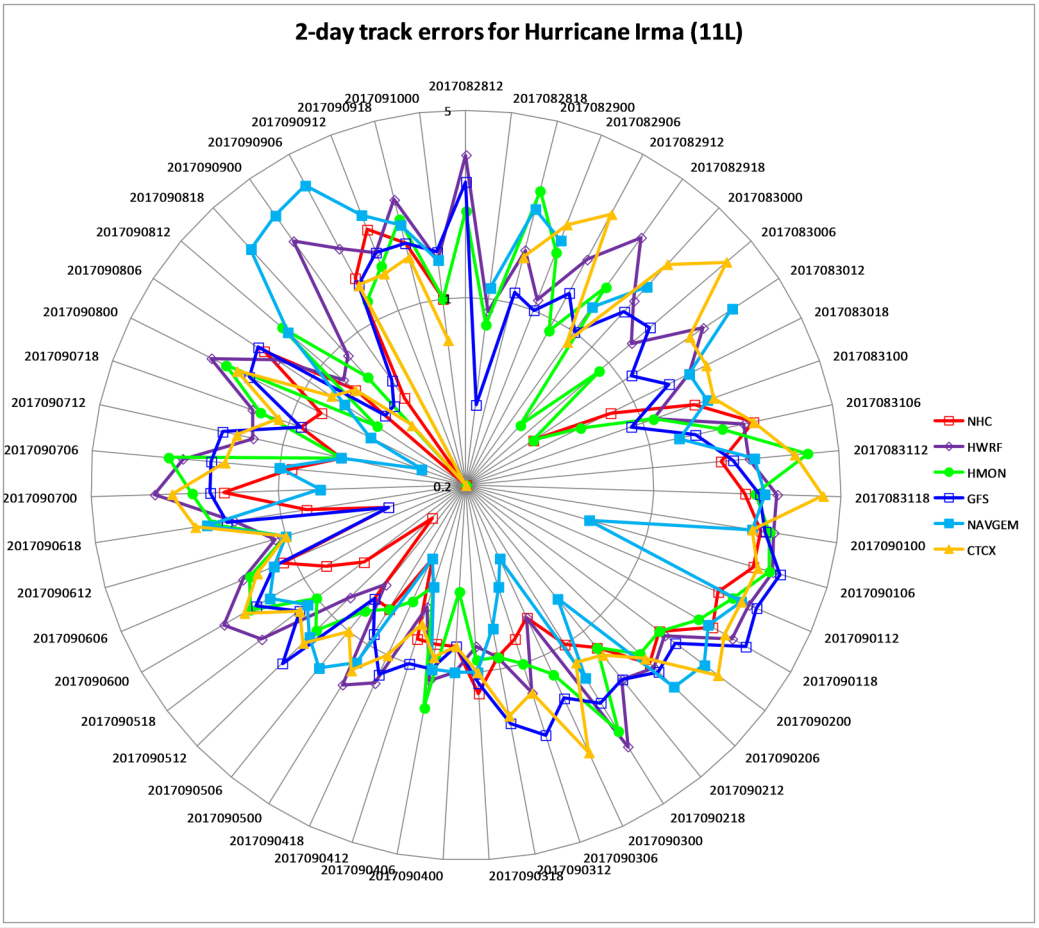
The next pages show the track and intensity forecast errors from the computer models and the National Hurricane Center.
The intensity error charts show how many miles per hour the model predictions were from the observed intensity two and five days later. A value of 0 denotes a perfectly accurate prediction. Negative values correspond to predictions lower than the observation, and positive values show predictions higher than the observation.

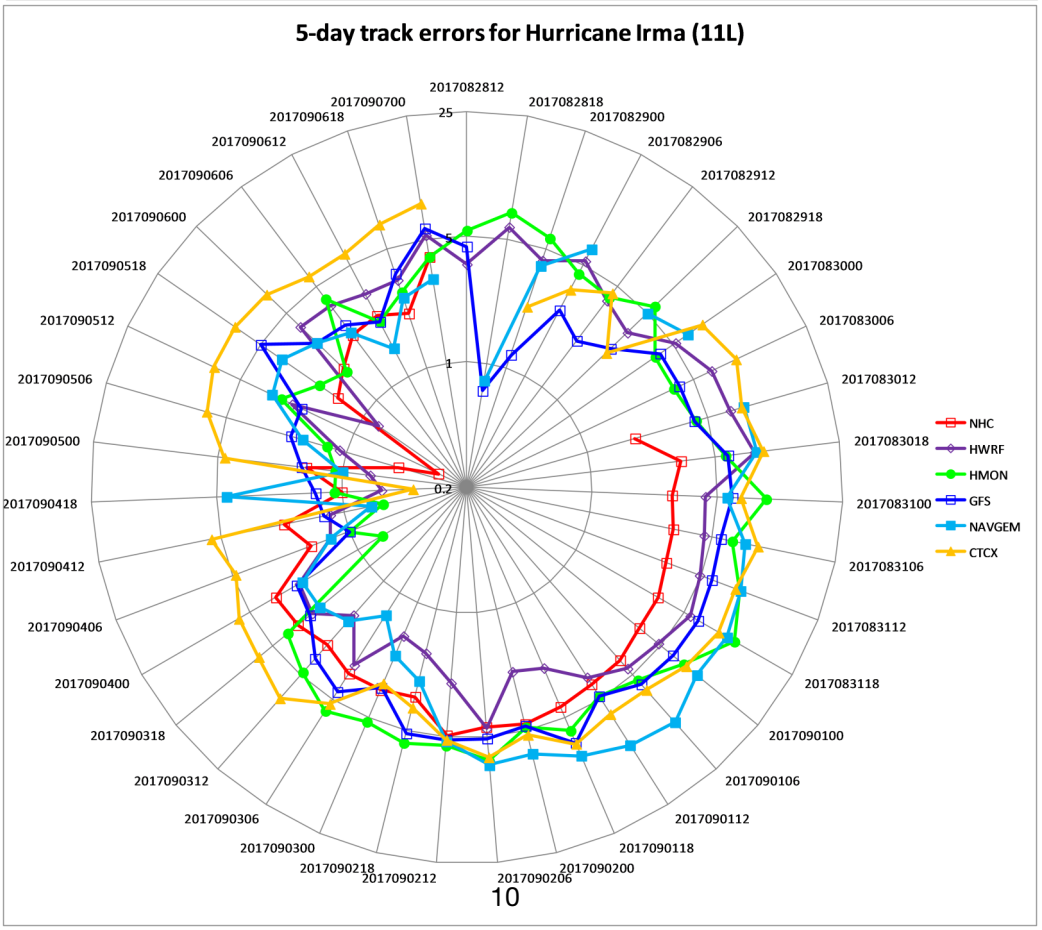




3. Forecasting Critique

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





3. Forecasting Critique

Data from the charts are published below.

2-day forecast intensity error							
Run	NHC	HMON	HWRF	SHF5	DSHP	CTCX	**Average**
2017082812		20	25	0	20		**16**
2017082818		10	15	10	5		**10**
2017082900		20	10	20	10	15	**15**
2017082906		30	15	25	20	0	**18**
2017082912		45	40	40	30	30	**37**
2017082918		65	65	60	45	55	**58**
2017083000		75	70	70	55	45	**63**
2017083006		55	45	70	55	55	**56**
2017083012	35	5	5	35	25	25	**22**
2017083018	35	50	15	45	30	60	**39**
2017083100	10	15	10	35	15	15	**17**
2017083106	5	25	10	25	5	5	**13**
2017083112	5	10	5	10	5	10	**8**
2017083118	5	0	0	0	0	0	**1**
2017090100	5	15	5	0	0	10	**6**
2017090106	0	15	5	10	20	10	**10**
2017090112	0	25	5	10	10	10	**10**
2017090118	5	5	15	5	10	30	**12**
2017090200	10	25	0	0	0	40	**13**
2017090206	10	5	5	5	0	30	**9**
2017090212	5	10	0	10	5	35	**11**
2017090218	5	0	25	10	5	45	**15**
2017090300	5	15	0	20	15	25	**13**
2017090306	20	5	10	40	35	20	**22**
2017090312	25	15	25	50	40	25	**30**
2017090318	35	15	20	60	50	55	**39**
2017090400	45	45	45	70	60	20	**48**
2017090406	45	40	35	70	60	25	**46**
2017090412	35	40	20	60	50	30	**39**
2017090418	40	35	20	60	55	55	**44**
2017090500	35	25	35	50	40	25	**35**
2017090506	20	30	30	40	40	30	**32**
2017090512	20	20	25	35	35	25	**27**
2017090518	20	15	20	25	25	15	**20**
2017090600	15	0	30	5	15	15	**13**
2017090606	0	0	20	15	5	5	**8**
2017090612	10	5	10	25	10	0	**10**
2017090618	10	15	5	20	10	15	**13**
2017090700	5	5	15	15	10	15	**11**
2017090706	5	10	0	25	10	5	**9**
2017090712	5	45	0	35	30	20	**23**
2017090718	25	30	20	30	30	25	**27**
2017090800	25	25	30	35	40	5	**27**
2017090806	20	45	20	25	30	10	**25**
2017090812	15	15	0	15	5	45	**16**
2017090818	15	15	10	15	5	50	**18**
2017090900	25	5	5	35	10	25	**18**
2017090906	35	5	25	60	20	10	**26**
2017090912	50	5	20	60	20	5	**27**
2017090918	25	5	10	65	25	5	**23**
2017091000	25	0	10	70	10	15	**22**
2017091006	10	5	15	80	15	10	**23**
2017091012	5	0	10	85	10	10	**20**
2017091018	15	0	10	85	15	5	**22**

3. Forecasting Critique

Data from the charts are published below.

5-day forecast intensity error							
Run	NHC	HMON	HWRF	SHF5	DSHP	CTCX	Average
2017082812		30	10	55	15		28
2017082818		45	5	65	25		35
2017082900		75	75	65	35	80	66
2017082906		85	55	75	45	75	67
2017082912		85	85	70	35	70	69
2017082918		85	90	55	35	75	68
2017083000		50	15	50	30	70	43
2017083006		40	45	50	15	70	44
2017083012	30	20	5	40	20	20	23
2017083018	15	40	5	40	5	35	23
2017083100	10	20	5	45	0	0	13
2017083106	30	65	25	70	25	10	38
2017083112	35	65	45	75	50	35	51
2017083118	35	35	50	70	55	45	48
2017090100	45	60	55	80	65	65	62
2017090106	45	60	60	80	70	40	59
2017090112	55	60	50	75	65	30	56
2017090118	55	35	45	75	75	45	55
2017090200	50	65	30	70	65	40	53
2017090206	50	70	40	65	65	30	53
2017090212	50	50	30	65	65	30	48
2017090218	50	30	35	65	60	30	45
2017090300	45	20	30	55	55	30	39
2017090306	30	15	15	45	40	15	27
2017090312	25	0	10	40	30	0	18
2017090318	20	35	5	40	25	0	21
2017090400	25	5	15	40	30	10	21
2017090406	25	60	50	35	25	5	33
2017090412	0	45	25	20	10	15	19
2017090418	0	55	20	20	30	10	23
2017090500	0	50	0	15	0	5	12
2017090506	20	45	15	15	10	10	19
2017090512	15	25	25	10	0	0	13
2017090518	10	40	0	10	0	15	13
2017090600	35	15	35	5	40	20	25
2017090606	35	40	65	25	55	35	43
2017090612	60	15	55	45	0	5	30
2017090618	70	5	90	55	55	25	50
2017090700	70	10	75	50	60	15	47

2-day average intensity errors		
Model	**Average Error**	**Predictions**
NHC	17.8	46
HMON	19.6	54
HWRF	17.4	54
SHF5	34.7	54
DSHP	22.2	54
CTCX	22.5	52

5-day average intensity errors		
Model	**Average Error**	**Predictions**
NHC	33.5	31
HMON	42.3	39
HWRF	35.6	39
SHF5	49.4	39
DSHP	35.5	39
CTCX	30.0	37

Overall 2-day and 5-day intensity errors combined		
Model	**Average Error**	**Predictions**
NHC	24.2	77
HMON	29.1	93
HWRF	25.1	93
SHF5	40.8	93
DSHP	27.8	93
CTCX	25.6	89

3. Forecasting Critique

Data from the charts are published below.

2-day forecast track error							
Run	NHC	HWRF	HMON	GFS	NAVGEM	CTCX	**Average**
2017082812		3.4	2.1	2.7			2.7
2017082818		0.9	0.8	0.4	1.1		0.8
2017082900		1.6	2.7	1.1	2.3	1.5	1.8
2017082906		1.1	1.7	1	1.9	2.2	1.6
2017082912		1.8	0.9	1.3		2.8	1.7
2017082918		2.7	1.6	1	1.3	0.9	1.5
2017083000		1.7	0.4	1.5	2	2.6	1.6
2017083006		1.3	0.9	1.6		3.8	1.9
2017083012	0.4	2.3	0.4	1.1	3.1	2	1.6
2017083018	0.8	1.7	0.6	1.4	1.7	2	1.4
2017083100	1.6	1.1	1.1	0.9	1.8	1.9	1.4
2017083106	2.5	2.3	1.9	1.5	1.3	2.5	2.0
2017083112	1.8	2.3	3.8	2	2.4	3.4	2.6
2017083118	2.2	2.9	2.4	2.5	2.6	4.3	2.8
2017090100	2.6	2.9	2.8	2.7	2.4	2.4	2.6
2017090106	2.6	3.1	3	3.3	0.6	2.7	2.6
2017090112	2.1	2.8	2.4	3	2.6	2.6	2.6
2017090118	2.3	2.8	2	3.2	2.2	2.6	2.5
2017090200	1.6	1.7	1.6	1.9	2.6	3	2.1
2017090206	1.8	1.9	1.6	2	2.4	1.7	1.9
2017090212	1.2	1.7	1.2	1.7	0.7	1.3	1.3
2017090218	1	2.8	2.4	1.8	1.4	1.2	1.8
2017090300	0.7	0.7	1.2	1.5	0.4	2.5	1.2
2017090306	0.8	1.3	1	1.9	0.5	1.3	1.1
2017090312	0.9	0.9	0.9	1.6	0.7	1.5	1.1
2017090318	1.2	0.8	0.9	1.1	1	1	1.0
2017090400	0.8	1	0.5	0.8	1	0.8	0.8
2017090406	0.8	1.1	1.4	1	1	0.9	1.0
2017090412	0.8	0.6	0.5	1	0.5	0.7	0.7
2017090418	0.4	1.3	0.6	1.2	0.4	1	0.8
2017090500	0.7	1.5	0.7	0.9	1.2	1.3	1.1
2017090506	0.7	0.6	0.8	0.7	1.5	1	0.9
2017090512	0.3	0.8	1.2	1.8	1.3	1.4	1.1
2017090518	0.6	1.8	1	1.2	1.1	1.2	1.2
2017090600	0.8	2.2	1.7	1.6	1.4	1.8	1.6
2017090606	1.1	1.6	1.5	1.2	1.2	1.4	1.3
2017090612	0.4	1.1	1	0.4	1	1	0.8
2017090618	0.8	1.5	1.8	1.6	1.9	2.1	1.6
2017090700	1.6	2.9	2.1	1.8	0.7	2.5	1.9
2017090706	0.9	2.3	2.6	1.8	1	1.6	1.7
2017090712	0.6	1.3	0.6	1.7	0.6	1.5	1.1
2017090718	0.9	1.4	1.3	0.9	0.3	1.1	1.0
2017090800	0.8	2.3	2	1.6	0.5	1.8	1.5
2017090806	1.6	1.4	0.5	1.7	0.7	0.8	1.1
2017090812	0.7	0.8	1.6	0.5	1.5	0.7	1.0
2017090818	0.2	0.9	0.7	0.5	3.1	0.4	1.0
2017090900	0.5	2.6	0.2	0.6	3.4	0.2	1.3
2017090906	1.5	2	1.2	1.4	3.7	1.4	1.9
2017090912	2.1	1.7	1.5	1.7	2.4	1.4	1.8
2017090918	1.7	2.5	2.1	1.7	2	1.5	1.9
2017091000	1	1.4	1	1.5	1.4	0.7	1.2

3. Forecasting Critique

Data from the charts are published below.

5-day forecast track error							
Run	NHC	HWRF	HMON	GFS	NAVGEM	CTCX	Average
2017082812		3.5	5.4	4.4			4.4
2017082818		5.9	7.1	0.7	0.8		3.6
2017082900		4.3	5.8	1.2	4	2.3	3.5
2017082906		5.3	4.4	2.6	6.3	3.5	4.4
2017082912		4	4.2	2.1		4.5	3.7
2017082918		3.5	5.7	2.6	5	2.4	3.8
2017083000		5.2	3.8	4.1	6.3	7.9	5.5
2017083006		6.5	3.8	4.1		9.2	5.9
2017083012	1.9	6.8	4.3	4.2	8.1	7.9	5.5
2017083018	3.2	8.3	5.7	5.9	8.5	9.3	6.8
2017083100	2.8	4.3	9.4	6.1	5.7	6.8	5.9
2017083106	3	4.5	6.5	5.6	7.7	9.1	6.1
2017083112	3.1	4.9	8.5	5.8	8.6	8	6.5
2017083118	3.4	5.5	10.6	6.2	9.5	8.4	7.3
2017090100	3.5	4.8	7.3	6.1	9.1	7.6	6.4
2017090106	3.9	4.5	5.5	5.9	11.3	6.5	6.3
2017090112	4	3.6	4.8	4.8	10.1	6.3	5.6
2017090118	4.3	2.5	6	7.1	8.5	7.2	5.9
2017090200	4.6	2.3	4.8	4.7	6.8	5.3	4.8
2017090206	4.4	4.5	6.8	5.1	7.2	6.5	5.8
2017090212	4.9	2.5	5.6	5.2	5.3	5.2	4.8
2017090218	3.2	1.8	5.9	5.2	2.6	3.7	3.7
2017090300	3.4	1.6	5.3	3.3	2.1	3.1	3.1
2017090306	3.4	3	6	4.5	1.4	5.4	4.0
2017090312	3	1.8	4.8	3.8	2	7.5	3.8
2017090318	3.3	2.6	3.9	2.7	2.3	6.3	3.5
2017090400	3.4	2.4	0.7	2.5	2.3	5.9	2.9
2017090406	1.7	1.3	1	1	1.3	4.8	1.9
2017090412	2.2	1.2	0.6	1.3	0.7	5.7	2.0
2017090418	1	0.6	1.1	1.4	4.4	0.4	1.5
2017090500	1.6	0.7	1.1	1.7	1	4.6	1.8
2017090506	0.5	1.1	1.3	2.1	1.8	6.5	2.2
2017090512	0.3	2.4	2.8	2.1	3.2	7.3	3.0
2017090518	1.5	0.8	2	5	3.6	7.5	3.4
2017090600	1.8	3.9	1.7	2.9	2.9	7.1	3.4
2017090606	2.3	3.7	4.1	2.7	2.4	5.9	3.5
2017090612	2.4	3.3	2.2	2.2	1.5	5.9	2.9
2017090618	2.1	3.3	2.8	3.6	2.6	7	3.6
2017090700	4	5.3	4	5.8	3	8	5.0

2-day average track errors

Model	Average Error	Predictions
NHC	1.2	43
HWRF	1.7	51
HMON	1.4	51
GFS	1.5	51
NVGM	1.5	48
CTCX	1.7	49

5-day average track errors

Model	Average Error	Predictions
NHC	2.8	31
HWRF	3.5	39
HMON	4.5	39
GFS	3.8	39
NVGM	4.7	36
CTCX	6.1	37

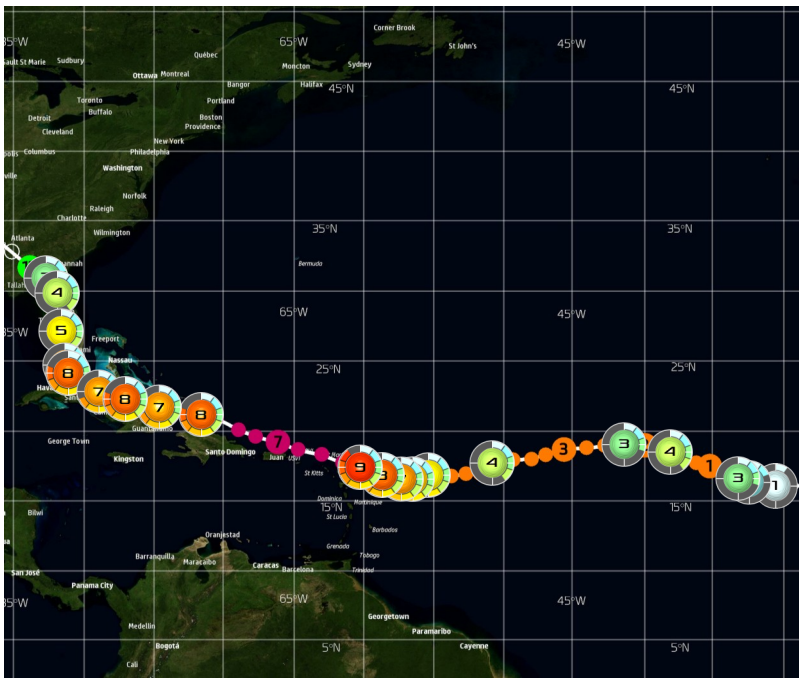
Overall 2-day and 5-day track errors combined

Model	Average Error	Predictions
NHC	1.2	43
HWRF	2.5	90
HMON	2.8	90
GFS	2.5	90
NVGM	2.9	84
CTCX	3.6	86

4. Cyclone Destruction Potential Scale

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

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



Hurricane Irma was observed by Force Thirteen using the CDPS—a method which was adopted in January 2017.

Irma reached CDPS Stage 9.

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

5. Force Thirteen's Coverage on Irma

Force Thirteen issued twenty hours of live coverage, thirty-seven recorded updates in English, and eight recorded updates in Spanish on Hurricane Irma.

The videos received a 95% approval rating overall.

Overall, the channel reached approximately 264,034 viewers during the life of Irma, broken down geographically:

United States	175,517
Canada	9,091
Philippines	9,059
United Kingdom	8,444
Mexico	4,625
Puerto Rico	4,251
Australia	2,491
Taiwan	2,357
Germany	2,286
Dominican Rep.	2,196

It also seems apt to report on viewership from the countries affected during this time:

Antigua and Barbuda	278
St Kitts and Nevis	270
Montserrat	21
Guadeloupe	282
Dominica	201
St Barthelemy	6
Sint Maarten	246
St. Martin	103
Anguilla	71
British Virgin Islands	57
US Virgin Islands	198
Haiti	151
Turks and Caicos	86
Bahamas	1,119
Cuba	23

Whilst Irma was active, other storms also occurred and the viewing figures may not be a reflection on the audience attained for Irma alone.

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