Climatological Summary 2013

&

~ Hurricane Season Review ~



Tropical Storm Chantal: Tues. Jul 9th 2013@ 10:53



METEOROLOGICAL DEPARTMENT ST. MAARTEN



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Introduction

In the extreme north east section of the Eastern Caribbean, lies an island which is approximately 37 square miles shared by two countries. French St. Martin to the north and Dutch St. Maarten to the south which occupies 16 square miles. The island is relatively flat but has a central range with various peaks. Pic Paradise on the French side is the highest point (1400ft).



The Princess Juliana International Airport (TNCM) is located on the south western strip of St. Maarten at latitude 18.02° north and longitude 63.06° west.

ISLAND CLIMATOLOGY

Based on records (1981-2010) at Princess Juliana International Airport (PJIA), the normal annual rainfall is approximately 1160mm or 46 inches. Like many other Caribbean islands the driest months are from January to June while the wettest months are from July to November. December, May and June can be considered as transition months since they can be either dry or wet.

The driest month on record is March while the wettest is November. On average there are about 140 rain days a year with April having the least (8 days) and November the most (15 days). Rainfall during December to April can be attributed mainly from old frontal boundaries or shear lines dipping southwards from north east United States while the rainfall during May and June are often from upper level trough interactions and from July onwards, rainfall is mostly from tropical cyclones.

The normal daily average temperature is about $27^{\circ}C$ or $81^{\circ}F$, the normal maximum and minimum temperatures are $32^{\circ}C$ and $23^{\circ}C$ respectively. August and September are the warmest months while February is the coolest.

On average St. Maarten receives approximately 251 hours of sunshine monthly and 8 to 10 hours daily. The months with the most sunshine hours are March and April and the least hours are recorded in November.

. About Us

The Meteorological Department of St. Maarten (MDS) — most commonly referred to as the Met. Office — is a scientific organization that operates 24 hours a day, all year round, monitoring and continuously keeping watch of the weather conditions across the island. Reliable early warnings are issued in the event of any severe weather, seismic issues or climatic events allowing decision-makers, communities, and individuals to be better prepared; thus avoiding socio-economic setbacks and helping to improve the quality of life for everyone on St. Maarten and the surrounding region.

Our Mission

Our aim is to protect life and property, by providing reliable meteorological services in support of the social and economic development of the country through monitoring and predicting weather & climate, using up-to-date technology to enable optimal utilization of resources. We issue appropriate weather forecasts and warnings for St. Maarten, its adjacent waters and air space.

Our Vision

The vision of the Meteorological Department of St. Maarten is to achieve excellence in meteorological science, and the provision of quality weather and climate services.

Tasks

The objectives of the Meteorological Department of St. Maarten are to:

- Monitor weather conditions 24/7, 365 ¹/₄ days a year
- Observe, record, and transmit upper-air data (temperature, humidity, winds, etc.)
- Correspond with regional & international weather stations on various meteorological & climatological phenomena
- Produce and disseminate weather forecasts and warnings to the general public, marine and aviation industries
- Issue special reports whenever necessary, such as in the event of heavy rainfall, tropical storms, and/or other hazardous weather phenomena
- Manage and maintain meteorological and climatological data on a regular basis (monthly and yearly)
- Uphold national & international policy in the field of meteorology, climatology and other geophysical fields

2013 Hurricane Season

The Atlantic Hurricane Season is the period of time each year when hurricanes usually form in the Tropical Atlantic Ocean. Officially it begins on June 1st and ends on November 30th, with the peak of activity from late August through September. Nonetheless, tropical cyclones are known to form outside of those dates.

The 2013 Hurricane Season was one of the quietest seasons to be observed in the past twenty years. Thirteen (13) named storms formed in the Atlantic Basin this year. Although the number of named storms was above its average of twelve (12), the numbers of hurricanes and major hurricanes were well below their averages of six (6) and three (3) respectively.

Two storms, Ingrid and Humberto, became hurricanes, but neither became major hurricanes. Major hurricanes are those reaching categories 3 and above. In addition to low activity, impact during this season was relatively minimal. 2013 is ranked as the sixth-least-active hurricane season since 1950, in terms of the collective strength and duration of named storms and hurricanes.

Local Effects

As a result of the place of origin and trajectory of the tropical storms for the 2013 hurricane season, there were only a few minor impacts on St. Maarten. Convection associated with the initial stages of Tropical Storms Chantal and Dorian traversed in close proximity to St. Maarten and generated minor impact on the weather.

On July 9th, Tropical Storm Chantal passed approximately 185 miles south southwest of St. Maarten. The island receive limited rainfall activity and some gusty winds. On July 8th 7.0 mm of rainfall was measured and a maximum wind gust of 33kts /38 mph was recorded on the 9th.

Later that month, on July 27th, a tropical wave (that later evolved into Tropical Storm Dorian) passed about 520 miles north of St. Maarten. Once again it had minimal effects on the prevailing weather. The Maximum gust recorded at the Princess Juliana International was 21kts/24 mph on that day while a total of 6.6mm of rainfall was recorded on the 28th.

There were no other direct or indirect effects of St. Maarten's weather as a result of any storms of the 2013 hurricane season.

Summary

Below is a recap of the 2013 Atlantic Hurricane Season in relation to its effects on St. Maarten.

	Storm	A otivo Dotoc	Uighaat	Min.	Ma	ax.	Local	Obcomrod	Observed Winds Custa		
	Name	Active Dates	Category	(mbar)	Km/h	Mph	Effects	Effects	Rainfall (mm)	kts	Mph
1	Andrea	Jun. 5-Jun. 7	Tropical Storm	992	100	65	None				
2	Barry	Jun.17- Jun. 20	Tropical Storm	1003	75	45	None				
3	Chantal	Jul. 7- Jul. 10	Tropical Storm	1003	100	65	Minor	7.0	33	38	
4	Dorian	Jul. 23- Aug. 3	Tropical Storm	1002	95	60	Very Minor	6.6	21	24	
5	Erin	Aug. 15- Aug.18	Tropical Storm	1006	75	45	None				
6	Fernand	Aug. 25- Aug. 26	Tropical Storm	1001	95	60	None				
7	Gabrielle	Sept.4- Sept. 13	Tropical Storm	1003	100	65	None				
8	Humberto	Sept. 8- Sept.19	Cat.1 Hurricane	979	140	85	None				
9	Ingrid	Sept. 12- Sept.17	Cat.1 Hurricane	983	140	85	None				
10	Jerry	Sept. 29- Oct. 3	Tropical Storm	1005	85	50	None				
11	Karen	Oct. 3- Oct. 6	Tropical Storm	998	100	65	None				
12	Lorenzo	Oct. 21- Oct. 24	Tropical Storm	1000	85	50	None				
13	Melissa	Nov.18- Nov. 22	Tropical Storm	979	100	65	None				

Overview of the Storms formed in the 2013 Hurricane Season

Tropical Storm Andrea

A broad area of low pressure formed over the southern Gulf of Mexico on June 3rd. The system subsequently organized at a steady pace, and on June 5th was upgraded to Tropical Storm Andrea. Tropical Storm Andrea is estimated to have attained a peak intensity of 65mph with a minimum barometric pressure of 992 mb (29.30 in. Hg) while located just offshore Florida. Dry entrainment caused the system to weaken slightly prior to landfall. On June 7th the system became an extra-tropical low over the southeastern United States.

Tropical Storm Barry

The disturbance that spawned Tropical Storm Barry was a tropical wave that moved off the coast of Africa on June 8th. Over the next several days, the weak wave moved briskly westward across the tropical Atlantic and northern South America, and moved into the southwestern Caribbean Sea early June 15th. On June 19th, it was upgraded to Tropical Storm Barry, although minimal intensification was likely due to the storm's proximity to land. Tropical Storm Barry produced heavy rainfall and flooding across portions of Central America, the Yucatan Peninsula, and eastern Mexico; the flooding resulted in five direct deaths. Two people were also injured after being struck by lightning.

Tropical Storm Chantal

Chantal was a rare early July tropical storm that formed over the tropical Atlantic on July 8th. The following day, the system entered the eastern Caribbean, moving west-northwest. It passed 185 miles south southwest of St. Maarten. During the subsequent 24-hour period between July 9th and July 10th, the forward motion of Chantal accelerated to 30mph, setting a record for the fastest-moving tropical cyclone in the deep tropics. Despite the latter, Chantal degenerated into an open tropical wave soon after.

Tropical Storm Dorian

Dorian developed from a strong tropical wave that moved off of the west coast of Africa on July 22nd. Two days later, convection associated with a tropical depression was upgraded to Tropical Storm Dorian, with very low wind shear and marginal water temperatures allowing for strengthening. The storm moved generally westward, steering by a strong ridge over the central Atlantic. On July 27th, Dorian weakened into a tropical wave east of the northern Leeward Islands. Several days later the system was briefly regenerated into a tropical depression near the northwestern Bahamas, only to once again degenerate into a remnant low just 12 hours later.

Tropical Storm Erin

The genesis of Erin was associated with a tropical wave that departed the west coast of Africa on August 13th. The wave had a large area of disorganized showers and thunderstorms and an elongated low-level circulation when it emerged off the coast. On August 15th, deep convection continued to develop over the center forming a depression which later intensified into Tropical Storm Erin just six hours later. On August 18th, Erin deteriorated into a remnant low about halfway between the Lesser Antilles and the west coast of Africa.

Tropical Storm Fernand

On August 25th the National Hurricane Center (NHC) upgraded a tropical depression to Tropical Storm Fernand, east-southeast of Veracruz, Mexico; after a Hurricane Hunter flight observed winds of 45 mph. The storm intensified with gusts of 72 mph reported at a coastal observation station. The following day Fernand made landfall about 25 miles west-northwest of Veracruz with winds of 50 mph. The storm weakened inland while moving parallel to the coast, with a large area of thunderstorms. By late August 26th, the circulation of Fernand dissipated over eastern Mexico. Heavy rainfall due to Fernand caused flash flooding and landslides that took the lives of 14 people.

Tropical Storm Gabrielle

Gabrielle was first designated as Tropical Depression Seven late in the afternoon of September 4th just south of Puerto Rico and was then upgraded to Tropical Storm Gabrielle six hours later. After a brief lifetime as a tropical storm, Gabrielle was downgraded to a tropical depression late in the morning on September 5th. 12 hours later, the NHC issued its final advisory on Gabrielle. Early on September 10th sufficient shower and thunderstorm activity flared up near a low-level center. Two days later, September 12th there was a reissuance of an upgrade to Tropical Storm Gabrielle. It oscillated between depression and tropical storm status for another 48 hours. Gabrielle dissipated once again on September 13th.

Hurricane Humberto

A vigorous tropical wave in the far eastern Atlantic emerged off Africa and quickly became a tropical depression on September 8th southeast of Cape Verde. It strengthened into a tropical storm the next morning, and became the first hurricane of the 2013 Atlantic Hurricane Season on Wednesday, September 11th. This was just three hours short of being the latest in the season that the first hurricane had developed. Humberto disintegrated into a remnant low on September 14th. The post-tropical low regained convection near the center on September 16th, becoming a tropical cyclone once more. On September 19th, the NHC issued its last advisory on Humberto, as the system degenerated into a remnant low.

Hurricane Ingrid

Tropical Depression Ten formed in the southwest Gulf of Mexico on September 12th, and strengthened into Tropical Storm Ingrid less than 24 hours later on September 13th. As Ingrid roamed around the southwest Gulf of Mexico, it continued to intensify and became the second hurricane of the 2013 season on the afternoon of September 14, 2013. Ingrid weakened to a tropical storm as it made landfall near La Pesca, Mexico on September 16th, with winds of 65 mph. Coincidentally, its landfall came 25 years to the day after powerful Hurricane Gilbert made landfall at La Pesca on September 16, 1988. The system weakened quickly over land becoming a tropical depression. It eventually dissipated over the mountains of eastern Mexico early on September 17th.

Tropical Storm Jerry

Tropical Storm Jerry was a weak cyclone that formed as Tropical Depression Eleven over the central Atlantic Ocean, about 1,000 miles east-southeast of Bermuda. On September 30th, after a turn to the east, it peaked to 50 mph. Further, with an increase in convection, the depression intensified into Tropical Storm Jerry. Due to weakening steering currents, Jerry became nearly stationary. Convection increased slightly later on October 1st, only to decrease the following day as it accelerated to the northeast. Early October 3rd, Jerry weakened to tropical depression status and later deteriorated into a post-tropical cyclone several hundred miles west-southwest of the Azores.

Tropical Storm Karen

This tropical storm developed over the Yucatan Channel and the southern Gulf of Mexico on the morning of October 3rd. It gained maximum winds of 65mph while moving north-northwest. Strong shear and dry air weakened the convection causing it to deteriorated to a tropical depression on October 6th and later degenerated into a remnant low with a disorganized area of thunderstorm activity.

Tropical Storm Lorenzo

Lorenzo formed on October 21^{st} , 2013 to the southeast of Bermuda in the central Atlantic Ocean. Lorenzo reached its peak intensity of 50 mph from October 22^{nd} into early October 23^{rd} . The storm did not affect any land areas and eventually dissipated due to strong winds aloft on October 24^{th} .

Tropical Storm Melissa

The thirteenth and final named storm of the 2013 Atlantic Hurricane Season was Tropical Storm Melissa. On November 18^{th} , Melissa began as a "subtropical storm," (a mix between a tropical and mid-latitude system). Despite passing over sea surface temperatures cooler than $21^{\circ}C$ (70°*F*), banding features persisted near the center, and the storm reached its peak intensity of 65 mph and a minimum pressure of 980 mb early November 21^{st} . Deep convection decreased later that day, leading to a transition into a post-tropical cyclone on November 22^{nd} .



2013 Climate Data

<u>Rainfall</u>

The total rainfall recorded at the Princess Juliana International Airport, for the year 2013 was **967.7 mm or 38.1 inches**. This amount was <u>below normal</u> or 89% of the normal annual rainfall which is 1083.9 mm/42.7 inches (1981-2010). 343.1 mm or 13.5 inches was recorded during the first half of 2013 while 624.6mm or 24.6 inches was recorded during the second half of the year.





Only two (2) months namely May and December exceeded the normal monthly rainfall for 2013, five (5) months were below normal while the other five (5) were near normal.

December was the *wettest month* of the year, with a total of 167.2 mm or 6.6 inches; while the *driest month* was **March** with 19.3 mm or 0.7 of an inch of rainfall. The *wettest day* of the year was **December** 7th, when 47.0 mm or 1.9 inches was recorded which was as a result of an upper level trough which interacted with an old frontal boundary across the area.





A rain day is considered any day which records 1.0 mm or more rainfall. Normally there are approximately 140 rain days in a year on St. Maarten. For 2013, there were 151 rain days with the month of January having the most (19 days) followed by December with eighteen (18) days.

With regards to rainfall many records were not broken in 2013. December was the wettest since 2003 and very wet compared to December 2012 which was very dry. May 2013 was very wet but not as wet as May 2012.



Temperature

The average temperature recorded in 2013 was **27.3** °C (81 °F) which was normal. The 30-year normal (1981-2010) is 27.3 °C. September was the warmest month while February was the coolest month which is normal for St. Maarten. There was a variation of about 3.6 °C between the warmest and coolest months.



The highest daily *temperature* recorded in 2013 was **32.8** °C (**91** °F) and was recorded on August 15th while the lowest daily *temperature* was recorded on December 23rd as **20.3** °C (**69** °F). The difference between the maximum and minimum temperatures recorded was **12.5**°C.



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Wind

Surface winds at the Princess Juliana International Airport for 2013 was generally from the east at an average speed of **9.6 knots** (11 mph or 18 km/h) which is <u>normal</u> compared to the 30-year average (1981-2010). The *highest monthly average wind speeds were recorded in* **December** as 11.5 knots (13 mph or 21 km/h); while **March** had the *lowest monthly average wind speeds* at 7.3 knots (8 mph or 14 km/h).

The *highest wind gust* for the year occurred on December 23rd at a speed of 42 knots (48 mph or 78 km/h). This was as a result of strong winds generated by the Atlantic High Pressure Ridge.



This following wind analysis was derived using the average hourly wind speeds and direction from 1st January to 31st December 2013.



This wind rose on the left shows that throughout 2013 the wind direction at Princess Juliana International Airport varied between 60 degrees (East-Northeast) and 120 degrees (East-Southeast) most of the time.

The longest spike: 19.8% of the winds were from the East (90°) and 12.5% of which were between 5 and 10 knots, 7.3% were between 10 and 15 knots while 0.5% were above 15 knots.

Second longest spike: 17.5% of the winds were from the East-Southeast (100-115°) and 11.5% of which were between 5 and 10 knots, 6.0% were between 10 and 15 knots while 0.5% were above 15 knots.



Air Pressure

At the Princess Juliana International the average Mean Sea-Level Pressure for 2013 was **1016.0 millibars**. The Highest daily average was recorded on January 9th as 1020.5 mb while the lowest daily average of 1008.1 mb occurred on November 18th.



Cloud Cover

The average cloud cover for St. Maarten over the past year as recorded at the Princess Juliana International Airport was 53.6 %. The *highest monthly average cloud cover* was 71.3 % during the month of **June** while *February* had the *lowest value* of 39.3 %.



Sunshine Duration

Approximately 67% of possible sunshine was recorded at the surface at the Princess Juliana International Airport, that is, 2984.9 hours out of a possible 4443.1 hours. The *average daily sunshine duration* was **8 hours 2 minutes**.

April received the *most hours of sunshine in 2013, an average of 9* hours and 12 minutes per day; while **June** received the *least with a daily average of 6* hours and 24 minutes.

Maximum daily sunshine hours was recorded on April 24th as <u>11 hours 24 mins</u>. On **May 25th and June 11th** absolutely no sunshine was recorded due to cloudy to overcast skies.





Statistic Summary

Below is a recap of the 2013 climate data, in terms of averages, extremes, and totals:

Rainfall							
Total Rainfall for the year	967.7 mm		38.1 inches				
Wettest Month	167.2 mm/6.6 in		December				
Driest Month	19.3 mm/0.7 in		March				
24-hr Maximum Rainfall	47.0 mm/1.9 in		December 7 th				
Number of Rain Days (with 1.0+ mm)		15	1 days	3			
Temperature							
Average Air Temperature	27.3 °C	2	81 °F				
Absolute Maximum Temperature	32.8 °C		91 °F				
Absolute Minimum Temperature	20.3 °C		69 °F				
Warmest Month	29.1°C/84 °F		September				
Coolest Month	25.5°C/78 °F			February			
Average Relative Humidity	73 %						
Wind & Pressure							
Average Wind Speed	9.6 knots	9.8 mph		15.7 km/h			
Maximum Wind Gust	42 knots	47.2 mph		75.9 km/h			
Average Air Pressure	1016.0 mbs.						
Sunshine & Clouds							
Average Cloud Coverage53.6 %							
Average Daily Sunshine Duration	8 hours, 2 minutes						

Conclusion

This report provides a summary of all the meteorological data recorded at the Princess Juliana International Airport during the year 2013. The data was collected from various meteorological parameters under regulations stipulated by the World Meteorological Organization. These elements include rainfall, relative humidity, atmospheric pressure, wind speed and direction, cloud cover and sunshine duration among others.

The Meteorological Department St. Maarten (MDS) records and compiles climatological data for use in research in a number of fields and institutions. Records go as far back as the 1950's in certain parameters. Requests for data must be put in writing through the Department Head.

Outlook for 2014



Rainfall Outlook for Jan-Feb-Mar 2014

Rainfall for the next three (3) months is hardly predictable. Global models are not very confident in predicting the next season's rainfall. Therefore, based on historical data, the current state of the weather and subjective input, St. Maarten is likely to experience **Normal to Above Normal Rainfall** during the next three (3) months – namely January to March. There is a **35%** chance of being **Above Normal** (more than 198.9 mm); a **35%** chance of being **Near Normal** (between 148.9 mm and 198.9 mm); and a 30% chance of being **Below Normal** (less than 148.9 mm).

Note that this area is indicated by the red arrow to the northeast of the Caribbean.

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List of Cyclone names for 2014 Tropical Atlantic Hurricane Season

•	ARTHUR	HANNA	OMAR
•	BERTHA	ISAIAS	PAULETTE
•	CRISTOBAL	JOSEPHINE	RENE
•	DOLLY	KYLE	SALLY
•	EDOUARD	LAURA	TEDDY
•	FAY	MARCO	VICKY
•	GONZALO	NANA	WILFRED

BE PREPARED!!! BE ALERT!!! BE READY!!!

Be reminded that it only takes one storm to impact our island to make it an active season for us. Therefore, all coastal and island residents need to prepare the same for every season, regardless of how much activity is predicted.

Appendix

Stages of Tropical Cyclone Development

Below are the decisive factors (criteria) for the various development stages for tropical cyclones:

Stage	Criteria			
Tropical disturbance	A discrete system of clouds, showers, and thunderstorms that originates in the tropics and maintains its identity for 24 hours or more.			
Tropical wave	A type of trough of low pressure or tropical disturbance that moves generally from east to west, typically embedded in the tropical easterlies. They are also sometimes called easterly waves.			
Tropical Depression	A tropical disturbance that has developed a closed circulation (counterclockwise winds blowing around a center of low pressure in the Northern Hemisphere). Tropical depressions contain maximum sustained (1-minute) winds of 38 mph (62 km/h or 33 knots) or less.			
Tropical Storm	A well-organized warm-core tropical cyclone that has maximum sustained (1-minute) winds of 39-73 mph (63-118 km/h or 34-63 knots). Once a system reaches tropical storm status, it is given a name by the National Hurricane Center (located in Miami, Florida).			
Hurricane	A warm-core tropical cyclone that has maximum sustained (1-minute) winds of at least 74mph (119 km/h or 64 knots). Hurricanes are categorized by the Saffir-Simpson Scale (<i>see next page</i>).			
Extra-tropical Cyclone	A cyclone that is no longer tropical in origin, which usually means the system moves away from the tropics and moves toward the poles. An extra-tropical cyclone has no wind speed criteria and may exceed hurricane force.			
Subtropical Cyclone	A closed circulation, low-pressure system that has characteristics of both tropical and extra-tropical cyclones. Subtropical cyclones typically have a radius of maximum winds occurring relatively far from the center (usually more than 60 nautical miles), and generally have a less symmetric wind field and distribution of convection (clouds and thunderstorms).			
Post-tropical Cyclone	A former tropical cyclone that no longer possesses sufficient tropical characteristics to be considered a tropical cyclone. Post-tropical cyclones can, however, continue carrying heavy rains and high winds.			

Saffir-Simpson Hurricane Scale

The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's intensity, which is used to give an estimate of the potential property damage and flooding expected from a hurricane landfall. Wind speed is the determining factor in the scale.

	Category	Max. S	Sustained V	Effects	
		mph	km/h	knots	
	1	74 - 95	119 - 153	64 - 82	Minimal Damage
	2	96 - 110	154 - 177	83 - 95	Moderate Damage
r	3	111 - 129	178 - 208	96 -112	Extensive Damage
Majo	4	130 - 156	209 - 251	113 - 136	Extreme Damage
	5	157+	252+	137+	Catastrophic Damage

Watches & Warnings

Tropical Storm Watch

Issued when tropical storm conditions (sustained winds of 39-73mph, 63-118 km/h, or 34-63 knots) are *possible* within the specified area within the next 48 hours (2 days).

Tropical Storm Warning

Issued when tropical storm conditions (sustained winds of 39-73mph, 63-118 km/h, or 34-63 knots) are *expected* somewhere within the specified area within the next 36 hours (1.5 days).

Hurricane Watch

Issued when hurricane conditions (sustained winds of 74 + mph, 119 + km/h, or 64 + knots) are *possible* within the specified area within the next 48 hours (2 days).

Hurricane Warning

Issued when hurricane conditions (sustained winds of 74+ mph, 119+ km/h, or 64+ knots) are *expected* within the specified area within the next 36 hours (1.5 days).

Note: Hurricane preparedness activities become difficult once winds reach tropical storm force, therefore, hurricane watches & warnings are issued well in advance of the anticipated onset of tropical-storm-force winds.