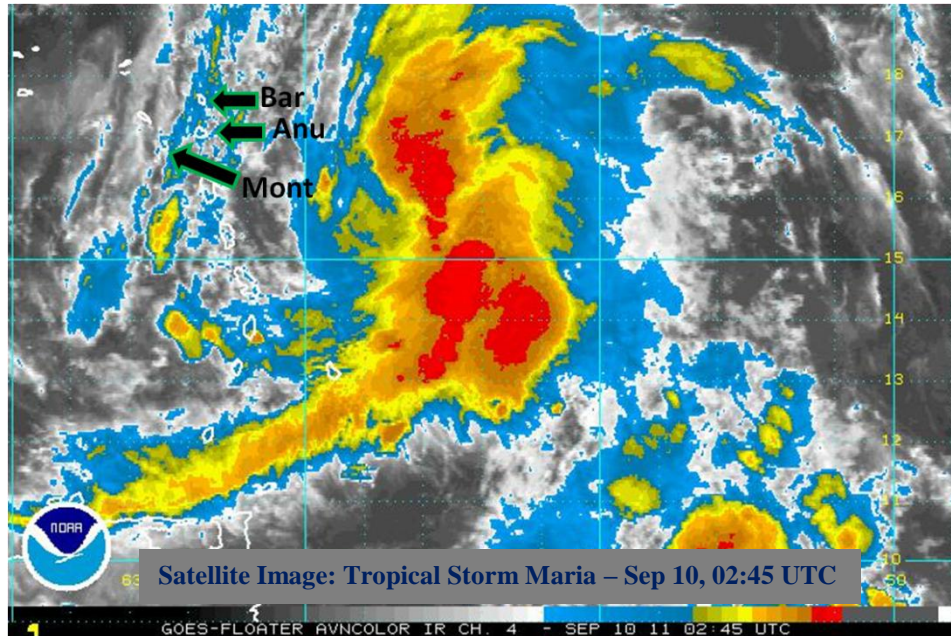


# THE ATLANTIC HURRICANE SEASON SUMMARY – 2011

## SPECIAL FOCUS ON ANTIGUA AND BARBUDA



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April 8, 2012

**The Atlantic Hurricane Season Summary – 2011  
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The Season in Brief

The 2011 Atlantic Hurricane Season produced nineteen (19) named storms. Of the nineteen (19) storms, seven (7) became hurricanes and four (4) strengthened to achieve major hurricane status - category three (3) or higher on the Saffir-Simpson Hurricane Wind Scale. The strongest tropical cyclone for the season was Major Hurricane Ophelia with peak winds of 140 mph, category 4.

Relative to Antigua and Barbuda, the rest of the Leeward Islands and the British Virgin Islands, five (5) tropical cyclones entered or formed in the defined monitored area (10N 40W – 10N 55W – 15N 70W – 20N 70W – 20N 55W – 15N 40W – 10N 40W). These were Emily, Irene, Katia, Maria and Ophelia. By the national definition, Irene and Maria hit Antigua and Barbuda; Ophelia hit Barbuda and brushed Antigua; all were tropical storms at the time of affecting the area. As far as land-falling hurricanes are concerned, this year marks 12 straight years without a tropical cyclone producing sustained hurricane force winds across Antigua and Barbuda. The last tropical cyclone to do this was Jose in 1999. Nonetheless, wind is not the only threat with tropical cyclones as was the case with Ophelia, which caused moderate to major flooding across the eastern half of Antigua; an even better example is Omar of 2008.

This season was well above normal (extremely active) with respect to named storms near normal in terms of hurricanes and above normal major hurricanes; the season tied with 2010 and 1995 for the second highest number of named storms for the period 1944 to 2011 and tied with 2010, 1995 and 1887 for the third highest since record began in 1851. Further, the season was above normal with respect to the Accumulated Cyclone Energy (ACE) index, which was 126. The ACE index, measures the collective strength and duration of named storms and hurricanes. The index of 126 is 135% of the median (93) or 123% of average (102.2); this is the 19<sup>th</sup> highest on record (1944 – 2011). This ranking is fairly low considering the number of storms. This relatively low ACE Ranking was clearly as a result of a relatively high number of short-lived and weak storms. Many seasons in the historical record have had a much lower total tropical storm count, but much higher ACE Index. Overall, tropical cyclone activity caused over 12 billion US dollars in damage and 114 deaths. For Antigua and Barbuda, Irene, Maria and Ophelia caused minor damage, mainly as a result of sea swells and rainfall. See table 1 and map 1 for all of the 2011 Atlantic Tropical Cyclones.

The season went fairly steadily with storms forming at regular intervals until the end of September, when things sort of came to a halt with only one tropical cyclone in October –

Hurricane Rina - and one in November - Tropical Storm Sean. The first storm was Arlene, which developed on June 29 in the Gulf of Mexico and made landfall near Veracruz, killing 25 persons. Three storms formed in July; this was well above normal activity and three times the normal number of storms for this month. These were a part of a series of weak tropical systems, mainly forming off frontal boundaries. Thus, for the first time since reliable records began in 1851, none of the first eight tropical storms attained hurricane strength. The streak came to an end when Hurricane Irene, the first hurricane and major hurricane of the season, formed in late August. Despite the eighteen storms that developed, only seven became hurricanes.

The well above normal season was caused mainly by the above normal sea surface temperatures in the Atlantic Ocean, especially in the Tropical North Atlantic and the lingering effect of a La Nina Episode (in the Pacific Ocean), which ended in the (NH) Spring. Most of the forecasts for the season including the early forecasts (those that came out before May) did quite well, especially with respect to the number of named storms (see table 2). An average season has 11 named storms and six (6) hurricanes, including 3 major hurricanes (1950 – 2010).

### Tropical Cyclone in the Monitored Area

#### Tropical Storm Emily (August 1 - 7, 2011)

By national definition, Emily did not hit nor brush Antigua and Barbuda, i.e. it did not come within 120 statute miles of the islands. However, instability associated with the system affected Antigua and to a lesser extent Barbuda. At its closest point, the centre of the storm was 125 miles south of Antigua on the morning of August 1. At the V. C. Bird International Airport in Antigua, the maximum 1-minute sustained winds from the storm were 28 mph with a maximum gust of 39 mph; total rainfall from the system was 46.2 mm for the period August 1 to August 4.

Tropical Storm Emily formed from a tropical wave on August 1. The wave developed a closed circulation just after it crossed Dominica having travelled the Atlantic quite disorganized. It was declared a storm upon formation of a closed circulation. On August 4, Emily weakened into a remnant low near Haiti. This low then tracked northwest across Cuba and the Bahamas before regenerating into a tropical depression on August 6; however, this was short-lived as the system, on the next day, dissipated within 300 miles of the Northern Bahamas.

#### Major Hurricane Irene (August 20 - 29, 2011)

Irene affected Antigua and Barbuda as a storm on August 21. At its closest point, the centre of the storm passed about 17 miles south of Antigua at about 6 am on August 21. At the V. C. Bird International Airport in Antigua, the maximum 1-minute sustained winds from the storm were 32 mph with a maximum gust of 47 mph. There were no sustained storm force winds recorded; however, this may have occurred in some areas on the southern side of Antigua. Total rainfall from the system, measured at the airport, was 112.2 mm or 4.42 inches over the period August 20 to August 23. Some of this rainfall resulted in minor to moderate flooding. The system also affected the rest of the Leeward Islands and the British Virgin Islands.

Irene formed from a large low pressure system on August 20. After passing through the Leeward Islands on August 21, the system strengthened into a Category 1 hurricane on August 22 and Category 3 on August 24. This was the first hurricane for the season, which saw for the first time, on record, a streak of eight consecutive tropical cyclones to start the 2011 season, all of which did not strengthen beyond tropical storm force. Irene also made landfall on St. Croix, Puerto Rico, Turks and Caicos Islands, the Bahamas, Cape Lookout - North Carolina, up the rest of the US Eastern Seaboard and becoming post-tropical over Quebec and Atlantic – Canada on August 29. Forming on August 20, Irene was the second earliest ninth Atlantic tropical cyclone on record, along with an unnamed tropical storm from the 1936 season. Irene caused the death of about 56 persons and caused damage of over USD\$10 billion.

#### Major Hurricane Katia (August 29 – September 10, 2011)

Katia entered the monitored area; however, it passed a safe distance away from the islands, over 300 miles northeast of Antigua and the rest of the Northeast Caribbean on September 3 with winds, at the time, of 70 mph. However, although there was no impact from storm winds, a feeder band from the system produced 21.5 mm or 0.85 inch of rainfall over the period September 6 to September 7. Thunderstorms were also experienced.

Katia formed south of the Cape Verde Islands on August 29, as a depression, and became a tropical storm on August 30. It later became the season's second hurricane early on September 1 and a Category 3 (major hurricane status) on September 5. Katia further strengthened into a Category 4 hurricane on September 5. On September 6, the system rapidly weakened to a Category 1 hurricane and remained at that strength until it became extra-tropical (loss its tropical characteristics). Katia eventually made a complete u-turn when its remnants struck the UK and the Republic of Ireland on September 11 and 12 with wind gusts of up to 98 mph, killing one person and causing notable damage. Its remnants caused blackouts as far east as Saint Petersburg, Russia. Katia was the strongest ex-hurricane to make landfall in the UK since Lili in 1996.

#### Hurricane Maria (September 6 – September 16, 2011)

Maria affected Antigua and Barbuda on September 10 and 11. At its closest point, the centre of the storm was within 20 miles of the islands, as it passed between them on the afternoon of September 10. Hence, by national definition, the system had a “direct hit” on both islands. Notwithstanding the proximity of the storm and its reported maximum sustained winds of 50 mph, no storm force winds were experienced in either island. This was because the storm winds were some distance away to the north of the centre, over open waters. At the V. C. Bird International Airport in Antigua, the maximum 1-minute sustained winds measured were 28 mph and the maximum gust was 43 mph; the total rainfall measured was 31.5 mm or 1.24 inches for the period September 9 to September 12.

Maria formed from a low pressure area associated with a tropical wave on September 6, in the Eastern Tropical Atlantic. Maria was upgraded to a storm on September 7. As Maria moved westward over the Atlantic, it struggled badly against strong vertical upper level wind shear. After struggling against the shear for most of the journey to the Caribbean, all of the deep

convection got decoupled (separated) from the centre of the system as it got to within a few hundred miles of the Eastern Caribbean. For a couple of days, the cyclone resembled a subtropical storm with the storm force winds well removed from its centre to the north and northeast. Because of this structure, notwithstanding its proximity to the islands, all watches and warning were dropped. On September 10, convection began to rebuild near the centre and the system began to regain strength. Under more favourable conditions, Maria intensified into a Category 1 hurricane on September 15; then it lost its tropical characteristics on September 16 off the northeast coast of Newfoundland. The remnants made landfall on the southern tip of the Avalon Peninsula.

#### Major Hurricane Ophelia (September 21 – October 3, 2011)

Ophelia affect Antigua and Barbuda on September 25 and 27. At its closest point, the system passed within 75 miles of Barbuda and 90 miles of Antigua. At the V. C. Bird International Airport in Antigua, the maximum 1-minute sustained winds from the storm were just 18 mph gusting to 27 mph; the total rainfall experienced from Ophelia was 69.1 mm for the period September 24 to September 30. However, during the evening of September 29, a feeder band caused moderate flooding across the eastern half of Antigua; the Pares Main Road became impassable and this prompted the police to issue a statement to motorists to avoid the area. Based on radar estimates, 2 to 3 inches of rain fell on that half of the island in about 5 hours. Observed also during the afternoon of this day were funnel clouds over the southern side of Antigua.

Ophelia formed from a tropical wave on September 21. However, this storm suffered an almost identical fate to that of Maria in that similar strong vertical upper level wind shear hampered the storm all through its journey across the Atlantic until they finally decimated the system just as it got to within a few hundred miles east of the Caribbean. Despite the shear from almost the beginning, Ophelia still managed to slowly strengthen and attained winds of 65 mph on September 22, a few days away from the Caribbean. Unlike Maria, the impact of the shear actually caused Ophelia to dissipate, on September 25; however, its remnants regenerated just east (within 120 miles) of Antigua and Barbuda on September 27. Thankfully for these islands, the regenerated Ophelia moved off to the north-northwest.

The wind shear remained strong, but not as strong as before. Thus, during the afternoon hours of September 27, Ophelia was able to regenerate to a tropical depression. The system gradually strengthened further into a tropical storm as it passed to the north of the Leeward Islands on September 28. During the afternoon hours of September 29, despite the relatively unfavourable environment, Ophelia strengthened into a Category 1 hurricane. As the wind shear relaxed, early on September 30, Ophelia rapidly intensified and became a Category 2 hurricane. Later that day, Ophelia further strengthened into a Category 3 hurricane, becoming the third major hurricane of the season. The intensification trend continued, and Ophelia strengthened further to a Category 4 hurricane on October 1, east of Bermuda. Through the following day, October 2, increasing southwesterly wind shear and cooler water temperatures combined to cause Ophelia to progressively weaken back into a Category 1 hurricane by evening and weakened to a tropical storm during the morning hours of October 3; it lost tropical characteristic on this very day soon after making landfall on the Avalon Peninsula in Newfoundland.

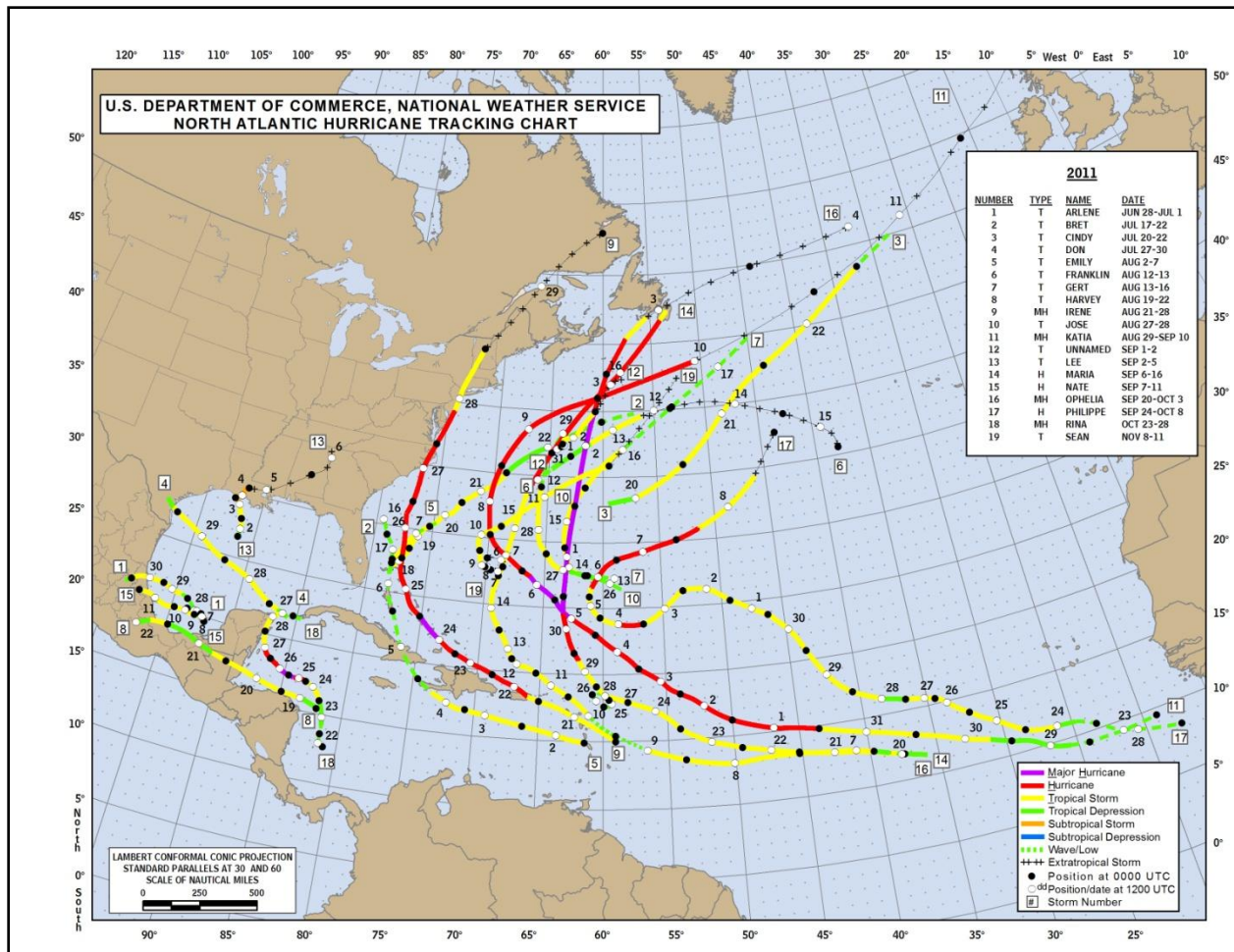
**THE ATLANTIC HURRICANE SEASON SUMMARY - 2011**

<b>Name</b>	<b>Date</b>	<b>Max Wind (mph)</b>	<b>Deaths</b>	<b>Antigua/Barbuda Damage - US\$Million</b>
1. <a href="#">TS ARLENE</a>	Jun 28 – Jul 1	65	22	0
2. <a href="#">TS BRET</a>	Jul 17 – 22	70	0	0
3. <a href="#">TS CINDY</a>	Jul 20 – 22	70	0	0
4. <a href="#">TS DON</a>	Jul 27 – 30	50	0	0
5. <a href="#">TS EMILY</a>	Aug 2 – 7	50	5	Minimal
6. <a href="#">TS FRANKLIN</a>	Aug 12 – 13	45	0	0
7. <a href="#">TS GERT</a>	Aug 13 – 16	65	0	0
8. <a href="#">TS HARVEY</a>	Aug 19 – 22	65	3	0
9. <a href="#">MH IRENE</a>	Aug 21 – 28	120	56	Minimal
10. <a href="#">TD TEN</a>	Aug 25 – 26	35	0	0
11. <a href="#">TS JOSE</a>	Aug 27 – 28	45	0	0
12. <a href="#">MH KATIA</a>	Aug 29 – Sep 10	140	4	0
13. TS Unnamed <sup>1</sup>	Sep 1 – 2	45	0	0
14. <a href="#">TS LEE</a>	Sep 2 – 5	60	18	0
15. <a href="#">H MARIA</a>	Sep 6 – 16	80	0	Minimal
16. <a href="#">H NATE</a>	Sep 7 – 11	75	5	0
17. <a href="#">MH OPHELIA</a>	Sep 20 – Oct 3	140	0	Minimal
18. <a href="#">H PHILIPPE</a>	Sep 24 – Oct 9	90	0	0
19. <a href="#">MH RINA</a> <sup>2</sup>	OCT 23 – 28	115	0	0
20. <a href="#">TS SEAN</a>	Nov 8 – 12	65	1	0

Table 1: The Atlantic Hurricane Season Summary - 2011. Totals: 20 Tropical Cyclones, 19 Named Storms, 7 Hurricanes and 4 Major Hurricanes. The season caused about 114 deaths and over 12 billion US dollars in damage. (Sources – NOAA, Wikipedia.com and ABMS).  
<sup>1</sup> Identified in the post-season analysis. <sup>2</sup>Reclassified to a hurricane in the post-season analysis.

Forecast Source	Forecast Date	Tropical Storms	Hurricanes	Major Hurricanes
NOAA	Aug 4, 2011	14 – 19	7 – 10	3 – 5
	May 19, 2011	12 – 18	6 – 10	3 – 6
CSU	Aug 3, 2011	16	9	5
	Jun 1, 2010	16	9	5
	Apr 6, 2011	16	9	5
	Dec 8, 2010	17	9	5
TSR	Aug 4, 2011	16	9	4
	May 24, 2011	14	8	4
	Apr 4, 2011	14	8	4
	Dec 6, 2010	16	8	4
WSI	Aug 4, 2011	15	8	4
	Jul 26, 2011	15	8	4
	May, 2011	15	8	4
	Apr, 2011	15	8	4
EUROSIP	Aug 1, 2011	22	-	-
	May 1, 2011	16	-	-
MOHC	May 26, 2011	(10 – 17)	-	-
NCSU	Apr 14, 2011	13 – 16	7 – 9	3 – 5
61-yr Antigua Climatology <sup>1</sup>	1950 - 2010	0.7	0.4	0.2
61-yr Atlantic Climatology	1950 - 2010	10.9	6.2	2.7
30-yr Atlantic Climatology	1981 - 2010	12.1	6.4	2.7
<b>Record High</b>	<b>2005</b>	<b>28</b>	<b>15</b>	<b>7</b>
<b>Record Low*</b>	<b>1983</b>	<b>4</b>	<b>3</b>	<b>1</b>
<b>Observed Cyclones</b>	<b>2011</b>	<b>19</b>	<b>7</b>	<b>3</b>

Table 2: Comparison of 2011 Hurricane Season Forecasts. <sup>1</sup>Storms passing within 105 nautical miles of Antigua. Forecasts include those issued by Colorado State University (CSU), Tropical Storm Risk (TSR), the National Oceanic and Atmospheric Administration (NOAA) and the Meteorological Office Hadley Centre (MOHC). The MOHC forecast is issued for the July–November period. North Carolina State University (NCSU). European Seasonal to Inter-annual Prediction (EUROSIP). Weather Services International (WSI), a Weather Channel Company, \*Most recent of several such occurrences



Map: 1 Storm Tracks – 2011 (Picture Courtesy NOAA).

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