MINISTRY OF
TRAFFIC, TRANSPORT & URBAN PLANNING
Meteorological Department Curaçao

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Climatological Report 2015

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MDC March 2016.

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New weather radar for the Meteorological Department

During late 2013 the existing weather radar of the Meteorological Department Curaçao (MDC) became defective and since there were no spare parts available anymore, it was not possible to repair the radar. The radar had worked mainly with technology from 1970s and was only able to detect precipitation areas. After modernization of the radar in 2003, it became also possible to share the radar images with users throughout the Internet.

It was necessary to purchase a new radar and therefore the MDC had to look first for funding. In July 2014 the Government of Curaçao approved the financing of a new weather radar and from that moment on the MDC investigated on the international market for manufacturers that could deliver a modern and affordable weather radar. In November 2014, based on the World Bank tender system, Vaisala was selected from three companies to deliver the new radar. This company is known in the meteorological world as a manufacturer of reliable equipment.

In December 2014 the signing of the purchase agreement of a dual polar C-band weather radar for the MDC took place between the Government of Curaçao and the Finnish company Vaisala in Helsinki. The delegation to negotiate the contract consisted of Mr. Haime Pieter, Head Technical Affairs of the MDC, Mr. Wladimir Martina, Financial Controller of the Ministry of Traffic, Transport and Urban Planning, Mr. Kenneth Pieter, Advisor of the Minister and Mr. Albert Martis, Director of the MDC. Under the agreement, the installation of the dual polarization weather radar would be completed in mid-July of 2015, before the active part of the hurricane season. The contract involved with this agreement comprised the purchase of the radar itself, the essential training for engineers and forecasters at the MDC, as well as maintenance of the equipment. The MDC would then be equipped with a brand new radar for

Signing ceremony of the purchase contract between Vaisala and the Curaçao delegation. From left to right in the front row, Mr. Martis and Mr. Kjell Forsén, CEO and President of Vaisala. In the back row, Messrs. H. Pieter, W. Martina and K. Pieter.

the surveillance of extreme weather in the flight Information Region (F.I.R.) of Curaçao and over the ABC Islands.

A weather radar is a very important component within the totality of weather monitoring systems to contribute towards the safety of the general public. This applies for instance to the short-range public weather forecasts (for the next 3 to 6 hours), also known as now-casting and for a number of other operational applications, which are of socio-economic importance. Particularly, this will be a key element of the Early Warning System regarding severe weather and hurricanes in Curaçao and the surrounding islands of Aruba and Bonaire and the coastal areas of Colombia and Venezuela as well. This next generation weather radar has revolutionary capabilities. It is the first of its kind in the Caribbean Area. This new equipment can also detect a wind vortex at an early stage, which may lead to the formation of vortices (funnel clouds or *Warwarú* (in papiamentu). In addition, this radar is also of great importance to better investigate the structure of tropical cyclones. In this connection, it serves one of the fundamentals of the Disaster Risk Reduction Program of the World Meteorological Organization (WMO).

Furthermore the operational capabilities of this dual polarization weather radar will mean a guaranteed improvement, as far as the monitoring of the weather for aviation purposes in the air space around Curaçao is concerned and this counts for the harbors and territorial waters of Curaçao as well. This system is able to detect different types of precipitation, such as rain or hail in the mid and upper levels of the atmosphere. It is very important to know what type of precipitation a plane may encounter, especially in and near thunderstorms. Particularly large hailstones can be dangerous for aircraft during a flight. This radar is also able to measure the wind direction and speed (wind shear) at various levels of the atmosphere and is capable of detecting so-called microbursts (strong falling winds), which could be a serious threat to landing or departing aircraft near airports. The MDC forecasters can now warn the aviation authorities in a timely manner for dangerous weather situations.

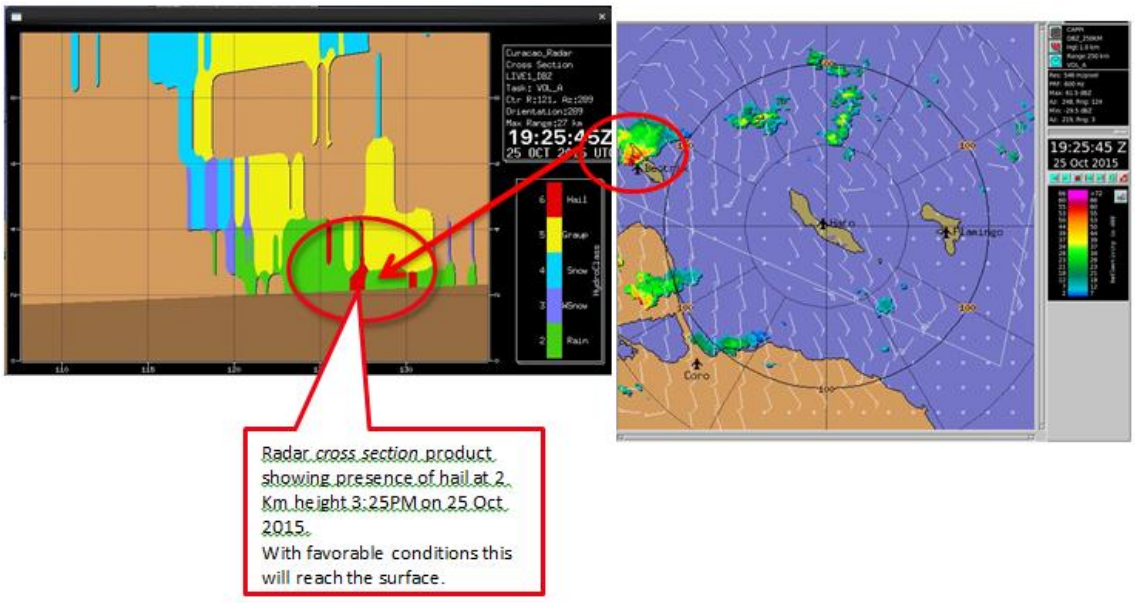
The radar equipment was shipped in April 2015 to Curaçao and in May 2015 the existing radar was dismantled. The new radar was installed in June 2015 at the same location and in the month thereafter the first images were generated. Both the technical and the forecasting employees received the required training. As soon as the new weather radar became operational in July 2015, forecasters of the Meteorological Department were able to detect several interesting new weather features. We also started to display its images on our website and on the MDC Facebook page, so the general public and other users were able to closely follow the development and movement of rain areas over or near the ABC Islands.

The renovated radar site on Seru Spelonk, near the Hato caves

The official inauguration of the new radar took place on September 21. This ceremony was performed by the Minister of Traffic, Transport and Urban Planning, Mrs. Suzy Camelia-Römer and was attended by local and foreign invitees from Panama, Finland, Paraguay, the Netherlands, Aruba and St. Maarten.

Minister Camelia-Römer (front row, second from the right) seated between acting U.S. Consul, Mr. Kanga on her right and Vaisala Deputy CEO, Mr. Konola on her left.

The radar proved its value for instance on October 25, 2015 when hail was observed in parts of Aruba and was clearly detectable on the radar. On November 28, 2015, it proved valuable again when severe thunderstorms caused excessive rainfall over mainly the northwestern sections of Curaçao (Bándabou).



Hurricane Hunter visit to Bonaire and St. Eustatius

Every year the United States National Oceanic and Atmospheric Administration (NOAA), in close cooperation with the United States Air Force Reserve (USAFR), organizes the Caribbean Hurricane Awareness Tour (CHAT). On this tour, a WS-130J Hurricane Hunter aircraft of the USAFR, based near Biloxi, Mississippi, makes stops in several countries and islands in our region. At each stop, the occupants of this aircraft will then inform residents and authorities of these countries about the hazards related to the passage of tropical cyclones near or over islands or coastal areas to increase their awareness about the hazards and aftermath of these systems. The CHAT in April 2015, on request of the MDC, among others visited Bonaire and St. Eustatius on respectively April 22 and 24.

The WS-130J Hurricane Hunter while being visited by hundreds of people in Bonaire.

The aircraft arrived shortly in the afternoon and was welcomed by dignitaries from Statia and Saba. Director Dr. Martis in the center with on the left and right authorities of St. Eustatius and Saba with the hurricane hunter in the background. (courtesy of USAF, NOAA,NHC)

On both islands local residents and authorities were able to board the plane and meet the crew of the hurricane hunter airplane and a few forecasters and specialists of the National Hurricane Center in Miami, including its director, Dr. Richard Knabb. These tropical cyclone experts through exhibitions and presentations informed the local visitors about the hazards posed by tropical cyclones. They also showed how these planes fly through the strongest hurricanes to investigate the development and structure of these systems.

Besides the occupants of the hurricane hunter airplane, the Dutch Caribbean Coastguard also generously attended this event in Bonaire with a Cougar helicopter (see picture to the left). This aircraft is being used among others for search and rescue missions. Representatives of the local governments and organizations like the Fire Department, the Meteorological Department Curaçao and the Red Cross were also present at the airports of both Bonaire and St. Eustatius. These experts gave additional information about tropical cyclones, including how to prepare for the threat of tropical cyclones and on how to deal with their aftermath. On both islands large groups of children and adults visited the exhibitions.

(courtesy of USAF, NOAA,NHC)

A group of about 40 school children even came by boat all the way from Saba to see the Hurricane Hunter in St. Eustatius.

The Lt. Governor of Bonaire, Mr. Edison Rijna also visited the exhibition of the Hurricane Hunter and the Coastguard's Cougar helicopter at the Flamingo Airport in Bonaire. On the image, the reader sees from left to right, Mr. Roderick Gouverneur of the Dutch Caribbean Coastguard, Lt. Governor Mr. Rijna and MDC Director Mr. Albert Martis

(courtesy of USAF, NOAA,NHC)

According to the organizing Office of Disaster Management of Statia, 2015 marks 72 years that the Air Force has supported the National Hurricane Center warning program to help mitigate the hurricane threat within the Atlantic basin, by military air crews flying ten state of the art WC-130J aircrafts directly into the core of tropical cyclones to gather data critical for forecasting a hurricane's intensity and landfall.

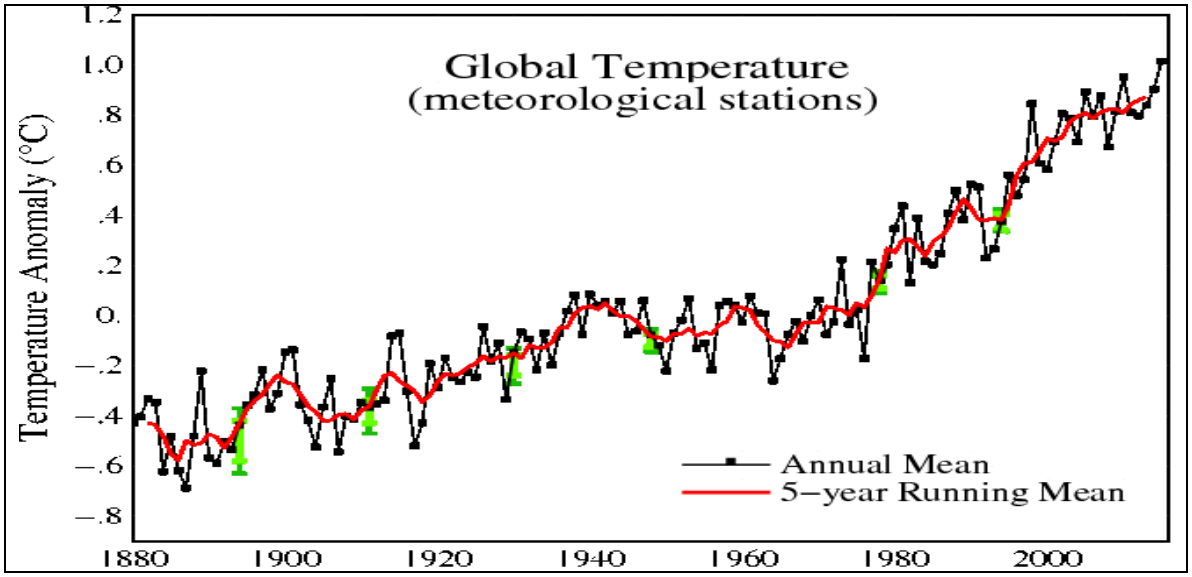
Introduction

Climate Summary 2015

Globally

According to the World Meteorological Organization (WMO) the year 2015 belonged to the five warmest years (period 2011-2015) with above average temperatures. This is due to a combination of a strong “El Niño” and human-induced global warming.
“This is all bad news for the planet” according to Mr. Michel Jarraud (former secretary general of the WMO).
According to independent analyses, NASA and the National Oceanic and Atmospheric Administration (NOAA), Earths 2015 surface temperature was the warmest since modern record keeping began in 1880. Globally- averaged temperatures in 2015 shattered the previous mark set in 2014 by 0,13 ºC. Only once before, in 1998, has the new record been greater than the old record by this much (see table 1). The planet’s average surface temperature has risen about 1.0 degrees Celsius since the late 19th century, a change largely driven by increased carbon dioxide and other human-made emissions into the atmosphere.
Most of the warming occurred in the past 35 years, with 15 of the 16 warmest years on record occurring since 2001. Last year (2015) was the first time global average temperatures were 1 degree Celsius or more above the 1880-1899 average.

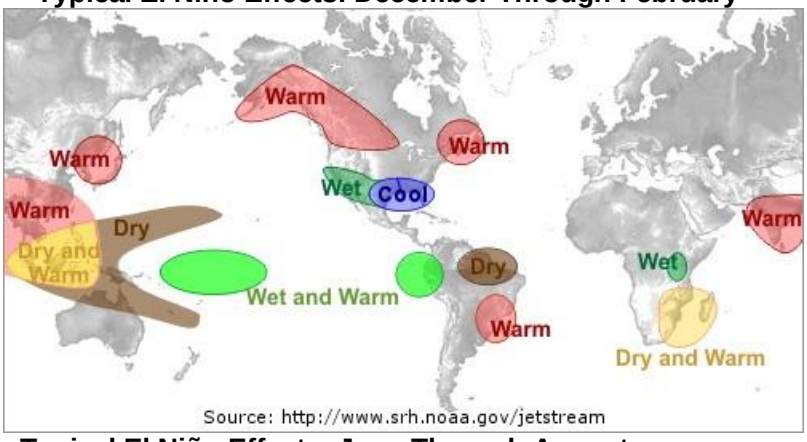
Table 1



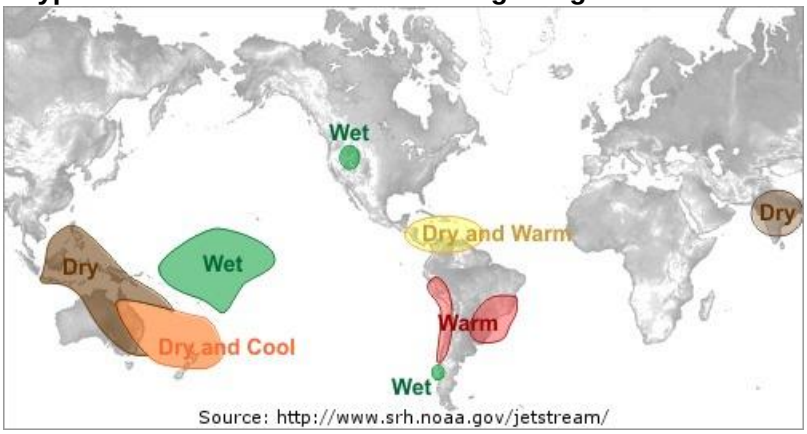
El Niño

According to data from the National Oceanic and Atmospheric Administration (NOAA) and the Climate Prediction Center (CPC) 2015 was a year marked by the strongest “El Niño” event since at least 1997/98. El Niño conditions, which are defined by the CPC as five consecutive months with sea surface temperatures greater than the 0.5ºC anomaly in the Niño 3 & 4 region in the Pacific Ocean (5ºN-5ºS &120º-170ºW) were first observed in March 2015 and intensified to above 2.0ºC by the last quarter of the year. Long range forecasts indicate that “El Niño” will persist through the boreal winter of 2015/2016 and transition back to ENSO neutral conditions by the end of the first half of 2016.

Typical El Niño Effects: December Through February



Typical El Niño Effects: June Through August



Precipitation

Consistent with typical “El Niño” impacts, large areas of Central America and the Caribbean recorded below average rainfall. This is also the case for Curaçao with a total 2015 year precipitation of 340.4 mm. (30 yr. avg. 601.9 mm.) which is well below the 30 year average.

Wind

As the effect of El Niño increased during the peak and latter part of the 2015 hurricane season, strong vertical wind shear and enhanced sinking motion of the air over the tropical Atlantic (characteristic for the El Niño effect), greatly helped to reduce the ability of storms to form or to gain strength.
A good example of this was Hurricane Danny, which because of increased vertical wind shear and dry air weakened and dissipated rapidly, as it moved into the Eastern Caribbean Basin. Stronger than normal trade winds persisted through most of the last months of 2015 in the Caribbean Basin.

Hurricane Season 2015

One of the most notable storms of the 2015 season was Tropical storm Erika, which will be remembered as the deadliest and costliest storm in the Atlantic basin, Erika claimed a total of 36 lives of which 31 in Dominica and 5 lives in Haiti. It also left an economic damage of USD 512 million in the Caribbean.

Major Hurricane Joaquin formed in September and was the strongest and longest-lived hurricane (10 days) of the season. Joaquin caused major damage in some of the lesser populated Bahamian islands where it lingered for nearly 48 hours as a Category 4 hurricane. It claimed 35 lives and prompted an estimated USD 100 million insured loss in the Bahamas and Bermuda. Most of these casualties were the 33 crew members of the cargo vessel “El Faro” which was lost at sea near Crooked Island, Bahamas.

Hurricane Joaquin (cat 4) is seen over the Bahamas in this NOAA GOES EAST satellite image taken at 08:45 E.T. (12:45 GMT) Oct 2, 2015. (Joaquin pounded the Bahamas for 2 days.)

The 2015 Atlantic hurricane season was a slightly below average season featuring eleven named storms, in which four reached hurricane status. The season was characterized by slightly below average numbers of named storms, hurricanes and major hurricanes. The seasonal forecast (2015) slightly under-estimated the Accumulated Cyclone Energy (ACE) and Net Tropical Cyclone (NTC) activity levels.
Notably, nearly half of the 2015 season's ACE was generated by just one storm (Joaquin). Integrated measures such as Net Tropical Cyclone (NTC) activity and Accumulated Cyclone Energy (ACE) were at below-average levels.
The primary inhibitor to TC formation this year was very strong vertical wind shear, especially in the central tropical Atlantic and Caribbean. Several TC's formed in the eastern Atlantic, only to be sheared apart as they approached the Lesser Antilles.
Most of these systems were short lived. However, the first named storm Ana, developed on May 8, nearly a month before the official start of the season (June 1 through November 30).
Due to a strong El Niño, most agencies predicted that only 6-10 tropical cyclones would develop. However, the number of tropical cyclones that developed this season exceeded this prediction. Most storms remained weak, in which they affected few land masses.
In August and September, despite a strong El Niño becoming evident, eight systems developed, most of which formed near and some affected the Cape Verde Islands. Erika affected the Lesser Antilles (mainly with extreme rain events) and was known for the worst natural disaster in Dominica, since Hurricane David in 1979, with 36 total fatalities and damages of more than $500 million (A more detailed section about Erika can be found below)
Tropical cyclone Fred became the first hurricane to strike the Cape Verde Islands in over a century. A month later, in late September, Joaquin developed and strengthened into a category 4 major hurricane, it affected the Bahamas and Bermuda with damages around $60 million dollars and 30 deaths.
The remnants of tropical cyclones Henri and Kate affected Europe in September and November, respectively.

Table 2.

Atlantic Basin Seasonal Hurricane Forecasts for 2015

	(30 yr.avg.)	**Forecast**	**Observed in 2015**
Named storms	(12)	**7 to 8**	**11**
Named storm days	(60)	**25 to 30**	**46¼**
Hurricanes	(6.5)	**2 to 3**	**4**
Hurricane days	(21.3)	**8 to 10**	**11½**
Mayor Hurricanes	(2.0)	**1**	**2**
Mayor Hurricane days	(3.9)	**½**	**4**
A.C.E.	(92)	**35 to 40**	**62**
N.T.C. Activity	(103%)	**45**	**40**

2015 Atlantic hurricane season statistics.

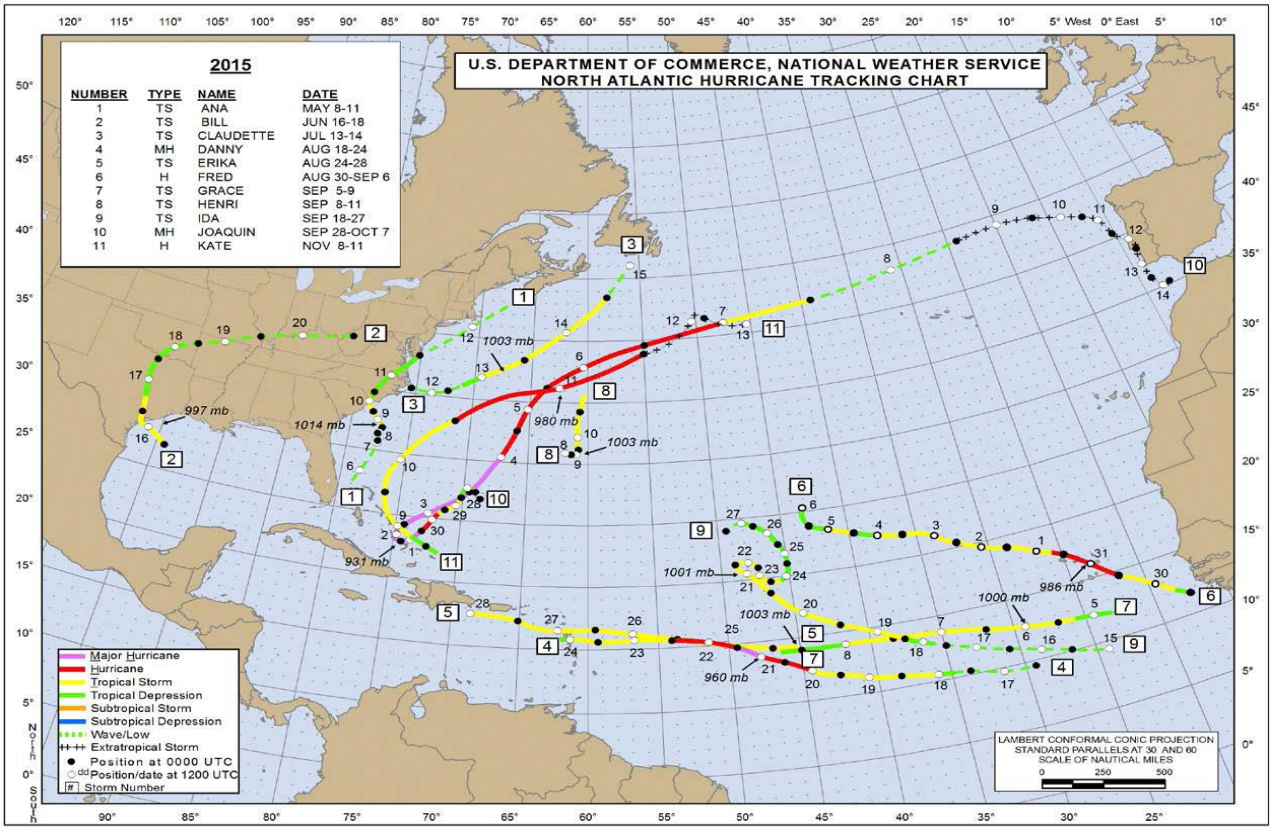
Storm Name	Class[a]	Dates[b]	Max. Winds (kt)	Min. Pressure (mb)	Deaths
Ana	TS	8 – 11 May	50	998	1
Bill	TS	16 – 18 June	50	997	2
Claudette	TS	13 – 14 July	45	1003	
Danny	MH	18 – 24 August	110	960	
Erika	TS	24 – 28 August	45	1001	30
Fred	H	30 August – 6 September	75	986	9
Grace	TS	5 – 9 September	50	1000	
Henri	TS	8 – 11 September	45	1003	
Nine	TD	16 – 19 September	30	1006	
Ida	TS	18 – 27 September	45	1001	
Joaquin	MH	28 September – 7 October	135	931	34
Kate	H	8 – 11 November	75	980	

(a) *Tropical depression (TD), maximum sustained winds 33 kt or less; tropical storm (TS), winds 34-63 kt; hurricane (H), winds 64-95 kt; major hurricane (MH), winds 96 kt or higher.*
(b) *Dates begin at 0000 UTC and include all tropical and subtropical cyclone stages; non-tropical stages are excluded.*

Tropical Storm Erika formed out of a westward moving tropical wave 1535 km (955 miles) east of the Eastern Caribbean island chain, on August 25.
MDC issued Tropical storm warnings for Erika on August 25 for the islands of St. Eustatius and Saba. However, this was discontinued on August 27 at 9 p.m. since little to no effects were experienced on the islands.
Erika fluctuated in organization over the next few days before encountering stronger wind shear. The tropical cyclone maintained a steady westerly track, contrary to a predicted northwesterly re-curvature. The hostile environment in the Caribbean basin at that time prevented Erika from strengthening beyond 85 km/hr (50 mph). The storm made landfall in the Dominican Republic near Barahona and the Pedernales provinces. Early during the following morning Erika re-emerged in the Caribbean but did not re-organize. After crossing the Guatánamo province of Cuba, it degenerated into a trough of low pressure on August the 28th. However, during the passage of Erika over the islands there were heavy rainfall events. At Canefield Airport (Dominica) 380 mm was measured in less than 12 hours, causing catastrophic mudslides and flooding, a total of 890 homes were destroyed.
Approximately 14.291 people became homeless. A total of 30 deaths were reported.

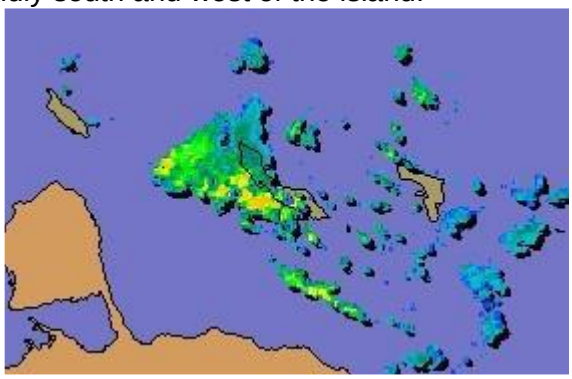
This was the deadliest natural disaster in Dominica since Hurricane David (CAT. #5) in 1979. Overall there was $430 million in damage and the island was set back approx. 20 years in terms of development.
In Guadeloupe, heavy rainfall in the vicinity of Basse-Terre caused flooding and mudslides, forcing roads to temporarily close. Approximately 200.000 people in Puerto Rico were left without electricity. The island experienced at least $20 million in agricultural damage. In the Dominican Republican the weather station in Barahona measured 616 mm of rain in 24 hours, in a single hour 220 mm was measured.
About 823 homes suffered damage and 7.345 people were displaced. Five people died in Haiti, four from a weather-related traffic accident and one from a landslide.

2015 Atlantic Basin Tracking Chart

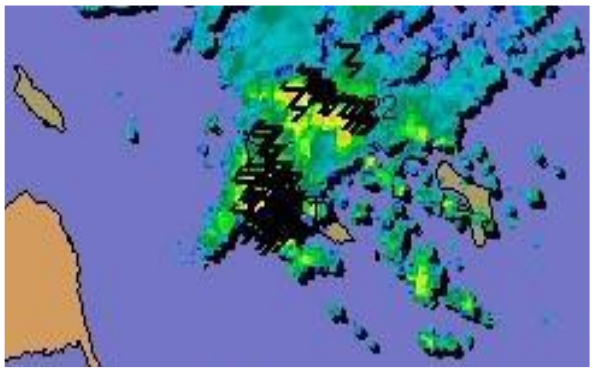


Extreme weather events in Curaçao

On the morning of November 28, a small area with showers and thundershowers started to develop, northwest of Curaçao and southwest of Bonaire, due to a small upper level trough, over the Southern Caribbean region. Around 8 a.m. in the morning, showers started to develop rapidly south and west of the island.



Around 10:00 a.m. showers and thunderstorms became more intense and develop mainly over the western part of Curaçao. Between 10:00 -10:30 a.m. strong lightning discharges caused most communications and electronic equipment at the MDC to fail.



The heaviest showers remained concentrated over Bullenbaai and the Christoffel/Kenepa area. Early in the afternoon hours the thunderstorm and heavy shower activity gradually diminished and later dissipated. Because of the large amount of precipitation in a very short time between 08:00 a.m. and 01:00 p.m. local flooding mainly over the Bánda-Bou region caused flash flooding with some roads being washed away. The voluntary rain collecting station of Seru Grandi measured in 24 hours 168.3 mm of precipitation, while the automatic weather station at Sumbu measured a total of 47.6 mm. between 08:00 -10:08 a.m. In 24 hours there was a total of 52.2 mm. measured there. Hoffi Mango measured in 24 hours 72.0 mm.
At the Hato Airport 51.9 mm was measured between 8:00 a.m. and 1:00 p.m. on November 28.

Special Bulletins

During 2015 the Meteorological Department Service of Curaçao issued more than 20 special bulletins concerning small craft warnings due to abnormal sea conditions in the proximity of Bonaire and Curaçao, which could endanger safe operations of these. During the months of January, February, May, November and December most of these bulletins were issued.

Tropical Cyclone bulletins

No tropical cyclone bulletins where issued by the Meteorological Department of Curaçao during 2015.

Aerodrome warnings

The Meteorological Forecast Center of Curaçao issued in 2015 more than 50 *Aerodrome warnings. Most of these warnings where issued because of strong winds 35 knots (65 km/hr.) or higher, almost all year round affecting the airfields of the A,B,C islands. Between May and December approximately 10 Aerodrome warnings were issued for heavy showers, thunderstorms or possible lightning strikes and/or crosswinds for one or more of the A,B,C aerodromes.

*[*Aerodrome warnings are issued when meteorological conditions could adversely affect safe operations of aircraft at the airport.*]

SIGMETs**

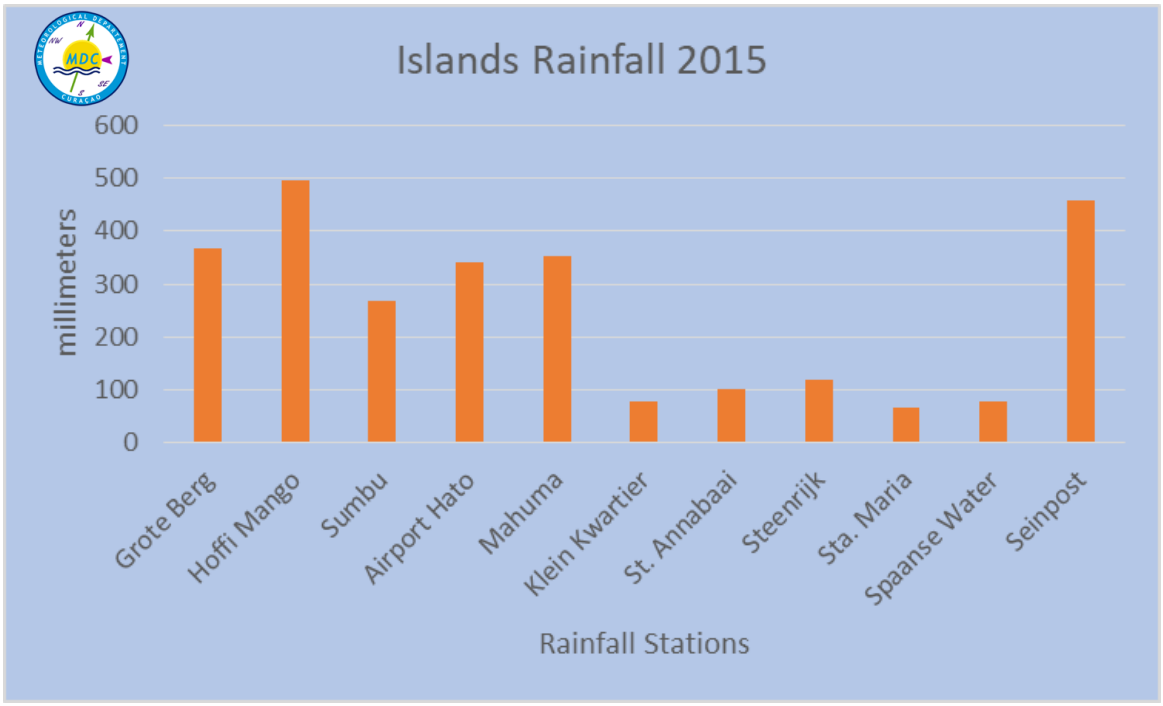
The Meteorological Watch Office of Curaçao has issued in 2015 about 10 SIGMETs** Most of the SIGMET were issued in the months of October and November.

**SIGMETs are special bulletins of possible threats that can affect flight safety and expedition. These are issued for aircraft in flight moving in a Flight Information Region (F.I.R.), for which a Meteorological Watch office is responsible. In the case of the Curaçao F.I.R. this encompasses an airspace of about 300.000 km² which MDC is responsible for.

Curaçao Climate

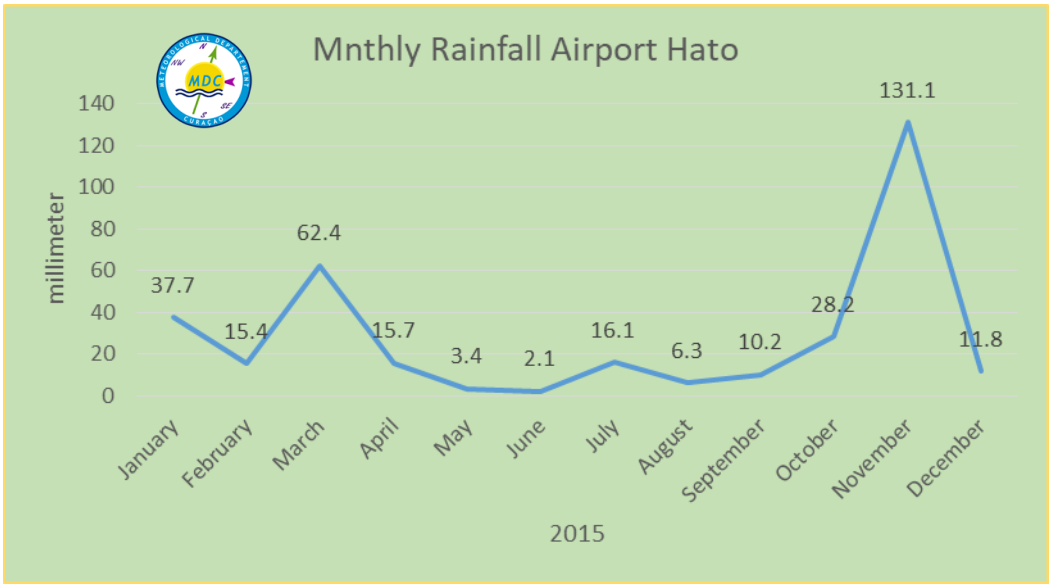
Precipitation

The island's average total rainfall for 2015 was **328.7 mm.**
The rainfall station with the highest year total, **496.0 mm**, was located in Hòfi Mango, in Banda Bou.
The station with the largest amount of days with rainfall ≥ 1.0 mm: **64 days** was located in Hòfi Mango. (average is 76 days). Which was 16% less days than the 30 year normal average.
The maximum 24-hour rainfall total for Curaçao was **168.3 mm** and was measured at the rainfall station in Grote Berg on November 28, as consequence of an area of severe weather developing and moving over mainly the western part of the island.
As can be noticed 2015 proved to be a year with rainfall well below the long-year average, due to the impact of El Niño.



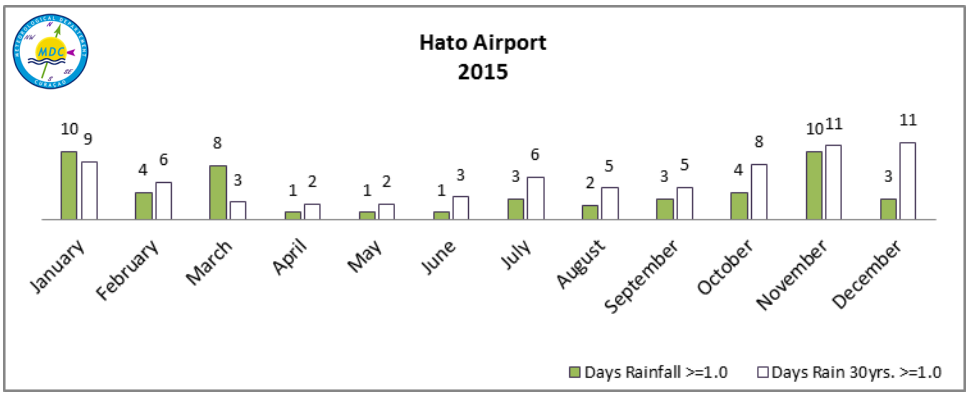
Rainfall data from Hato airport

The rainfall total recorded at the Hato International Airport for the year 2015 was **340.4 mm**. This was **43.4%** below average compared to the 30 year normal (1981-2010).
The wettest month of 2015 was November with a monthly total of **131.1 mm** and the driest month was June with **2.1 mm**. The rainfall accumulation for March was 62.4 mm and this was caused mainly by a frontal system during the first week of the month. This amount was high. Nevertheless this is not a record compared to March 1995 when a total rainfall of 112.6 mm was measured.
The number of hours with rainfall for 2015, recorded at Hato international Airport, was **233 hours.** (normal 481.5 hrs.). This equals 52% of hours below the 30 year normal.



Days with rainfall

The number of days with rainfall greater or equal to 1.0 mm was **50 days** (normal 70 days). This equals 29 % less days with 1.0 mm rain or more.
The number of days with thunder was **12** (normal 28 days).
November and March proved to be the wettest months with monthly totals varying from **62.4 mm** in March and **131.1 mm** in November.



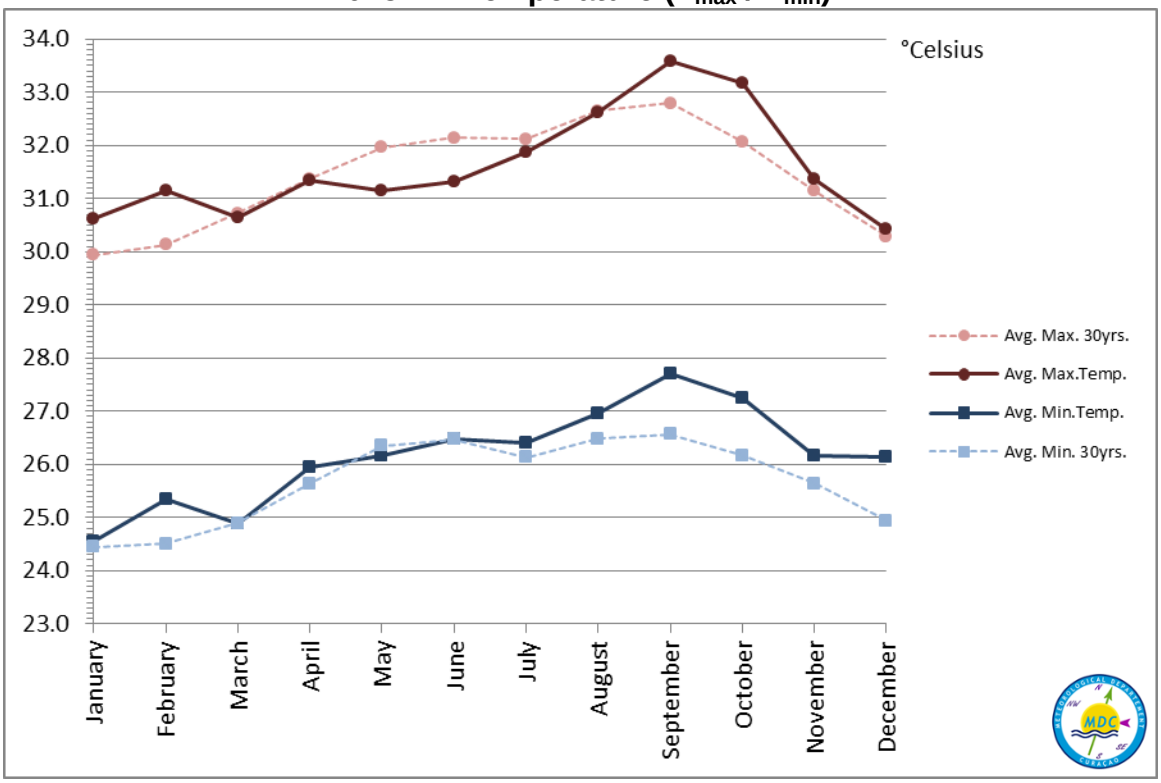
***Picture of a road washed away in Bandabou, due to flash flood on November 28, 2015**

Temperature

The average air temperature as recorded at Hato International Airport over 2015 was **28.2 °C** (normal 28.0 °C). The average maximum air temperature for 2015 was **31.6 °C** (30 year normal: 31.4 °C). September proved to be the warmest month of the year with a daily average temperature of **29.8 °C**. January 2015, was the coolest month with a daily average temperature of **27.1 °C**. The average minimum temperature (30 year, 25.9°C) for December was also exceeded reaching 26.1°C, which is a record.

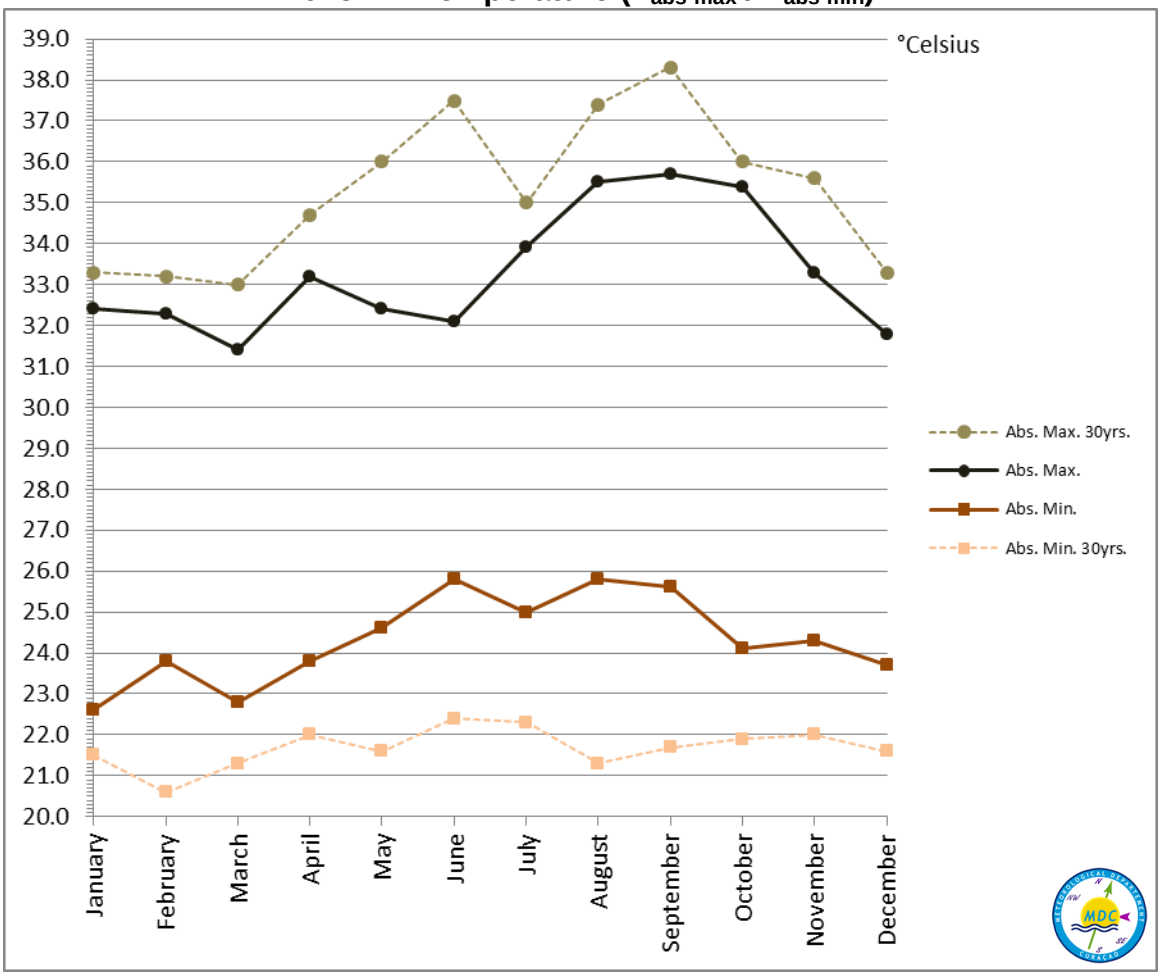
Hato Airport
2015 Air Temperature (Average)

2015 Air Temperature (T_{max} / T_{min})



The absolute maximum air temperature for 2015 was **35.7 °C** and was recorded on September 12, at 13:34 local time. *(The all-time absolute maximum air temperature was 38.3 °C and was recorded on September 11, 1996)*
The absolute minimum air temperature of **22.6 °C** was measured on January 7, at 06:09 a.m.
(The all-time absolute minimum air temperature was 17.0 °C and was recorded in March 1933)

Hato Airport
2015 Air Temperature ($T_{abs-max}$ / $T_{abs-min}$)

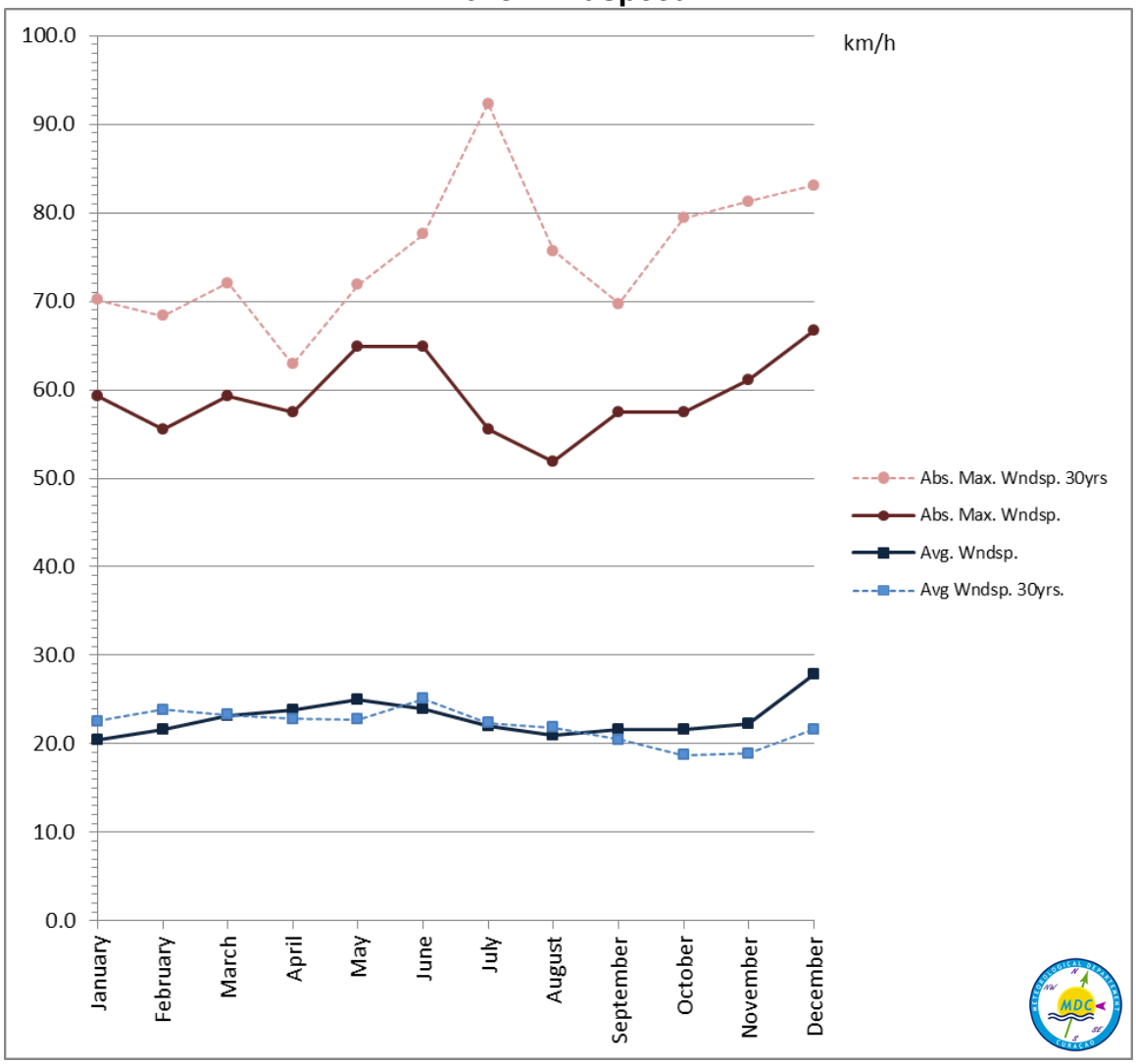


In 2015 there were two consecutive warmest days, October 4 and 5, with an average day temperature of **30.2 °C**. The coolest day for 2015 was November 19, with a 24-hour average temperature of **25.9 °C**.

Wind

The average wind speed for the year 2015 was 22.8 $^{km}/_{hr}$ [=6.3 $^{m}/_{sec.}$] (normal 23.8 $^{km}/_{hr.}$ [=6.6 $^{m}/_{sec.}$]) at a height of 10 meters above ground level and the average wind direction was **91.8°** (East). [30 year normal 88.7°]. December 2015 had the highest monthly average wind speed of 27.8 $^{km}/_{hr}$ [=**7.7 $^{m}/_{sec.}$**] and January 2015 had the lowest monthly average wind speed of 20.4 $^{km}/_{hr.}$ [=**5.7 $^{m}/_{sec.}$**]. The highest wind gust was 66.7 $^{km}/_{hr.}$ [=**18.5 $^{m}/_{sec.}$**] and was recorded on December 22 at 06:06 am. [all time record 92.2 $^{km}/_{hr.}$ **(=25.6 $^{m}/_{sec.}$)**) July 1996 Tropical Storm Cesar]. An average maximum wind speed of 54.5 $^{km}/_{hr}$ [=**15.1 $^{m}/_{sec.}$**] was measured in December, which exceeded the 30 year record of 51.9 $^{km}/_{hr}$ [=**14.4 $^{m}/_{sec.}$**].

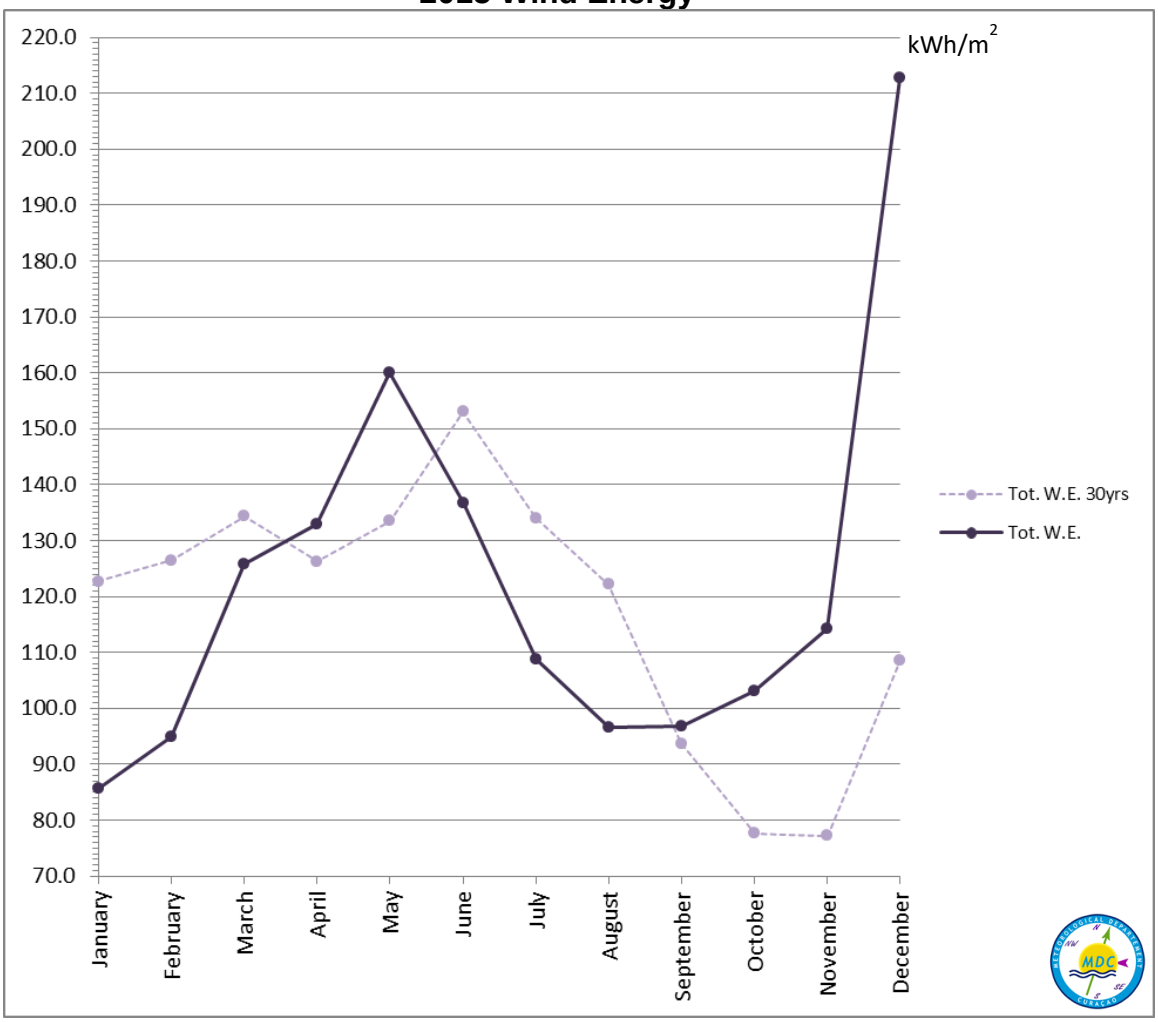
Hato Airport
2015 Windspeed



Potential Wind Energy

The total potential wind energy (at 10m. height and wind speeds ≥ 4 $^{m}/_{sec.}$) for the year 2015 was **1468.5 kWh/m²**.
The daily average was **4.04 kWh/m²/day**.
The maximum daily wind energy potential was **10.1 kWh/m²/day** measured on May 8, 2015.
The minimum daily wind energy potential was **0.4 kWh/m²/day** and was recorded on January 19 and February 11, 2015.
The maximum average monthly wind energy potential was **212.7 kWh/m²** measured in December 2015. (30 yr avg max 153.1 kWh/ m² June) The minimum average monthly wind energy potential was **85.6 kWh/m²** measured in January 2015. (30 yr. avg. min 74.5 kWh/ m² in November).

Hato Airport
2015 Wind Energy



Total Wind Energy per month

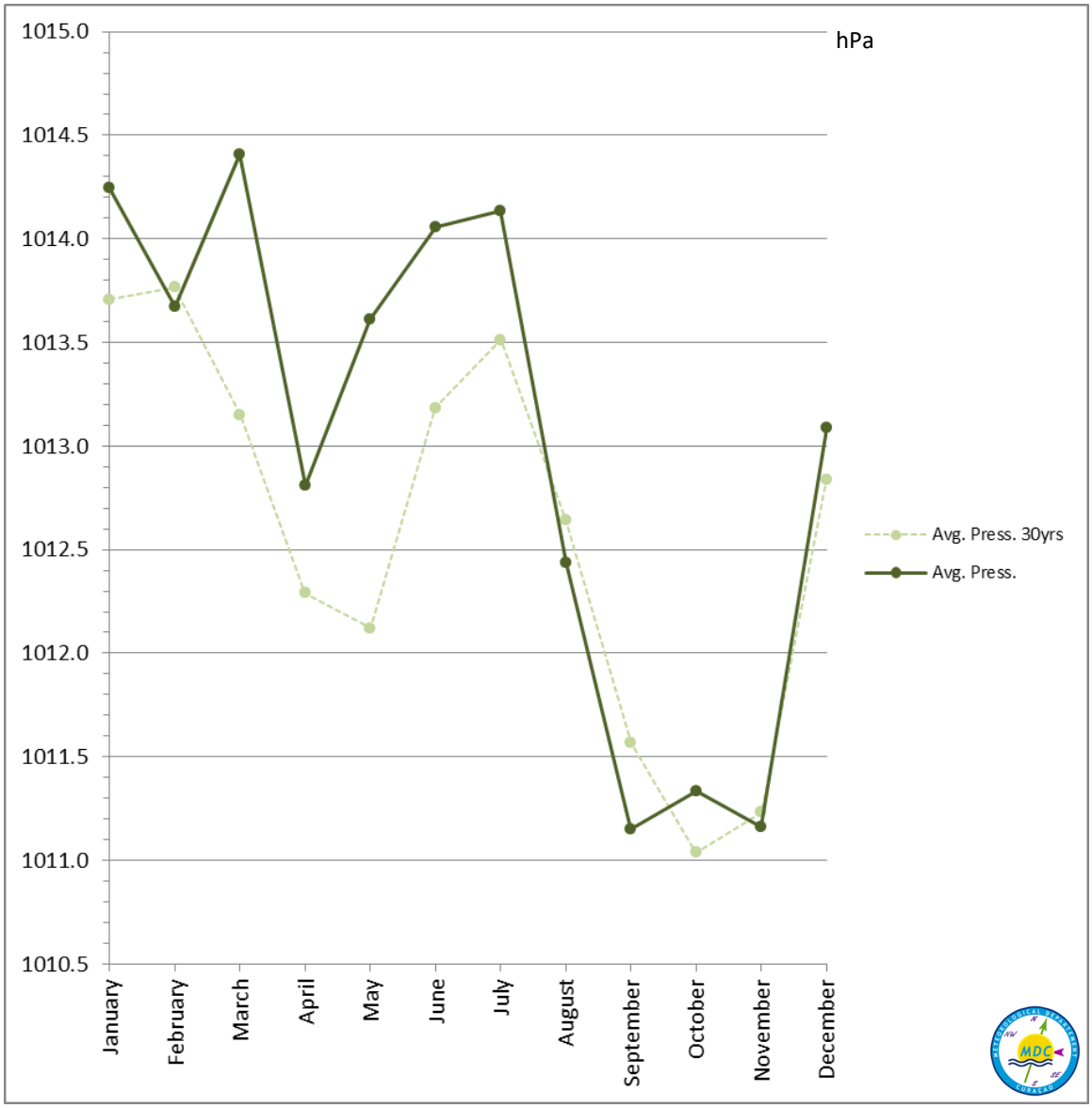
Air Pressure

The average air pressure recorded at Hato International Airport over the past year (2015) was **1013.0 hPa**. (30 year average: 1012.5 hPa.)

The maximum air pressure of **1019.5** hPa was recorded on January 5 at 10:00 a.m., while the minimum air pressure of **1004.5** hPa was observed on October 04:00 p.m. and again at 05:00 p.m.

The maximum average monthly air pressure was **1014.4 hPa** measured in March 2015. The minimum average monthly air pressure was **1011.2 hPa** measured in September and November 2015.

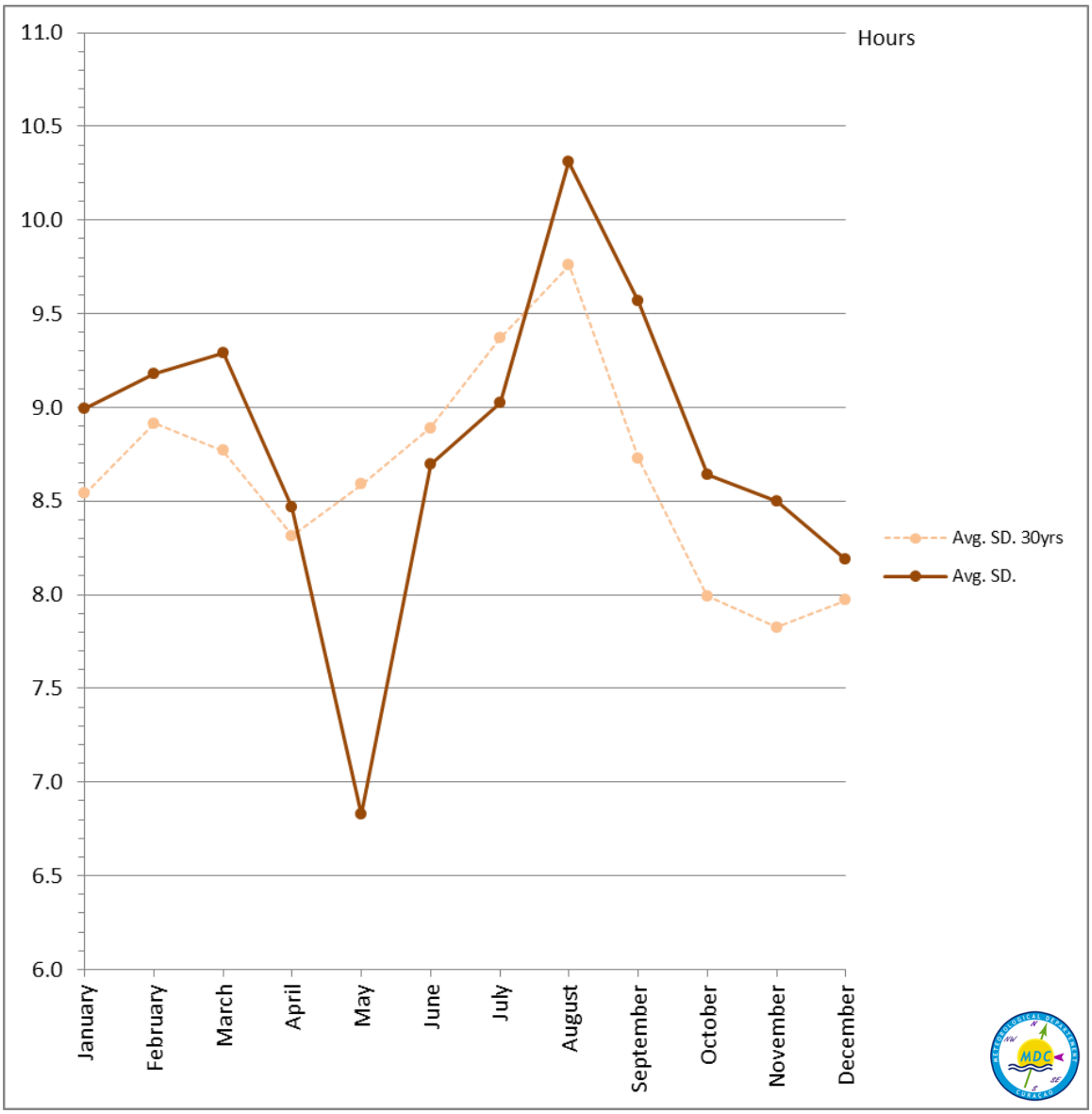
Hato Airport
2015 Air Pressure



Sunshine Duration

The total sunshine duration over the year was **3214 hrs**. This is **73%** of the maximum possible duration (4428 hrs).
The average daily sunshine duration was **8 hours** and **48 minutes.**
The warmest month, September, had a daily average sunshine duration of **9 hours** and **36 minutes**, while the coolest month January had a daily average of **9 hours.**
The four longest days, as far as sunshine is concerned for the past year, were recorded on 22nd, 23rd of March and 12th, 18th of August. The duration lasted for **11 hrs.** and **18 minutes** of sunshine.
For the months January through March and August till December the sunshine duration remained above the 30-year average.

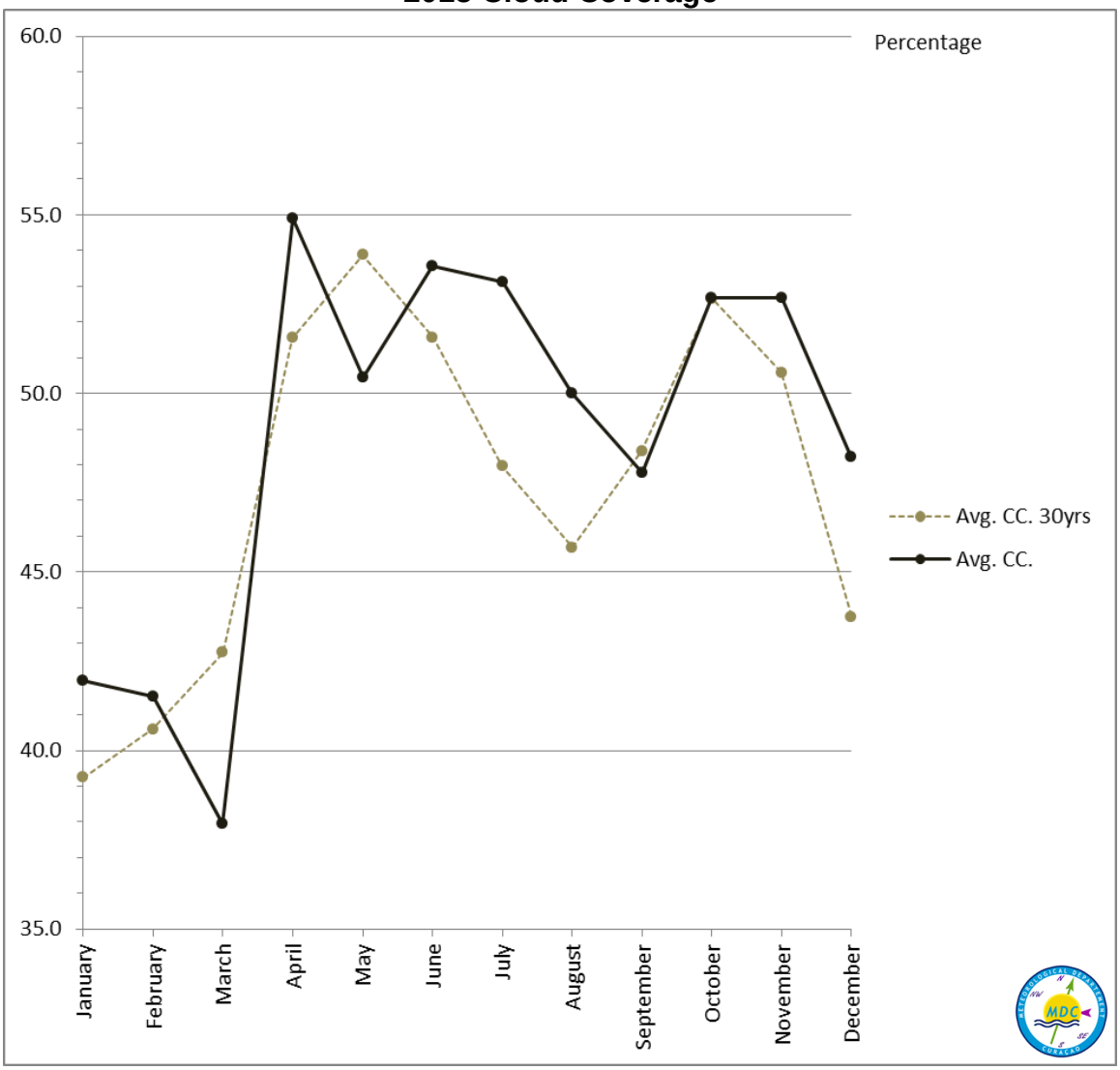
Hato Airport
2015 Sunshine Duration



Cloud coverage

The average cloud cover for the past year was **48.7%**.
The highest total cloud coverage per month was **54.9 %** and was observed in April.
The lowest amount was **41.5%** and was recorded in February.

Hato Airport
2015 Cloud Coverage



Evaporation

The site of the evaporation pan is located at the Meteorological Department's building at Seru Mahuma. The daily average evaporation for the year 2015 was **8.7 mm.**
The highest daily average evaporation value of **14.76 mm,** was measured on May 10.
The total evaporation during 2015 was **3143 mm.**

Conclusion

The total rainfall at the Hato International Airport for 2015 was 340.4 millimeters, which was 43.4% below the long term average. Except for the month of November, with a total rainfall of 131.1 mm, most of this (55.7 mm.) fell on the 28th of November. Rainfall for all other month's remained well below the 30 year monthly average. Mainly due the effect of a strong El Niño during most of the year. During the last 2 months of 2015 conditions became gradually neutral.

The average temperature was 28.2 °C (long year average is 27.8 °C) approximately 1.4 % above the long year average. The average minimum temperature was 26.2 °C which is 0.2 % higher compared to the long year average of 25.7 °C.
Whilst the average maximum temperature was 31.6 °C, this is 0.6 % above the long year average maximum temperature which was 31.4 °C.

The average wind speed for 2015 (6.3 m/sec) was very close to the 30 year average (6.2 m/sec). The average maximum wind speed was12.7 m/sec (12.4 m/sec).
We can say however, that the monthly average wind speed for the four last months of the year (September- December.) remained above the monthly average, with an extreme windy December month.

We can conclude that:

The year 2015 will go into the books as dry, warm and windy.

««++»»

METEOROLOGICAL DEPARTMENT CURAÇAO

CLIMATOLOGICAL DATA 2015

Absolute Minimum Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Abs. Min.
CURAÇAO 2015	22.6	23.8	22.8	23.8	24.6	25.8	25	25.8	25.6	24.1	24.3	23.7	**22.6**
Record	**19.0**	**19.0**	**17.0**	**20.1**	**20.2**	**20.8**	**21.6**	**20.6**	**21.5**	**20.0**	**20.0**	**19.9**	**17.0**
Year			*1933*										

Average Minimum Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	24.6	25.3	24.9	25.9	26.2	26.5	26.4	27.0	27.7	27.2	26.2	26.1	**26.2**
Long Year Avg.	**24.4**	**24.5**	**24.9**	**25.6**	**26.3**	**26.5**	**26.1**	**26.5**	**26.6**	**26.2**	**25.6**	**24.9**	**25.7**

Average Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	**27.1**	**27.4**	**27.2**	**27.8**	**27.9**	**28.2**	**28.4**	**29.1**	**29.8**	**29.3**	**28.3**	**27.7**	**28.2**
Long Year Avg.	**26.5**	**26.6**	**27.1**	**27.6**	**28.3**	**28.5**	**28.4**	**28.7**	**28.9**	**28.5**	**27.9**	**27.0**	**27.8**

Average Maximum Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	30.6	31.2	30.7	31.3	31.2	31.3	31.9	32.6	33.6	33.1	31.4	30.4	**31.6**
1981-2010 Avg.	**29.9**	**30.1**	**30.7**	**31.4**	**32.0**	**32.1**	**32.1**	**32.7**	**32.8**	**32.1**	**31.1**	**30.3**	**31.4**

Absolute Maximum Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Abs. Max.
CURAÇAO 2015	32.4	32.3	31.7	33.2	32.4	32.1	33.9	35.5	35.7	35.4	33.3	31.8	**35.7**
1981-2010 Record	**33.0**	**33.2**	***33***	**34.7**	**36.1**	**37.5**	**35.0**	**37.4**	**38.3**	**36.9**	**35.6**	**33.3**	**38.3**
Year									*1996*				

METEOROLOGICAL DEPARTMENT CURAÇAO
CLIMATOLOGICAL DATA 2015

Rainfall in mm.													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
CURAÇAO 2015	37.7	15.4	62.4	15.7	3.4	2.1	16.1	6.3	10.2	28.2	131.1	11.8	**340.4**
1981-2010 Avg.	**46.0**	**28.8**	**14.1**	**19.4**	**21.3**	**22.4**	**41.3**	**39.7**	**49.1**	**102.0**	**122.4**	**95.5**	**600.6**

Average air pressure (Hpa.)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	1014.2	1013.7	1014.4	1012.8	1013.6	1014.1	1014.1	1012.4	1011.2	1011.3	1011.2	1013.1	**1013.0**
1981-2010 Avg.	**1013.7**	**1013.8**	**1013.2**	**1012.3**	**1012.1**	**1013.2**	**1013.5**	**1012.6**	**1011.6**	**1011.1**	**1011.3**	**1012.8**	**1012.5**

Average Wind Speed at 10 m. height (in m/sec.)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	5.7	6.0	6.4	6.7	7.0	6.7	6.1	5.8	6.0	5.8	6.2	7.7	**6.3**
1981-2010 Avg.	**6.3**	**6.6**	**6.5**	**6.3**	**6.3**	**6.9**	**6.4**	**6.2**	**5.6**	**5.2**	**5.2**	**6.0**	**6.2**

Average Wind Direction at 10 m. height (in m/sec.)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	**91.6**	**91.6**	**86.6**	**91.6**	**92.6**	**92.6**	**92.6**	**93.6**	**92.6**	**89.7**	**92.7**	**94.7**	**91.8**
1981-2010 Avg.	**87.6**	**87.4**	**86.5**	**86.3**	**89.5**	**92.7**	**90.5**	**90.2**	**90.7**	**88.9**	**86.7**	**87.0**	**88.7**

Absolute Maximum Wind Speed at 10 m. (in m/sec.)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Max.
CURAÇAO 2015	16.5	15.4	16.5	15.9	18.0	18.0	15.4	14.4	15.9	15.9	17.0	18.5	**18.5**
Absolute Max.	**19.5**	**19.0**	**24.9**	**19.0**	**20.0**	**21.6**	**25.7**	**21.1**	**19.0**	**22.1**	**22.6**	**23.1**	**25.7**

METEOROLOGICAL DEPARTMENT CURAÇAO

CLIMATOLOGICAL DATA 2015

Avg. Sunshine duration in hours

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	**9.0**	**9.2**	**9.3**	**8.5**	**6.8**	**8.7**	**9.0**	**10.3**	**9.6**	**8.6**	**8.5**	**8.2**	**8.8**
1981-2010 Avg.	**8.5**	**8.9**	**8.8**	**8.3**	**8.6**	**8.9**	**9.4**	**9.8**	**8.7**	**8.0**	**7.8**	**8.0**	**8.6**

Cloud Coverage(in %)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	**42.0**	**41.5**	**37.9**	**54.9**	**50.4**	**53.6**	**53.1**	**50.0**	**47.8**	**52.7**	**52.7**	**48.2**	**48.7**
1981-2010 Avg.	**45.7**	**42.3**	**58.3**	**43.1**	**47.5**	**54.5**	**49.9**	**45.0**	**44.2**	**36.4**	**36.8**	**41.4**	**46.1**

Avg. Evaporation (in mm/day)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	**5.9**	**8.1**	**8.4**	**9.8**	**11.5**	**10.6**	**9.4**	**9.7**	**9.5**	**8**	**6.4**	**6.2**	**8.6**
1981-2010 Avg.	**5.6**	**6.3**	**7.2**	**7.6**	**7.8**	**8.1**	**7.8**	**8.1**	**7.7**	**6.3**	**5.2**	**5.1**	**6.9**

Potential Wind Energy (in KWhr/m^2)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2015	86	95	126	133	160	137	109	97	97	103	114	213	**122.5**
Long Year Avg.	**121.0**	**121.9**	**134.5**	**122.3**	**129.4**	**150.1**	**132.0**	**118.5**	**92.4**	**74.6**	**74.5**	**106.4**	**114.8**

Abs. Max = Absolute maximum

Abs. Min = Absolute minimum

Avg. = Average

Record= Long Year Record

METEOROLOGICAL DEPARTMENT CURAÇAO
CLIMATOLOGICAL SUMMARY

Year 2015

Station: HATO, Airport

RAIN				
Rainfall total		340.4	mm	
Rainfall percentage total /(long-term average)		-49.5		
Rainfall 24 hour's maximum date:	29/nov/15	55.7	mm	
Rainfall amount of days >= 1.0 mm		49	day(s)	
Hours with rainfall		228	hrs	
Hours with rainfall percentage / (long-term average)		-52.6		

EVAPORATION				
Evaporation daily average		8.70	mm	
Evaporation total		3143	mm	
Evaporation maximum / month date:	1/aug/15	18.31	mm	

SUNSHINE						
Sunshine duration average		8	8	hrs	min	
Sunshine percentage total / normal				%		
Sunshine absolute max. / month date:	22/mrt/15	11	18	hrs	min	
Sunshine absolute min. / month date:	3/dec/15	0	0	hrs	min	
Solar radiation monthly average		-	Whr /	m²	/day	
Solar radiation absolute max. / month date:		-	Whr /	m²	/day	
Solar radiation absolute min. / month date:		-	Whr /	m²	/day	

TEMPERATURE					
Temperature average			28.2	°C	
Temperature max. average			31.6	°C	
Temperature absolute max. date / time:	12/sep/15	13:34	35.7	°C	
Temperature min. average			26.2	°C	
Temperature absolute min. date / time:	7/jan/15	6:09	22.6	°C	
Relative humidity average			76.7	%	

WIND						
Wind speed average			12.3	kts		
Wind speed average max.			24.7	kts		
Wind speed absolute max. date / time:	22/dec/15	6:06	36	kts		
Wind vector average			91.8 °	12.0 Kts		
Wind energy potential total *			1.468	KWhr /	m²	
Wind energy average *			4045	Whr /	m²	/day
Wind energy potential maximum * date:	8/mei/15		10136	Whr /	m²	/day
Wind energy potential minimum * date:	19/jan/15		401	Whr /	m²	/day

REMARKS

* Wind energy at a height of 10 m for windspeeds of 4 m/s or more.
** Sunshine duration in hrs (solar time)
*** Solar radiation (local time)
_ Blank field - No data available