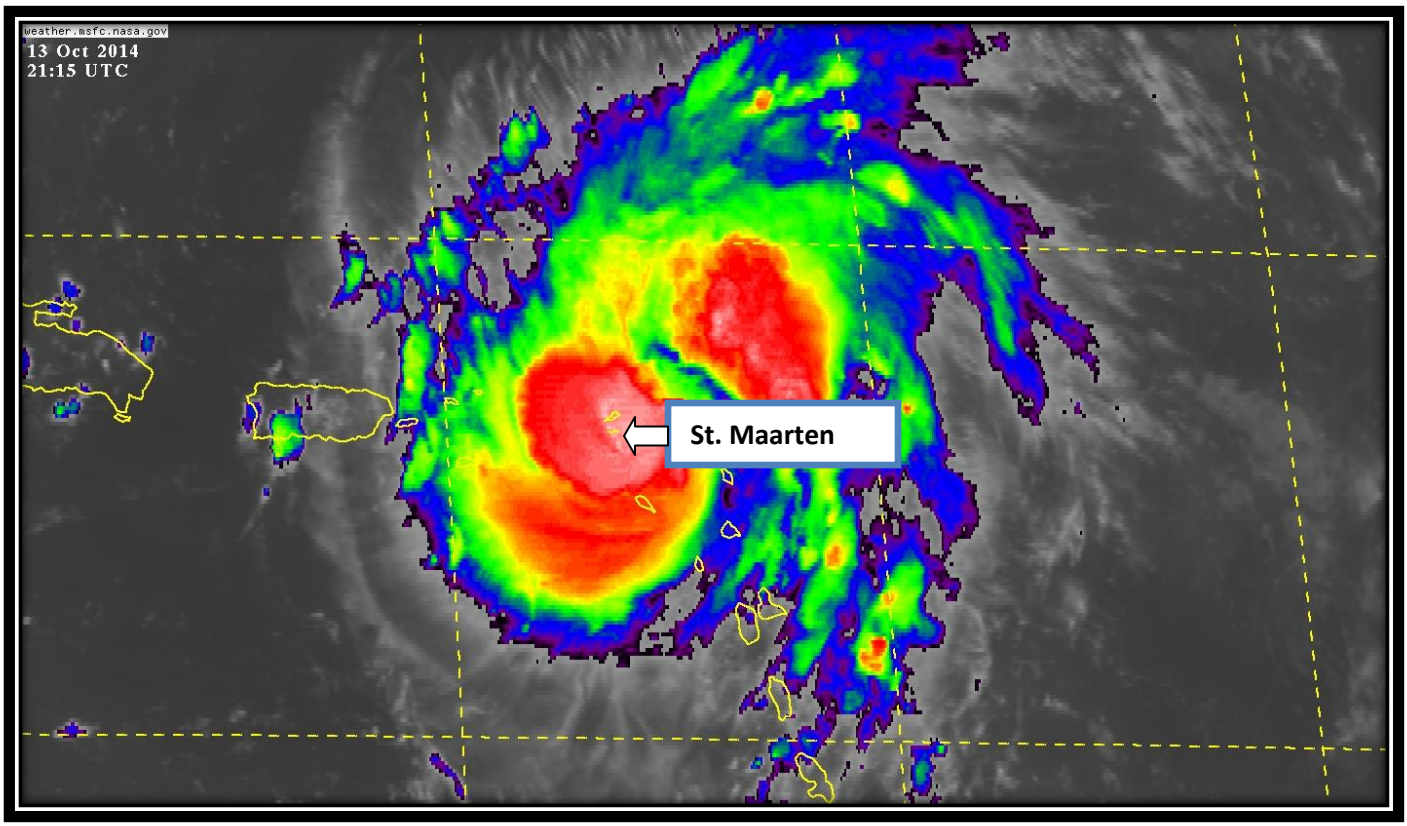
Climatological Summary 2014

&

~ Hurricane Season Review ~



Hurricane Gonzalo: Monday October 13th 2014 @ 5:15pm

METEOROLOGICAL DEPARTMENT ST. MAARTEN

Airport Rd. # 69, Simpson Bay
(721) 545-2024 or (721) 545-4226
www.meteosxm.com

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Meteorological Department St. Maarten
Airport Road #69, Simpson Bay
St. Maarten, Dutch Caribbean

Prepared by:	Sheryl Etienne-LeBlanc
	Carshena Gordon
	Forecast Section
Telephone:	(721) 545-2024 or (721) 545-4226
Fax:	(721) 545-2998
Website:	www.meteosxm.com
E-mail:	meteo@sintmaartengov.org

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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^{o} north and longitude 63.06^{o} 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^{o}C or 81^{o}F, the normal maximum and minimum temperatures are 32^{o}C and 23^{o}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 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 ¼ 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.

2014 Hurricane Season

The 2014 Atlantic Hurricane Season was a relatively quiet season as was predicted. NOAA's latest prediction was for a below-average season with 7-12 named storms, 3-6 hurricanes with 0-2 major hurricanes. Actually, there were 8 named storms, 6 hurricanes with 2 major hurricanes. Two storms, Edouard and Gonzalo became major hurricanes. Major hurricanes are those reaching categories 3 and above.

2014 was the second year in a row that the Atlantic Hurricane Season was below average. Some of the reasons being; the presence of extensive dry air in key areas of development in the early and mid-season, cooler than normal sea surface temperatures and large areas of vertical wind shear.

Local Effects

In the 2014 hurricane season, there were only a few impacts on St. Maarten. Early August, convection associated with Tropical Storm Bertha drifted very close to St. Maarten, however only gusty winds were felt on the island, no significant rainfall or damage were reported.

On September 3rd and 4th a tropical wave affected the island by producing overcast conditions and heavy rainfall. A total of 43.4mm / 1.7 inches of rainfall was recorded.

On October 13th, Hurricane Gonzalo grazed the island, leaving some structural damaged, downed power lines and minor flooding. A total of 144.7mm / 5.6inches of rainfall was recorded. A maximum wind gust of 69 kt. /79 mph was recorded before data was lost at the office due to flooding.

On November 7th, the interaction of a low pressure center and a surface trough brought a tremendous amount of rainfall across the island. Massive flooding was reported island wide. The Meteorological Department recorded 255.0mm/10 inches of rainfall in a 24-hour period.

Some of the destruction done by Hurricane Gonzalo

Flooding of November 7th 2014.

Summary

Below is a recap of the 2014 Atlantic Hurricane Season in relation to its effects on St. Maarten.

	Storm Name	Active Dates	Highest Category	Min. Pressure (mbar)	Max. Winds		Local Effects	Observed Rainfall (mm)	Observed Winds Gusts	
					Kt.	Mph			kts	Mph
	TD 2	**Jul. 21– Jul. 23**	**Tropical Depression**	**1012**	**30**	**35**	**None**			
1	**Arthur**	**Jul. 1 - Jul. 5**	**Hurricane**	**972**	**85**	**98**	**None**			
2	**Bertha**	**Aug.1 - Aug. 6**	**Hurricane Cat. 1**	**998**	**70**	**81**	**Minor**	**1.2**	**39**	**45**
3	**Cristobal**	**Aug.23-Aug. 29**	**Hurricane**				**None**			
4	**Dolly**	**Sept. 1- Sept. 3**	**Tropical Storm**				**None**			
5	**Edouard**	**Sept.11-Sept.19**	**Major Hurricane Cat. 3**	**955**	**105**	**121**	**None**			
6	**Fay**	**Oct. 10- Oct. 13**	**Hurricane Cat. 1**	**983**	**70**	**81**	**None**			
7	**Gonzalo**	**Oct. 12- Oct. 19**	**Major Hurricane Cat. 4**	**952**	**125**	**144**	**Minimal**	**144.7**	**69**	**79**
8	**Hanna**	**Oct. 22- Oct. 28**	**Tropical Storm**	**1005**	**35**	**40**	**None**			

Overview of the Storms formed in the 2014 Hurricane Season

Hurricane Arthur (July 1st to 5th)

On June 27th, a non-tropical area of low pressure, formed over South Carolina and moved into the southwestern Atlantic the next day. It was upgraded to a tropical depression on July 1st. The depression was further upgraded to Tropical Storm Arthur nine hours later based on surface observations from Grand Bahama. The cyclone attained Category 1 hurricane intensity on July 3rd and further intensified to reach Category 2 strength the next day. Arthur became extratropical on July 5th .

Hurricane Bertha (August 1st to 6th)

Bertha originated from a tropical wave that moved off of the west coast of Africa on July 24th with limited thunderstorm activity. Increased convection resulted in the formation of a low pressure area on July 29th . The low finally acquired enough persistent deep convection to be declared a tropical storm on August 1st, when it was located about 300 miles east southeast of Barbados. Bertha passed north of Martinique and south of Puerto Rico by August 2nd and rapidly intensified, becoming a hurricane early on August 4th about 170 miles north northeast of San Salvador in the central Bahamas. By August 6th, the tropical cyclone transitioned into a frontal extra-tropical. **Bertha; a category 1 hurricane caused 2 rip current deaths in the United states**

Hurricane Cristobal (August 23rd to 29th)

A strong tropical wave developed into Tropical Depression Four while located near Turks and Caicos Islands on August 23rd. The system intensified into Tropical Storm Cristobal while moving northwestward on the following day. However, Cristobal soon decelerated and moved erratically due to an upper-level trough. Despite being continually plagued by wind shear, the storm managed to reach Category 1 hurricane intensity early on August 25th. The storm lost its tropical characteristics and transitioned into an extratropical cyclone while located well southeast of Newfoundland on August 29th .

Tropical Storm Dolly (September 1st to 3rd)

A tropical wave crossed the Yucatán Peninsula quickly strengthened after entering the Bay of Campeche, and became a Tropical Depression Five on September 1st. The tropical depression had strengthened into Tropical Storm Dolly the following day. Tropical Storm Dolly made landfall near Tampico, Mexico on September 3rd and dissipated that same day after losing its well defined center of circulation over Eastern Mexico. One fatality was attributed to the storm.

Major Hurricane Edouard (September 11th to 19th)

Edouard developed from a westward-moving tropical wave that exited the coast of western Africa late on September 6th. By September 11th, deep convection had become sufficiently organized to designate the system as a tropical depression about 720 miles west of the Cape Verde Islands. Edouard became a major hurricane early on September 16th, reaching its peak intensity of 105 kt. that morning when it was located about 360 miles east of Bermuda, making it the first major hurricane to develop in the Atlantic basin since Hurricane Sandy of 2012. Edouard weakened to a tropical storm late on September 18th, and degenerated into a strong post-tropical cyclone early on September 19th about 400 miles west of the western Azores Islands.

Hurricane Fay(October 10th to 13th)

A lobe of vorticity broke off of a mid- to upper-level trough over the east-central Atlantic Ocean and moved westward on October 7th. A large area of showers and thunderstorms formed in association with this system that day several hundred miles northeast of the northern Lesser Antilles, with the developing convection possibly enhanced by a surge of moisture from an easterly wave passing to the south. Fay was a short-lived hurricane of non-tropical origin that passed over Bermuda before turning east-northeastward into the north-central Atlantic Ocean. Fay became the first hurricane to make landfall on Bermuda since Emily of 1987.

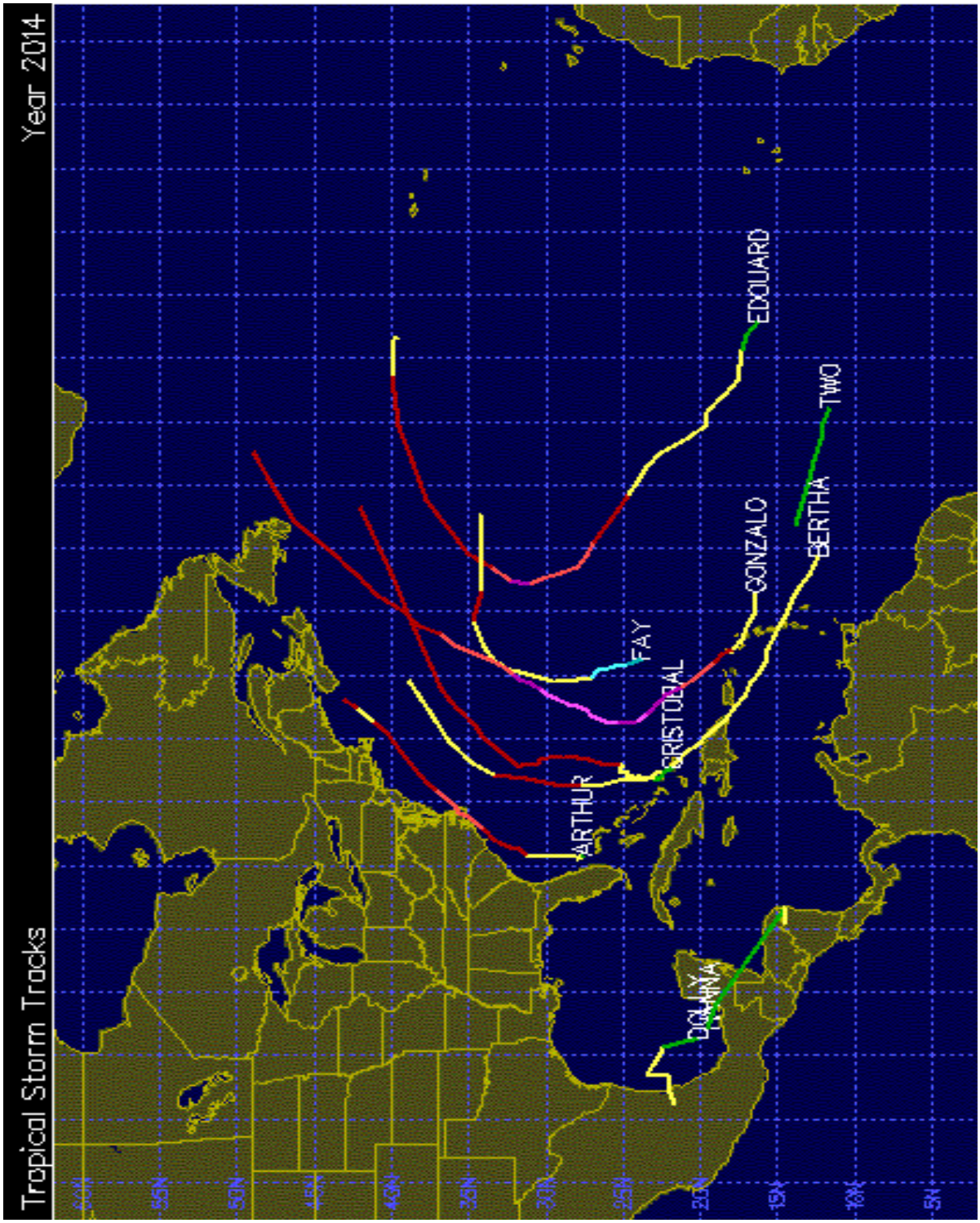
Major Hurricane Gonzalo (October 12th to 19th)

The development of Gonzalo can be traced to a tropical wave that departed the west coast of Africa on October 4th. Thunderstorm activity associated with system increased in organization, and it is estimated that a tropical depression formed around 8pm October 11th about 340 miles east of the Leeward Islands. The tropical depression strengthened and became a tropical storm on October 12th when it was located about 330 miles southeast of St. Maarten. Gonzalo began to rapidly strengthen and became a hurricane late October 13th when it was located just east of St. Maarten. Gonzalo made landfall on the island of St. Martin at about 2245 UTC with an estimated intensity of 75 kt, and passed over Anguilla about 45 minutes later.

Tropical Storm Hanna(October 22nd to 28th)

The genesis of Hanna was associated with the remnants of eastern Pacific Tropical Storm Trudy. A weak area of surface low pressure developed in association with a mid-level feature on October 21st about 60 miles east of Veracruz, Mexico, and the low moved slowly eastward while producing disorganized showers and thunderstorms that day. The system degenerated into a remnant low by October 23rd and on October 26th, the remnants of the depression became a little better organized. The low became a tropical depression again on October 27th, when it was located about 70 miles east of the Nicaragua/Honduras border. The cyclone strengthened to a tropical storm 6 hours later and maintained minimal tropical storm strength until it moved inland over northeastern Nicaragua. Hanna weakened to a tropical depression a couple of hours after it moved inland, and then degenerated into a remnant low over eastern Honduras on October 28th.

2014 Atlantic Hurricane Season Storm Track



2014 Climate Data

Rainfall

The total rainfall recorded at the Princess Juliana International Airport, for the year 2014 was **1180.8 mm or 46.5 inches**. This amount was slightly above the normal range, normal annual rainfall about 1026mm - 1074 mm/40 - 42 inches (1981-2010). 391.5 mm or 15.4 inches was recorded during the first half of 2014 while 789.3mm or 31.1 inches was recorded during the second half of the year.

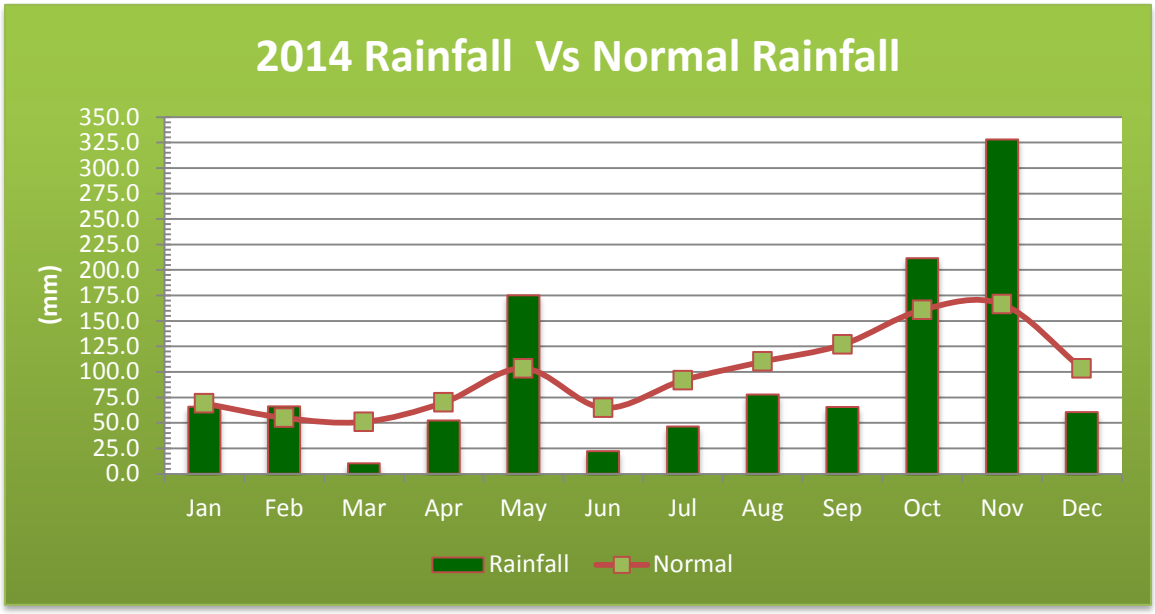


Fig. 1

May, October and November exceeded the normal monthly rainfall for 2014, while the remaining months were either below normal or near normal.

November was the *wettest month* of the year, with a total of 327.8 mm or 12.9 inches; while the *driest month* was **March** with 10.1 mm or 0.4 of an inch of rainfall. The *wettest day* of the year was **November 7th**, when 255.0 mm or 10.0 inches was recorded which was as a result of an upper level low interacting with a surface trough across the area.

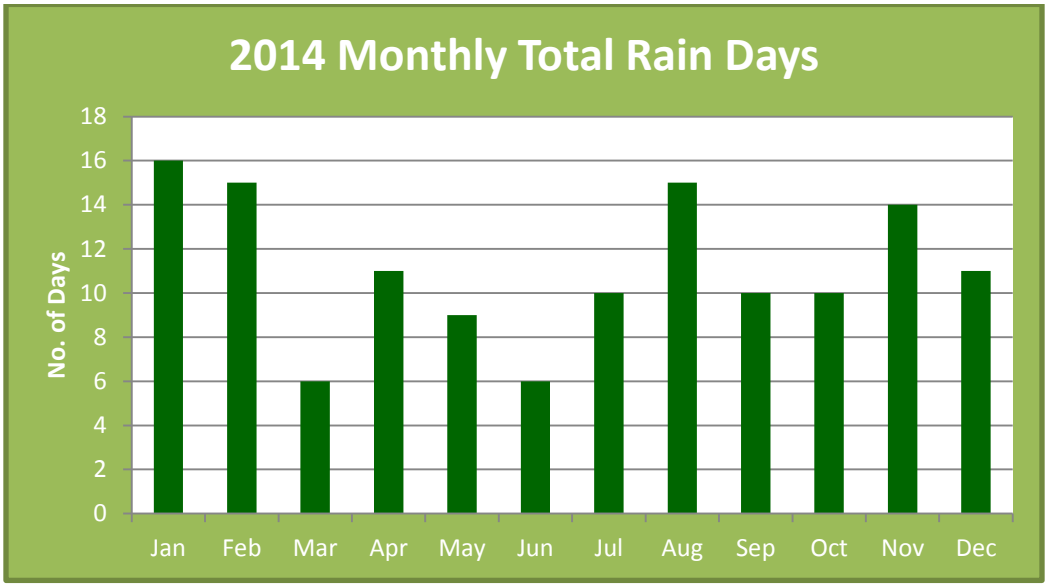
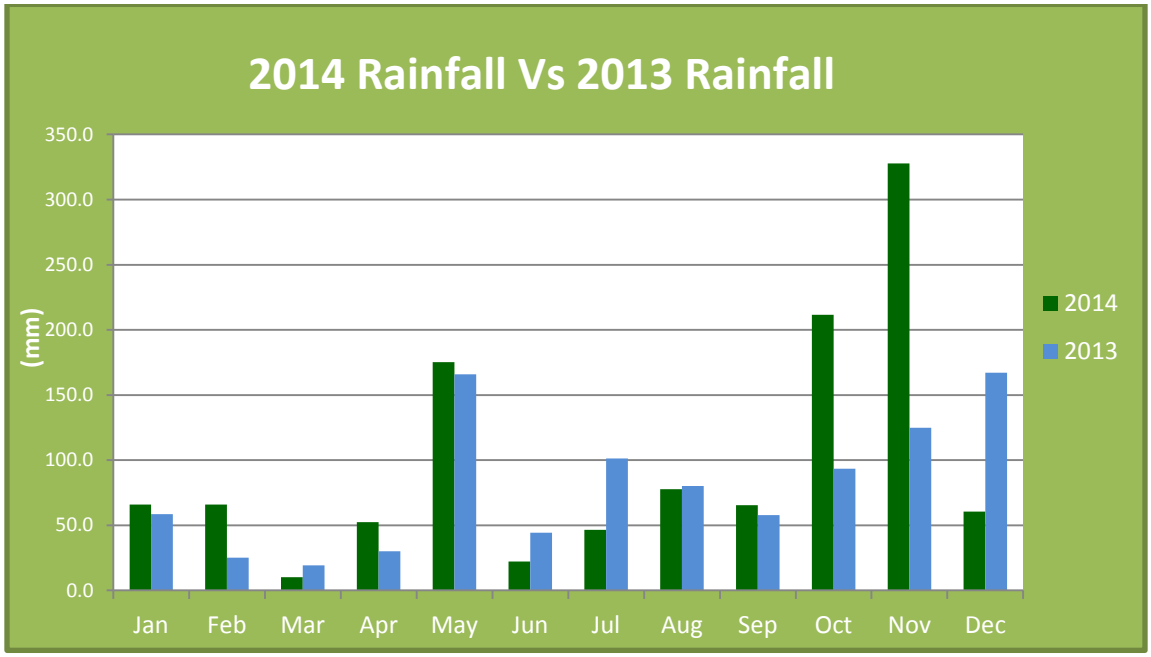


Fig. 2

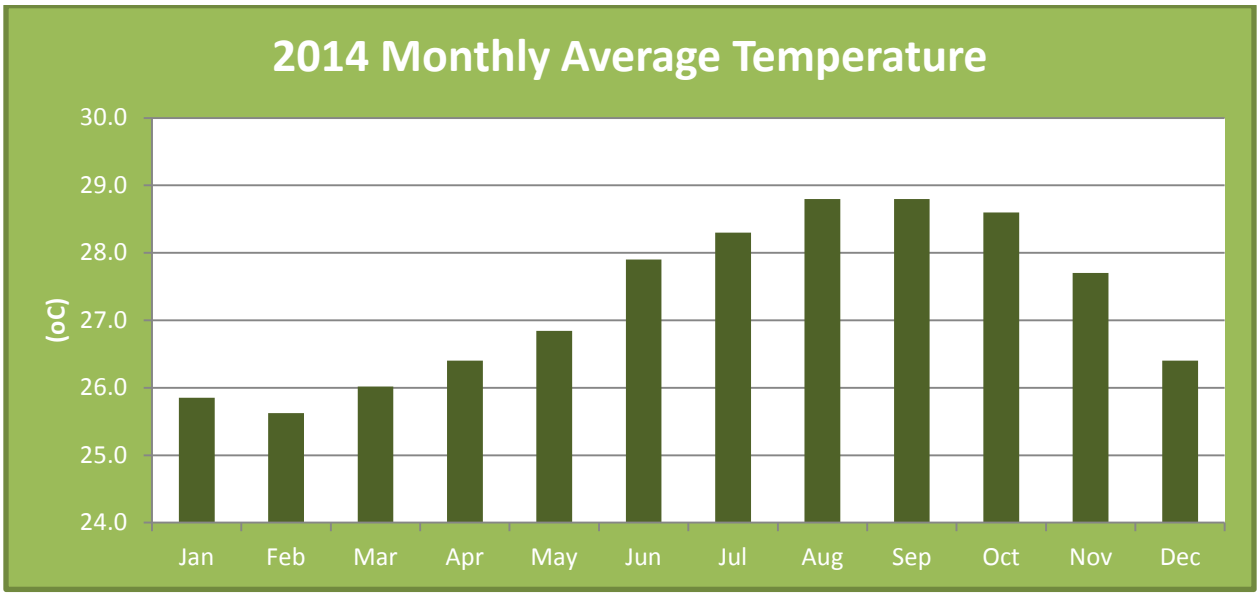
A rain day is considered any day which records 1.0 mm or more rainfall. Normally there are approximately 140 rain days in a year on St. Maarten. For 2014, there were 133 rain days with the month of January having the most (16 days) followed by February and August with fifteen (15) days each.

Just a few records were broken in 2014. November was the wettest since 2003 and exceptionally wet compared to November 2013. March 2014 was the driest March since 2000 and drier than March 2013. November 7th was the wettest day since November 18th 1999 (Hurricane Lenny).

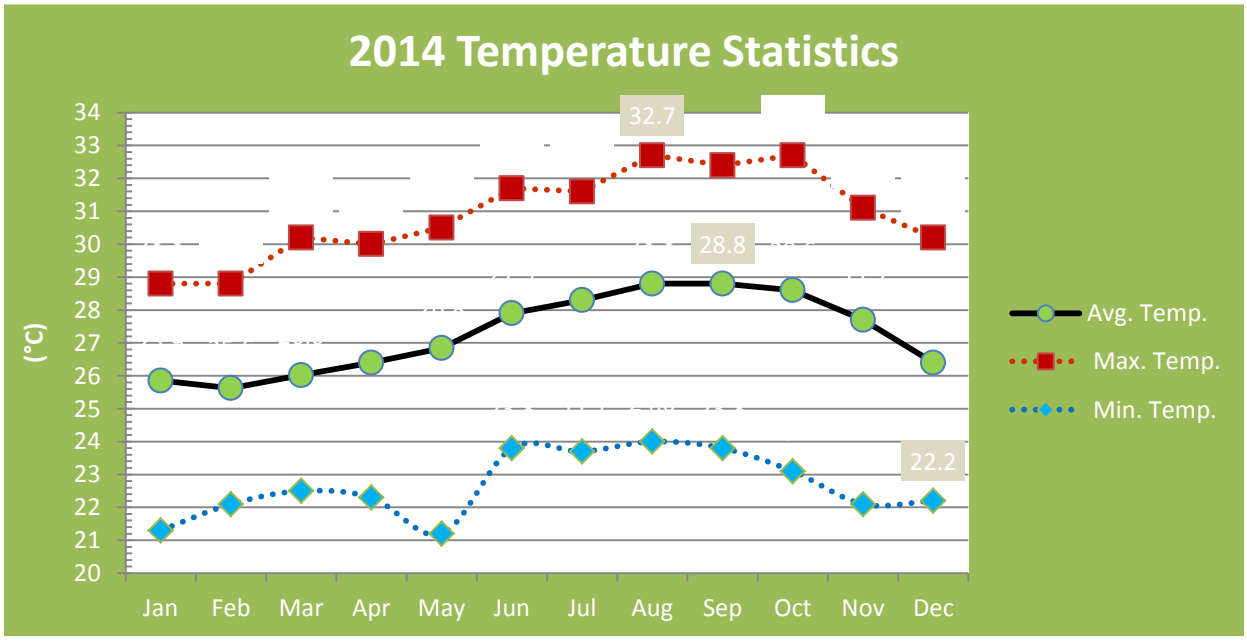


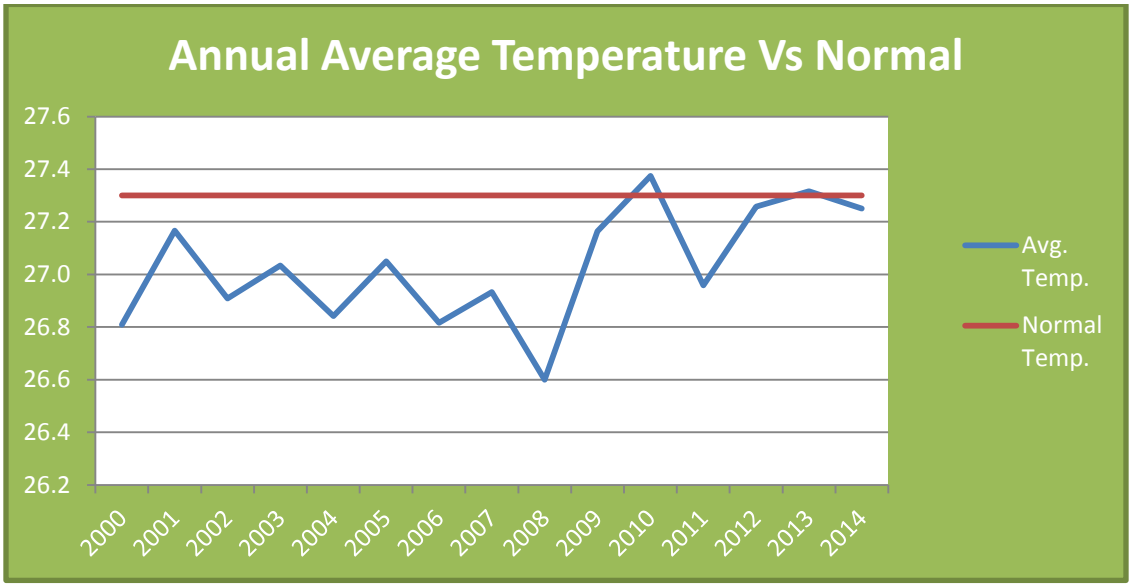
Temperature

The average temperature recorded in 2014 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 3.2 °C between the warmest and coolest month.



The highest daily *temperature* recorded in 2013 was **32.7 °C (91 °F)** and was recorded on August 19th while the lowest daily *temperature* was recorded on February 22nd and November 8th as **22.1°C (72 °F**). The difference between the maximum and minimum temperatures recorded was **10.6°C.**



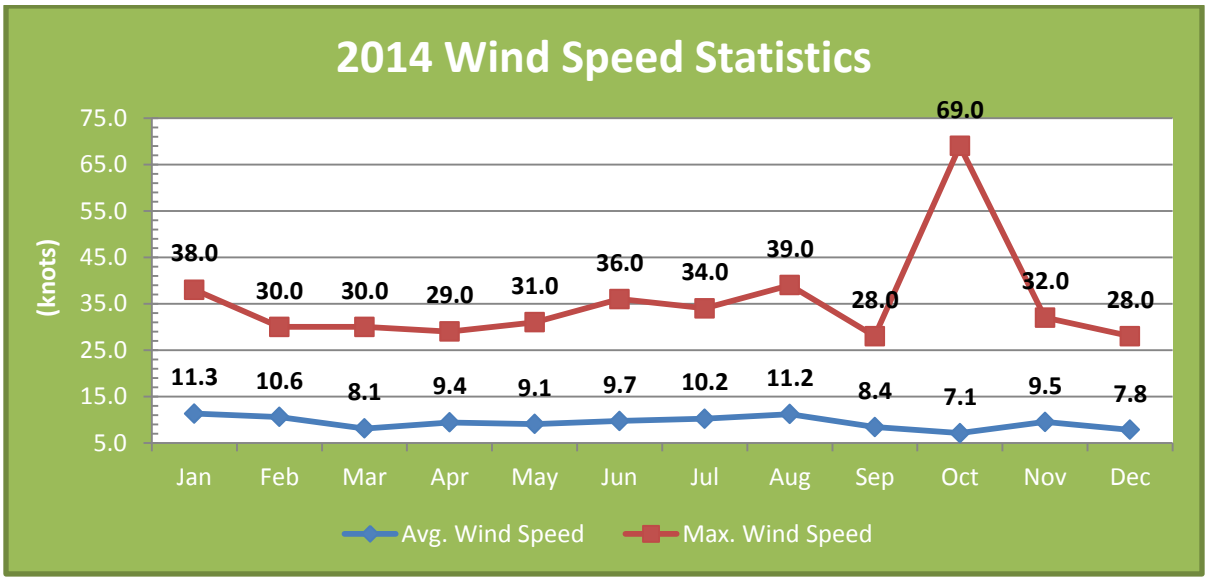


Annual Average temperature for the past 15 years has been below normal most of the time and becoming near normal in the most recent years.

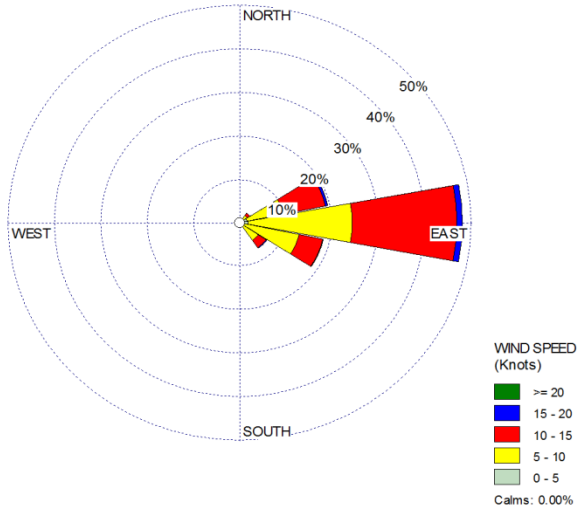
Wind

Surface wind at the Princess Juliana International Airport for 2014 was generally from the east at an average speed of **9.4 knots** (11 mph) which is normal compared to the 30-year average (1981-2010). The *highest monthly average wind speeds were recorded in* **January** as 11.3 knots (13 mph); while **October** had the *lowest monthly average wind speeds* at 7.1 knots (8 mph).

The *highest wind gust* for the year occurred on October 13th at a speed of 69 knots (79 mph). This was during the passage of Hurricane Gonzalo.

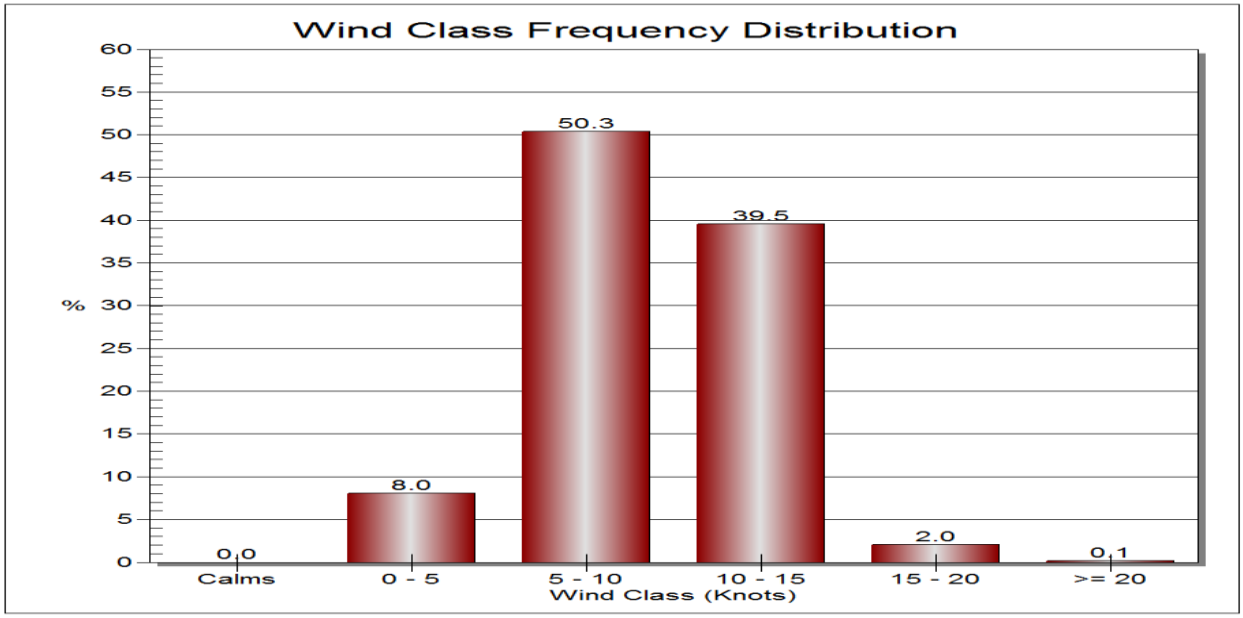


This following wind analysis was derived using the average hourly wind speeds and direction from 1st January to 31st December 2014.



19% of the time winds came from between 60 and 80 degrees, i.e between northeast and East northeast.

67% of the time winds were coming from between 80 and 120 degrees, i.e. between East Northeast and east.



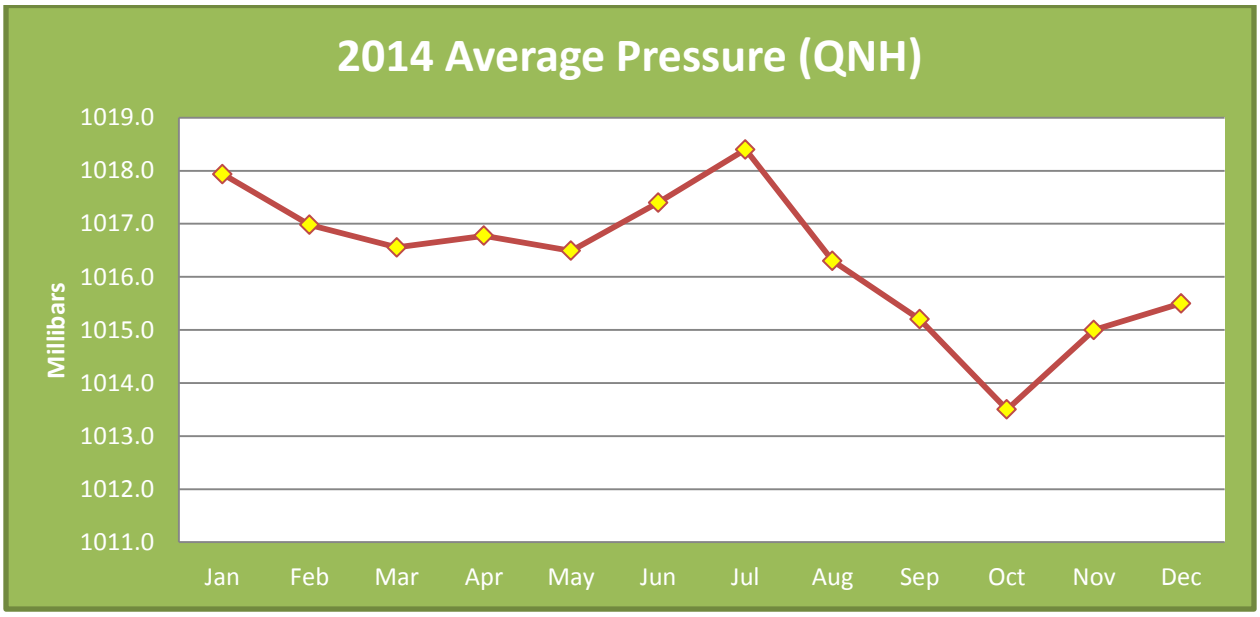
50% of the time in 2014 wind speeds at Juliana were between 5 and 10 knots.

40% of the time wind speeds were between 10 and 15 knots.

8% of the time wind speeds were between 0 and 5 knots and 2% of the time speeds were between 15 and 20 knots.

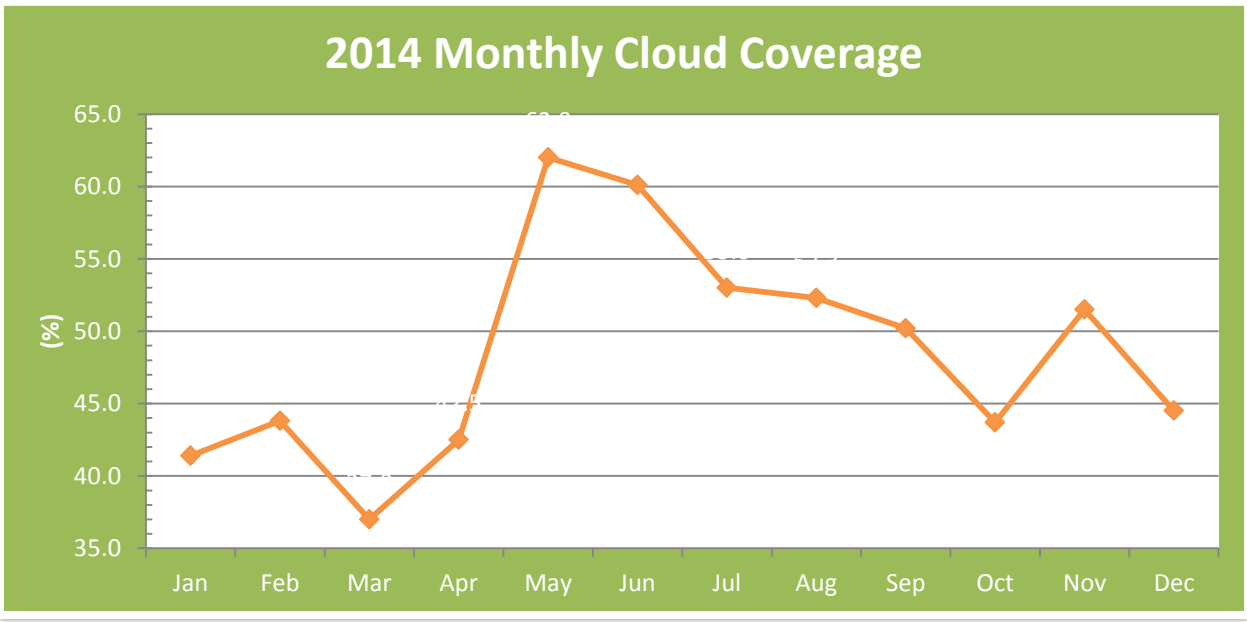
Air Pressure

At the Princess Juliana International the average Mean Sea-Level Pressure for 2014 was **1016.3 millibars**. The Highest daily average was recorded on July 8th as 1020.1 mb while the lowest daily average of 1008.5 mb occurred on October 13th.



Cloud Cover

The average cloud cover for St. Maarten over the past year as recorded at the Princess Juliana International Airport was 47.6 %. The *highest monthly average cloud cover* was 62.0 % during the month of **May** while **March** had the *lowest value* of 37.0 %.

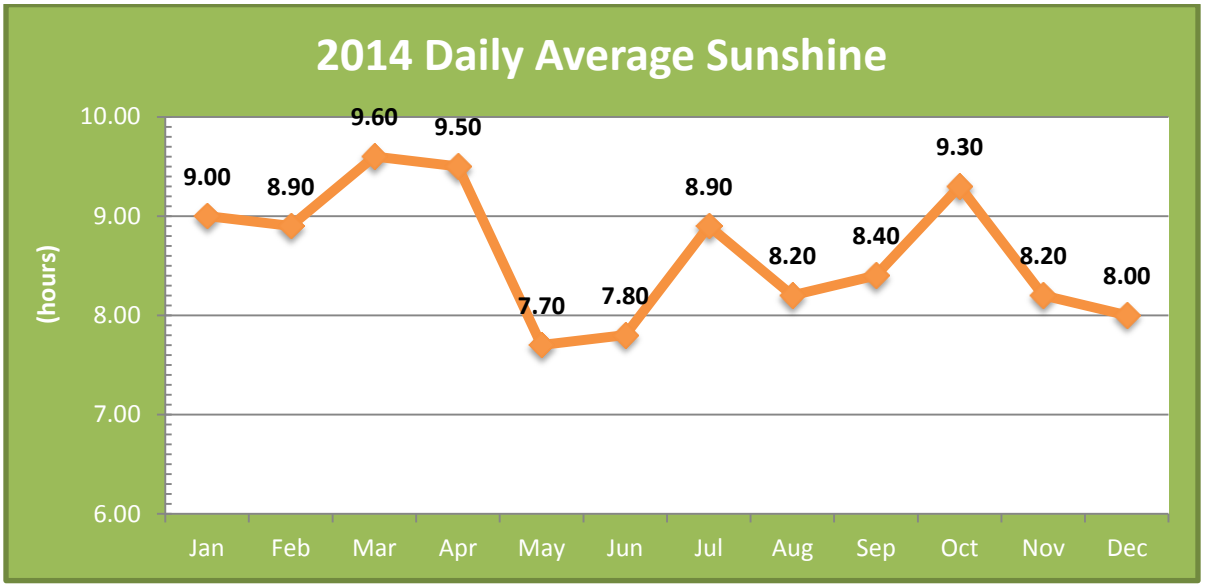


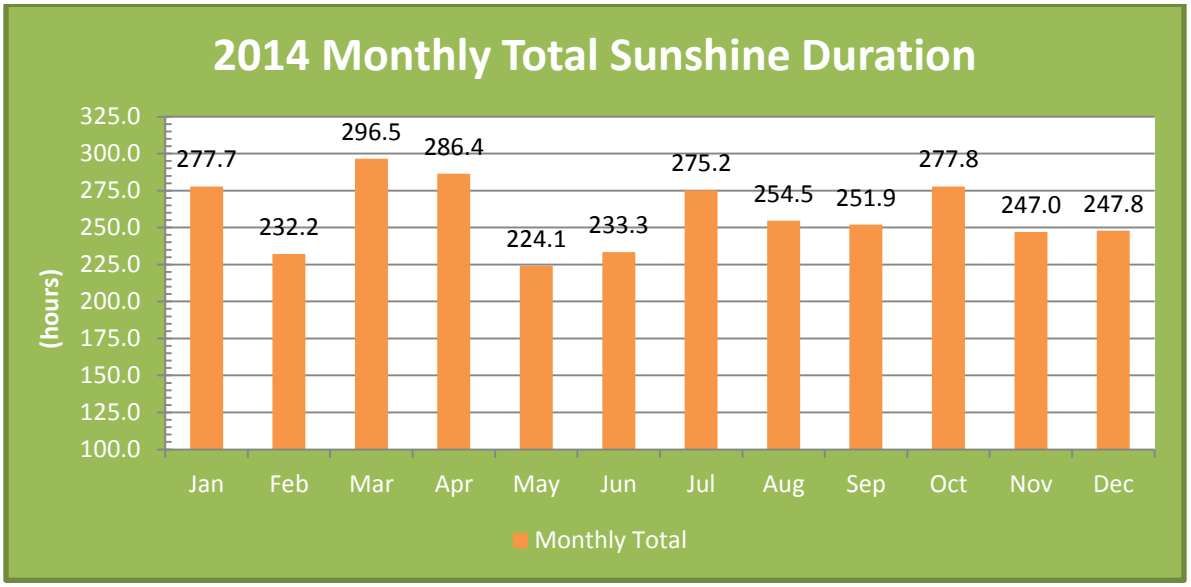
Sunshine Duration

Approximately 70% of possible sunshine was recorded at the surface at the Princess Juliana International Airport, that is, 3104.4 hours out of a possible 4443.1 hours. The *average daily sunshine duration* was **8 hours 36 minutes**.

March received the most hours of sunshine in 2014, an average of 9 hours and 36 minutes per day; while **May** received the least with a daily average of 7 hours and 42 minutes.

Maximum daily sunshine hours was recorded on **May 6th** as 11 hours 42 mins. On **August 2nd and September 4th** absolutely no sunshine was recorded due to cloudy to overcast skies.





Statistic Summary

Below is a recap of the 2014 climate data, in terms of averages, extremes, and totals:

Rainfall		
Total Rainfall for the year	1180.8 mm	46.5 inches
Wettest Month	327.8 mm/12.9 in	November
Driest Month	10.1 mm/0.4 in	March
24-hr Maximum Rainfall	255.0 mm/10.0 in	November 7th
Number of Rain Days (with 1.0+ mm)	133 days	
Temperature		
Average Air Temperature	27.3 °C	81 °F
Absolute Maximum Temperature	32.7 °C	91 °F
Absolute Minimum Temperature	22.1 °C	72 °F
Warmest Month	28.8°C/84 °F	September
Coolest Month	25.6°C/78 °F	February
Average Relative Humidity	73 %	
Wind & Pressure		
Average Wind Speed	9.4 knots	11 mph
Maximum Wind Gust	69 knots	79 mph
Average Air Pressure	1016.3 mbs.	
Sunshine & Clouds		
Average Cloud Coverage	47.6 %	
Average Daily Sunshine Duration	8 hours : 36 minutes	

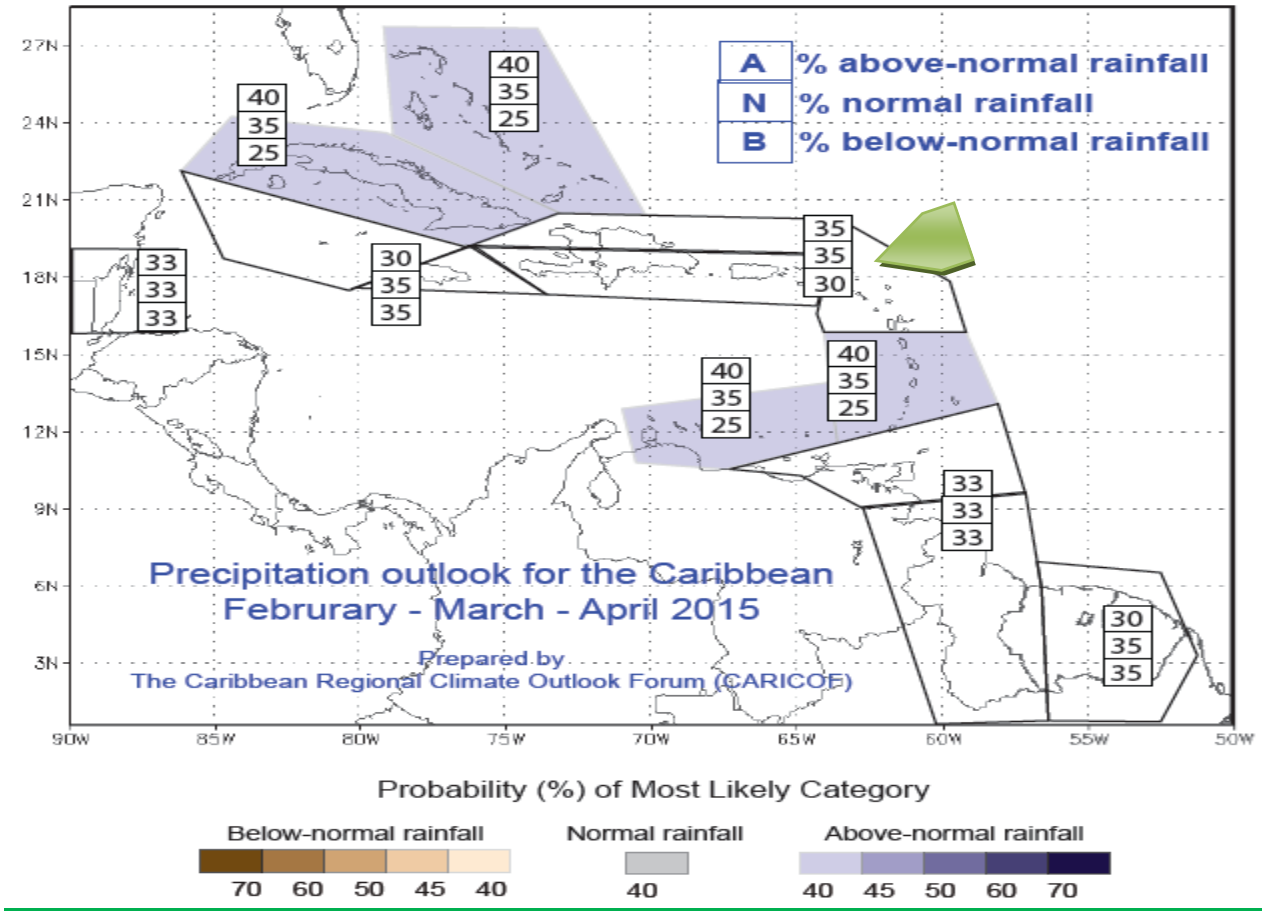
Conclusion

This report provides a summary of all the meteorological data recorded at the Princess Juliana International Airport during the year 2014. 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 2015

Rainfall Outlook for Feb-Mar-Apr 2015



Rainfall for the next three (3) months February-March-April is hardly predictable at this time for the northeast Caribbean. Based on historical data, the current state of the weather and subjective input, St. Maarten is likely to experience **near-normal to above normal Rainfall** during the next three (3) months. There is a **35%** chance of being ***Above Normal*** (more than 178.9 mm); a ***35%*** chance of being ***Near Normal*** (between 148.1 mm and 178.9 mm); and a **30%** chance of being *Below Normal* (less than 148.1 mm).

Note that the area indicated by the green arrow is the northeast Caribbean Region.

List of Cyclone names for 2015 Tropical Atlantic Hurricane Season

▪ ANA	HENRI	ODETTE
▪ BILL	IDA	PETER
▪ CLAUDETTE	JOAQUIN	ROSE
▪ DANNY	KATE	SAM
▪ ERIKA	LARRY	TERESA
▪ FRED	MINDY	VICTOR
▪ GRACE	NICHOLAS	WANDA

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 (*see next page*).
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. Sustained Winds			Effects
		mph	km/h	knots	
	1	74 - 95	119 - 153	64 - 82	Minimal Damage
	2	96 - 110	154 - 177	83 - 95	Moderate Damage
Major	**3**	111 - 129	178 - 208	96 -112	Extensive Damage
Major	**4**	130 - 156	209 - 251	113 - 136	Extreme Damage
Major	**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.