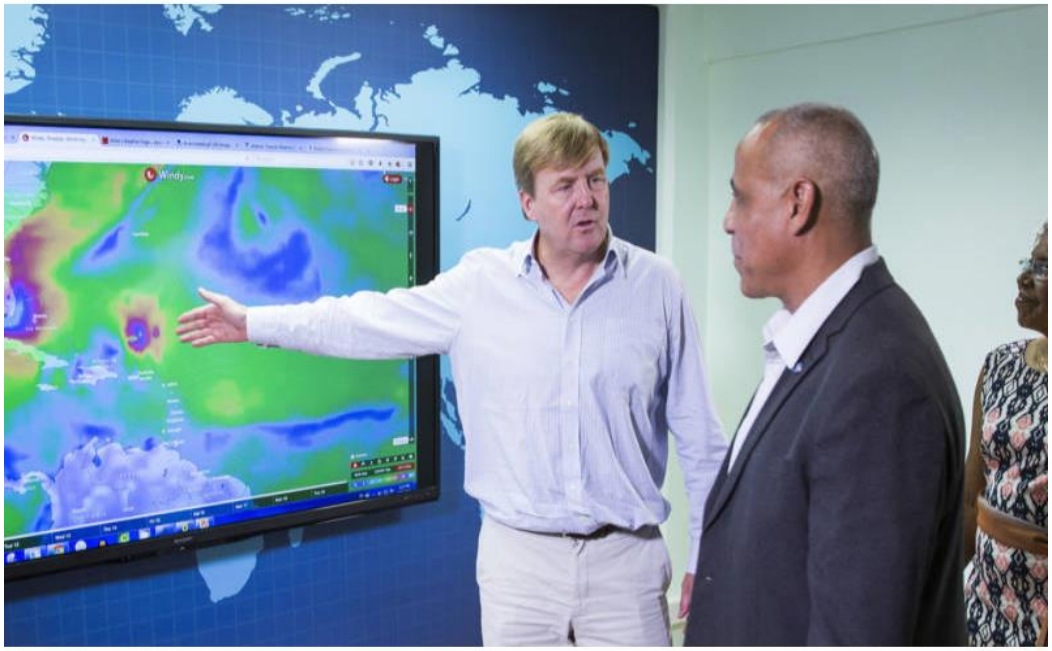
MINISTRY OF
TRAFFIC, TRANSPORT & URBAN PLANNING
Meteorological Department Curaçao

Meteorological Department Curaçao



Dutch King receiving briefing on Hurricane IRMA by Director MDC

Climatological Report 2017

Published by: The Meteorological Department Curaçao,
Seru Mahuma z/n,
Curaçao,
http://www.meteo.cw

Facebook at: http://www.facebook.com/meteo.curacao

Meteorological Department Curaçao

Climatological Report 2017

Published by: **The Meteorological Department Curaçao**
Siegfried Francisco Building
Seru Mahuma z/n.

Telephone: 5999 839-3360 or 5999 839-3361
Fax : 5999 868-2699
E-mail: info@meteo.cw
Website: www.meteo.cw

Portal picture: King Willem Alexander getting briefing at M.D.C. in preparation of a visit to St. Maarten, in the aftermath of Hurricane IRMA.

Prepared by: Climatological & Seismological Division.

Table of Contents

Introduction

World Climate Summary 2017

Global Climate Events

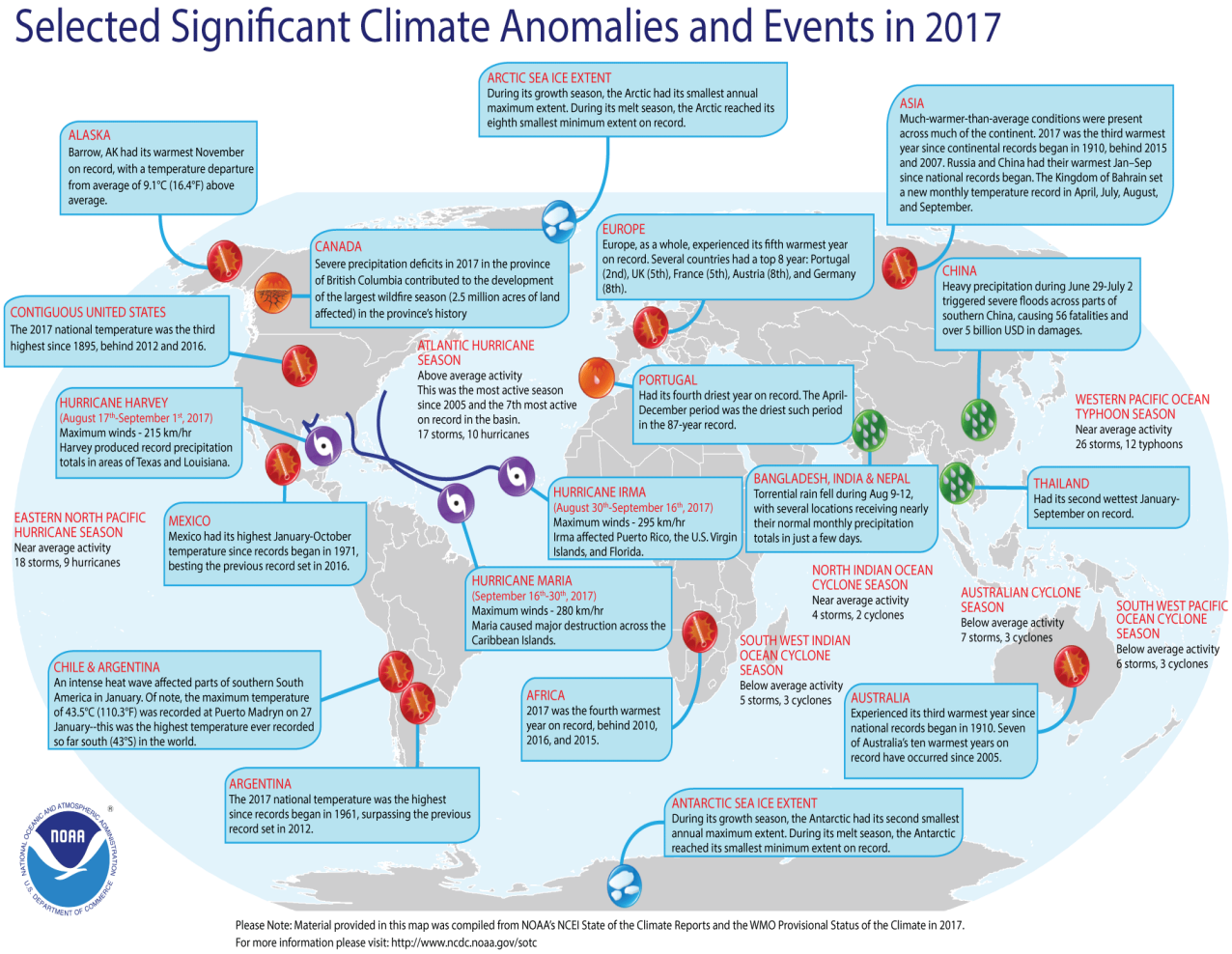


Fig 1.

The following information was compiled from previous NCEI monitoring reports and public reports by National Hydro-meteorological Services (NHMSs; peers of the U.S. National Weather Service), including those submitted to inform the Provisional Status of the Climate in 2017 by the World Meteorological Organization. More comprehensive information will be available in the WMO's final Statement, to be released in March 2018.

Regional Temperatures

The year 2017 was characterized by warmer-than-average conditions across much of the globe's land and ocean surfaces. Record temperature was observed across parts of the western and central Pacific Ocean, western Indian Ocean, southern South America, and the southwestern contiguous U.S. and scattered across parts of the northern Atlantic Ocean, Africa, the Middle East, and eastern Asia. Averaged separately, the global land surface temperature was 1.31°C (2.36°F) above the 20th century average and also the third highest in the 138-year record, behind 2016 (warmest) and 2015 (second warmest). The global oceans also had their third warmest year since global records began in 1880 at 0.67°C (1.21°F) above the 20th century average. Only the years 2016 and 2015 were warmer.

North America commenced the year with very warm conditions across much of the continent. The 2017 continental temperature for North America was the sixth highest yearly temperature on record.

South America had its second warmest year on record, trailing behind 2015 by 0.16°C.

Cold temperatures engulfed much of Europe at the start of 2017, with Austria experiencing one of its coldest Januarys since 1987, while the Netherlands had the coldest January since 2010. Then warmer temperatures affected the region throughout the rest of the year. Overall, Europe had its fifth highest temperature on record. Africa had its fourth highest continental temperature on record, behind 2010, 2016, and 2015.

Asia's 2017 regional temperature ranked as the third highest in the 108-year record, behind 2015 (highest) and 2007 (second highest).Averaged as a whole, Oceania had its sixth warmest year since continental records began in 1910.

The year 2017 was globally the third warmest year since 1880 with an anomaly of 0.84°C. For Curaçao this anomaly was 0.40°C compared to the (1981-2010) average temperature

Global Precipitation

Drier-than-average conditions engulfed Portugal throughout most of 2017. The nationally-average total precipitation was 60% of Portugal's yearly precipitation normal, resulting in a rank among the top four driest years since 1931. The April–December period was the driest such period in the 87-year record.

March 2017 was a very wet month for the Dominican Republic. Climatologically, it is the island's driest month of the year. However, the nation's precipitation total was 96% above average. Several locations set new March precipitation records. Of note, La Unión, Puerto Plata had a monthly total of 608.7 mm (24.0 inches), which is a little over five times its normal March precipitation total of 116.3 mm (4.5 inches).

The 2017 precipitation total for Australia was 504.06 mm (19.8 inches) or 8% above the 1961–1990 average—the 30th wettest year since national precipitation records began in 1900. Much

of the western half of Australia had above-average precipitation for the year, while the eastern half had drier-than-average conditions.

The year 2017 began wetter-than-average across parts of New Zealand, with several storms and cyclones producing heavy rains. Of note, Whangaparaoa, north of Auckland, received nearly five times its March normal total rainfall and had its wettest March since records began in 1946. Also, Cyclone Cook (April 6–11) caused torrential downpours, resulting in record or near-record precipitation totals. However, near the end of the year conditions switched from wet to dry across New Zealand, with several locations having their driest November on record. Of note, the town of Orari had no rainfall during November 2017—marking the first time since records began in 1897 that this location had zero rainfall for a whole month. Overall, the 2017 annual precipitation totals were below-average across most of Southland, interior Otago, and in the Southern Alps, while the rest of New Zealand had near- to above-average conditions. The town of Oamaru (located in the South Island) had its second wettest year on record, receiving a total of 813 mm (32.0 inches) of precipitation.

According to Environment and Climate Change Canada, drier-than-average conditions were present across northern and southwestern Ontario, with many locations receiving nearly one third of their monthly July precipitation total. However, wetter-than-average conditions were present across parts of northwestern, northeastern, and central Ontario, with eastern Ontario setting new high precipitation totals. Of note, Ottawa recorded a total of 250 mm (9.8 inches) of precipitation in July, tying with 1899 as the wettest July on record. Brockville had its third wettest July since 1871 and Cornwall its fourth wettest since 1951. Meanwhile, drier-than-average conditions plagued much of Western Canada during the year. The hardest hit areas included parts of British Columbia and the Prairies. The severe precipitation deficits in the province of British Columbia contributed to the development of the largest wildfire season (2.5 million acres of land affected) in the province's history.

An extratropical cyclone brought copious rain to parts of Argentina during the last week of March, setting several new daily and monthly precipitation records. The station Comodoro Rivadavia set a new 24-hour precipitation total record when it observed a total of 232.0 mm of rain on March 30. This surpassed the previous record of 48.3 mm set in 1976. Comodoro Rivadavia also set a new monthly record (320.4 mm), surpassing the previous record of 140.6 mm set in 1946.

Severe thunderstorms brought torrential rain to France's south-central department of Haute-Loire on June 13th, with several southern communes being the most affected. According to Meteo France, the Landos-Charbon station received a total of 123 mm (4.84 inches) of precipitation in one hour. To put it in perspective, this value represents 48 days of rain and is more than twice the 100-year return period. The total amount of precipitation for the event was 226 mm (8.90 inches) or nearly three months of rain.

Southern and western Finland had wetter-than-average conditions for October 2017, while northern parts of the country were drier-than-average. Of note, Nuuksio (a district of Espoo) had a total of 226.1 mm (8.9 inches) for October 2017, which is only 2 mm (0.08 inch) shy of tying the nation's record for the month, which was set in Hiiskula, Vihti in 2006.

According to the WMO's provisional statement, Thailand had its second wettest January–September period on record, while Italy had its driest January–September on record. Heavy

precipitation during June 29–July 2 triggered severe floods across parts of southern China, causing 56 fatalities and over 5 billion USD in damages. In southern Asia, copious rain fell during August 9–12 across parts of Bangladesh, India, and Nepal. Several locations received their normal monthly precipitation totals in just a few days.

Hurricanes Irma and Maria affected the Caribbean and the southeastern U.S in September 2017. Maria caused great devastation and severe floods across Dominica, Puerto Rico, and the U.S. Virgin Islands. Maria was the strongest hurricane to impact Puerto Rico since Hurricane San Felipe II in 1928.

The 2017 Atlantic hurricane season

The 2017 Atlantic hurricane season was a very active tropical cyclone season and the costliest on record, with a damage total of at least $294.67 billion (USD). Featuring **17** named storms, **10** hurricanes, and **6** major hurricanes, 2017 had the fifth-most named storms since reliable records began in 1851 – tied with 1936 – and the most major hurricanes since 2005. Collectively, the tropical cyclones were responsible for at least **3,364** deaths – the most fatalities in a single season since 2005. Most of the season's damage was due to hurricanes Harvey, Irma, and Maria. Another notable hurricane, Nate, was the worst natural disaster in Costa Rican history. The names Harvey, Irma, Maria, and Nate were retired following the season due to the number of deaths and amount of damage they caused. This season is also one of only six years on record to feature multiple Category 5 hurricanes and the only season other than 2007 with two hurricanes making landfall at that intensity. All ten of the season's hurricanes occurred in a row – the greatest number of consecutive hurricanes in the satellite era, and tied for the highest number of consecutive hurricanes ever observed in the Atlantic basin. 2017 had the highest accumulated cyclone energy (ACE) since 2005, while a record three hurricanes each had an ACE of over 40: Irma, Jose, and Maria.

The season officially began on June 1st and ended on November 30th. These dates historically describe the period of year when most tropical cyclones form in the Atlantic basin. However, as shown by Tropical Storm Arlene in April, the formation of tropical cyclones is possible at other times of the year. In late August, Hurricane Harvey struck Texas and became the first major hurricane to make landfall in the United States since Wilma in 2005. The storm tied the record for the costliest tropical cyclone and broke the record for most rainfall by a tropical cyclone in the United States, with extreme flooding in the Houston area. In early September, Hurricane Irma became the first Category 5 hurricane to impact the northern Leeward Islands on record, later making landfall in the Florida Keys as a Category 4 hurricane. In terms of sustained winds, Irma, at the time, became the strongest hurricane ever recorded in the Atlantic basin outside of the Gulf of Mexico and Caribbean Sea, with maximum sustained winds of 180 mph (285 km/h).

Atlantic Hurricane Season Statistics

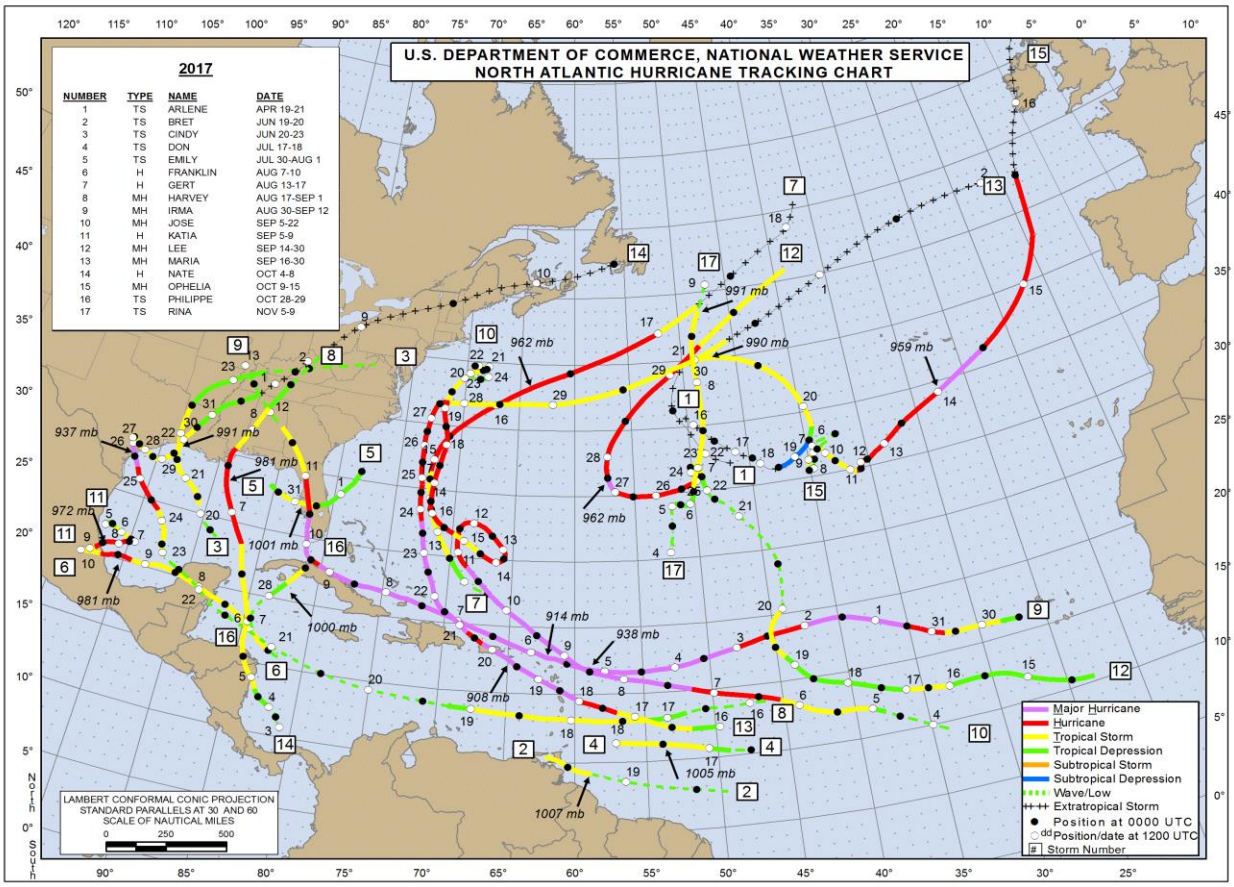
Table 2017 Atlantic hurricane season statistics

Storm Name	Class	"Dates	Max. Winds in Km/hr. (1 min.)	Min. Pressure in hPa.	Casualties (deaths)
Arlene	Trop. Storm	April 19 - 21	85	990	0
Bret	Trop. Storm	June 19 - 20	85	1007	1
Cindy	Trop. Storm	June 20 -23	95	991	3
Four	Trop. Depr.	July 5 -7	45	1009	0
Don	Trop. Storm	July 17 - 18	85	1005	0
Emily	Trop. Storm	July 30 -Aug. 1	95	1001	0
Franklin	Hurricane	Aug. 7 - 10	140	981	0
Gert	Hurricane	Aug. 12 - 17	175	962	2
Harvey	Mayor Hurricane	Aug. 17 -Sep. 1	215	937	108
Irma	Mayor Hurricane	Aug. 30 - Sep. 12	**285**	**914**	19
Jose	Mayor Hurricane	Sep. 5 -Sep. 22	250	938	1
Katia	Hurricane	Sep. 5 - Sep. 9	165	972	3
Lee	Mayor Hurricane	Sep. 14 - Sep. 30	185	962	0
Maria	**Mayor Hurricane**	**Sep.16 - Sep. 30**	**280**	**908**	**146** [2975(*)]
Nate	Hurricane	Oct. 4 - Oct. 8	150	981	50
Ophelia	Mayor Hurricane	Oct. 9 - Oct. 15	185	959	5
Philippe	Trop. Storm	Oct 28 - Oct. 29	65	1000	?
Rina	Trop. Storm	Nov. 5 - Nov. 9	95	991	0
Other systems	Pot. Trop Cycl. Ten	Aug. 28	XXX	XXX	X

" Dates begin at 00:00 UTC. and include all tropical and subtropical cyclone stages; non tropical stages are excluded.

[(*)] Indirect Casualties in Puerto Rico.

In late September, Hurricane Maria became the first Category 5 hurricane in history to strike the island of Dominica. It later made landfall in Puerto Rico as a high-end Category 4 hurricane with catastrophic effect. Most of the deaths from this season occurred from Maria. In early October, Hurricane Nate became the fastest-moving tropical cyclone in the Gulf of Mexico on record and the fourth hurricane to strike the contiguous United States in 2017. Slightly over a week later, Hurricane Ophelia became the easternmost major hurricane in the Atlantic basin on record, and later impacted most of Northern Europe as an extratropical cyclone. The season concluded with Tropical Storm Rina, which became extratropical on November 9. Initial predictions for the season anticipated that an El Niño would develop, lowering tropical cyclone activity. However, the predicted El Niño failed to develop, with cool-neutral conditions developing instead, later progressing to a La Niña – the second one in a row. This led forecasters to raise their predicted totals, anticipating that the season could be the most active since 2010.



2017 North Atlantic Hurricane Season Track Map

Beginning of 2017, the National Hurricane Center (NHC) had the option to issue advisories – and thus allow watches and warnings to be issued – on disturbances that are not yet tropical cyclones but have a high chance to become one, and are expected to bring tropical storm or hurricane conditions to landmasses within 48 hours. Such systems are termed "Potential Tropical Cyclones". The first storm to receive this designation was Potential Tropical Cyclone Two, which later developed into Tropical Storm Bret, east-southeast of the Windward Islands on June 18. In addition, the numbering that a potential tropical cyclone receives would be retained for the rest of the hurricane season, meaning that the next tropical system would be designated with the following number, even though potential tropical cyclones do not qualify as tropical cyclones. This was first demonstrated with Potential Tropical Cyclone Ten, which failed to develop into a tropical cyclone.

Due to the nature and catastrophic impact that ***Irma*** and ***Maria*** had for the Caribbean basin islands, especially the island of St. Maarten and Puerto Rico, a more detailed summary follows of these two destructive natural phenomena.

Hurricane Irma **Category 5 hurricane**

Duration August 30 – September 12

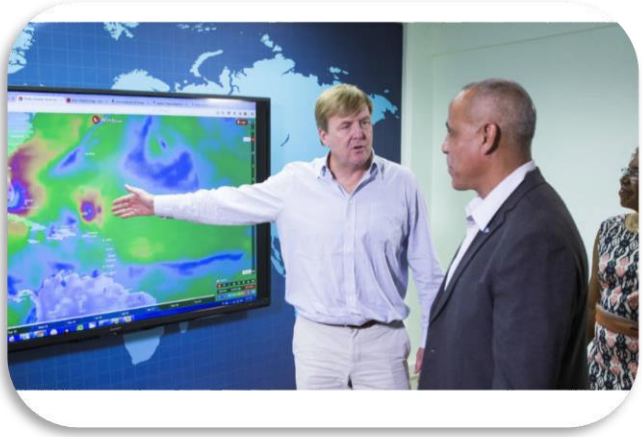
Peak intensity 180 mph (285 km/h) (1-min) 914 mbar (hPa.)

A westward-moving tropical wave developed into a tropical depression about 140 mi (230 km) west-southwest of São Vicente in the Cape Verde Islands at 00:00 UTC on August 30, just six hours before becoming Tropical Storm Irma. Amid an environment of low wind shear and warm ocean temperatures, Irma rapidly strengthened, becoming a hurricane early on August 31 and then a major hurricane less than 24 hours thereafter. After reaching an initial peak with winds of 115 mph (185 km/h), Irma fluctuated in intensity over the next few days due to a combination of drier air and eyewall replacement cycles. However, by September 4, intensification resumed and Irma gained Category 4 status. A reconnaissance aircraft investigating the system east of the Caribbean on September 5 found the cyclone at Category 5 intensity. With a clear eye surrounded by a ring of extremely deep convection, Irma peaked with maximum sustained winds of 180 mph (285 km/h). The storm would maintain Category 5 intensity for the next 60 hours as it moved through the northern Leeward Islands. On September 6, Irma struck Barbuda, Saint Martin/St. Maarten and Virgin Gorda with winds of 180 mph (285 km/h).

Compared to Hurricane Luis which passed on September 5th 1995 with sustained 80 mph (130 km/h) winds and a maximum wind gust of 114.0 mph. (183 km/h) measured at 6:16 pm at the Juliana airport. The lowest air pressure measured in major hurricane Irma when passing over St.Maarten was 944.0 hPa, in hurricane Luis this was 962.9 hPa. The difference between Irma and Luis was that hurricane Luis stalled for more than 24 hours over the St. Maarten territory, whilst Irma moved slowly but steadily over the island in a westerly direction. The 24 hour rainfall in Luis was 165.8 mm. No twenty four hour rainfall data of Irma on St. Maarten was available.

Some weakening of Irma occurred south of the Bahamas, but the cyclone regained Category 5 intensity before making landfall on the Cayo Romano of Cuba at 03:00 UTC on September 9 with winds of 160 mph (260 km/h). Land interaction disrupted the storm temporarily, but once again it strengthened to acquire winds of 130 mph (215 km/h), before making landfall on Cud-Joe Key in the Florida Keys early on September 10. A few hours later, it struck Marco Island, Florida, with winds of 115 mph (185 km/h). Irma continued north-northwestward across Florida and weakened to a tropical storm over the northern part of the state later that day. The storm steadily weakened over the Southeastern United States before losing tropical characteristics in

Georgia early on September 12. The remnant low persisted for another day before dissipating over Missouri.



Dutch King Willem Alexander receiving briefing on IRMA by Director Albert Martis at the MDC before departing to St. Maarten

As the storm moved through the northern Leeward Islands, its landfall intensity stands behind the 1935 Labor Day hurricane as the strongest land falling cyclone on record in the Atlantic. The storm devastated several Leeward Islands. On Barbuda, approximately 95% of structures were damaged or destroyed. All Barbudians who stayed during the storm left for Antigua afterwards, leaving the island uninhabited for the first time in 300 years. The French territories of Saint Martin and Saint Barthélemy combined suffered about $4.07 billion in damage and 11 fatalities. In the former, about 90% of homes were damaged, with 60% of those being considered uninhabitable. On Sint Maarten, the Dutch portion of Saint Martin, Irma severely damaged the airport and approximately 70% of structures were damaged or destroyed. Sint Maarten received about $1.5 billion in damage and four deaths occurred there. The British Virgin Islands experienced $3.47 billion in damage and four deaths, with numerous buildings and roads destroyed in Tortola. In the United States Virgin Islands (USVI), widespread destruction was reported on Saint Thomas, Saint John, and Saint Croix. The storm's toll in the USVI included four deaths and about $2.4 billion in damage. In Turks and Caicos Islands, Irma wrought significant damage to structures and communication infrastructures. Damage totaled about $500 million. The storm devastated some islands in the Bahamas, especially Great Inagua and Crooked islands, with 70% of homes damaged on the former. In Cuba, the provinces of Camagüey, Ciego de Ávila, and Matanzas were hardest hit.

Dutch King arrives in St. Maarten and greeted by the Governor on their way to observe devastation caused by Hurricane Irma.

Irma damaged over 150,000 homes in Cuba, with almost 15,000 totally destroyed. A total of 10 deaths occurred and damage was estimated at $13.6 billion. In Florida, the storm damaged numerous homes and businesses, including more than 65,000 structures in the west-central and southwestern portions of the state alone. Approximately 50,000 boats were damaged or destroyed. At the height of the storm, more than 6.7 million electrical customers were without power. The storm also left flooding along at least 32 rivers and creeks, especially the St. Johns River and its tributaries. At least 84 deaths occurred in the state and damage was estimated at $50 billion. In other states, such as Georgia and South Carolina, Irma left some wind damage, tornadoes, and coastal flooding. Irma resulted in at least 92 deaths in the United States.

Aftermath Irma in Dutch St Maarten & St. Martin (courtesy Dutch military)

Aftermath Irma in Dutch St Maarten & St. Martin (courtesy Dutch military)

Devastation caused by hurricane IRMA, Port of Philipsburg, St. Maarten

Completely levelled neighborhood, St. Maarten, Hurricane IRMA 2017

Hurricane Maria **Category 5 hurricane**

Duration September 16 – September 30

Peak intensity 280 km/h 908 hPa.

On September 12, a well-defined tropical wave emerged into the Atlantic from the west coast of Africa. The wave initially produced disorganized and scattered deep convection as it moved westward. However, by September 15, convective activity increased and became more organized, including the development of curved cloud bands. Around 12:00 UTC on the following day, a tropical depression formed approximately 665 mi (1,070 km) east of Barbados. Six hours later, the depression intensified into Tropical Storm Maria. The cyclone moved west-northwestward and strengthened into a hurricane around 18:00 UTC on September 17. Thereafter, warm sea surface temperatures and light wind shear allowed Maria to intensify rapidly. By 12:00 UTC on September 18, Maria became a major hurricane upon reaching Category 3 status. Just 12 hours later, the cyclone became a Category 5 hurricane while nearing Dominica. At 01:15 UTC on September 19, Maria struck the island with winds of 165 mph (270 km/h). The storm briefly weakened to a Category 4 by the time it reached the Caribbean, but re-strengthened to a Category 5 hurricane later on September 19. At 03:00 UTC the next day, Maria peaked with sustained winds of 175 mph (280 km/h) and a barometric pressure of 908 mbar (26.8 in. Hg).

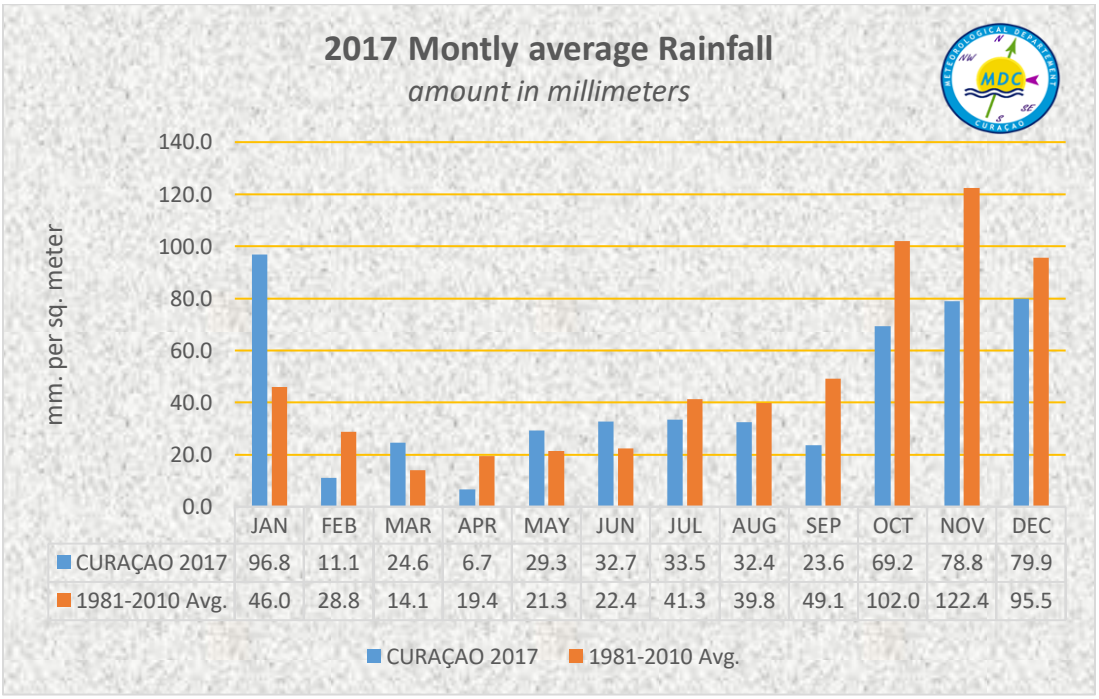
Maria then underwent an eyewall replacement cycle, causing the storm to weaken somewhat. Around 10:15 UTC on September 20, the hurricane made landfall near Yabucoa, Puerto Rico, as a Category 4 hurricane with winds of 155 mph (250 km/h). Moving diagonally across the island, Maria weakened significantly due to land interaction, emerging into the Atlantic as a Category 2 late on September 20. Early the next day, the system re-strengthened into a Category 3 hurricane while curving northward around the edge of mid-level high over the western Atlantic. Maria weakened as it continued northward, falling below major hurricane intensity again by early on September 24. Turning sharply eastward on September 28, the cyclone weakened to a tropical storm around that time. Maria then accelerated eastward to east-northeastward across the Atlantic, before becoming extratropical about 535 mi (861 km) southeast of Cape Race, Newfoundland. The extratropical cyclone dissipated southwest of Ireland on September 30.

Dominica sustained catastrophic damage from Maria, with nearly every structure on the island damaged or destroyed. Surrounding islands were also dealt a devastating blow, with reports of flooding, downed trees, and damaged buildings, with Guadeloupe in particular experiencing extensive damage. The storm almost entirely destroyed the island's banana crop. Puerto Rico also suffered catastrophic damage. The island's electric grid was devastated, leaving all 3.4 million residents without power. By the end of January 2018, only about 65% of electricity on the island had been restored. Many structures were leveled, while floodwaters trapped thousands of citizens. Throughout the island, Maria moderately damaged 294,286 homes, extensively damaged 8,688 homes, and completely destroyed 4,612 homes. The hurricane caused about $90 billion in damage in Puerto Rico and the USVI. Maria damaged or destroyed hundreds of homes in the Dominican Republic, where flooding and landslides isolated many communities. Along the coastline of the mainland United States, tropical storm-force gusts cut power to hundreds of citizens; rip currents offshore led to four deaths and numerous water rescues. A total of 146 people were confirmed to have been directly killed by the hurricane: 64 in Puerto Rico, 65 in Dominica, 5 in the Dominican Republic, 4 in the contiguous United States, 3 in Haiti, 2 in Guadeloupe, and 3 in the USVI. The indirect death toll is much higher; an estimated 2,975 people in total died in Puerto Rico as a result of Hurricane Maria, in the six months after the hurricane, due to the effects of catastrophic damage to the island's infrastructure. Maria was the deadliest hurricane in Dominica since the 1834 Padre Ruíz hurricane, and the deadliest in Puerto Rico since the 1899 San Ciriaco hurricane.

Devastation caused by Hurricane Maria in Puerto Rico September 2017

Curaçao Climate in 2017

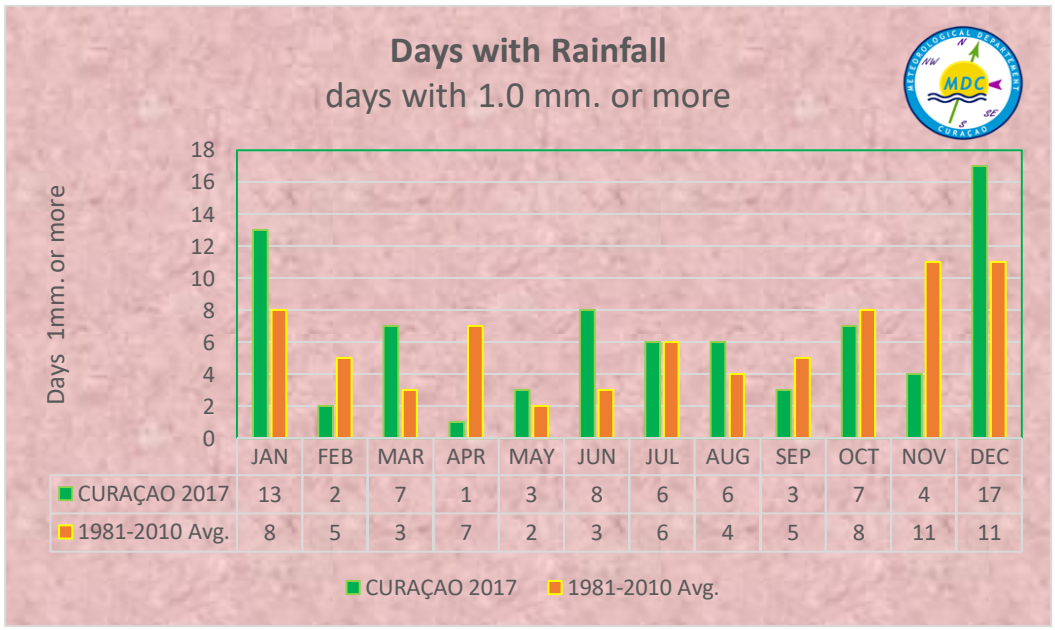
Although 2017 was announced by the WMO as a non El Niño year (less than 0.2 °C rise for the Eastern Pacific) it was considered as the second warmest year (2015) on record. Extremely warm and dry months where experienced worldwide. The month of January however, experienced an extreme amount of rainfall. A total of 96.8 millimeter was collected at the official rain gauge of the Hato airport during the month of January. On the 13th of January a maximum of 21.4 millimeter was collected in 24 hours. Thirteen days with more than 1 millimeter in a time span of 85 hours where registered for January. The total rainfall percentage/long-term average for January was 40%. February showed a different picture, only 2 days with a rainfall amount of 1 millimeter or more was observed. The rainfall percentage vs long-term average for February was about 54% below normal. The month of March showed a better amount of rainfall which was 24.6 millimeters, this was 73% above normal.



Graph 1.

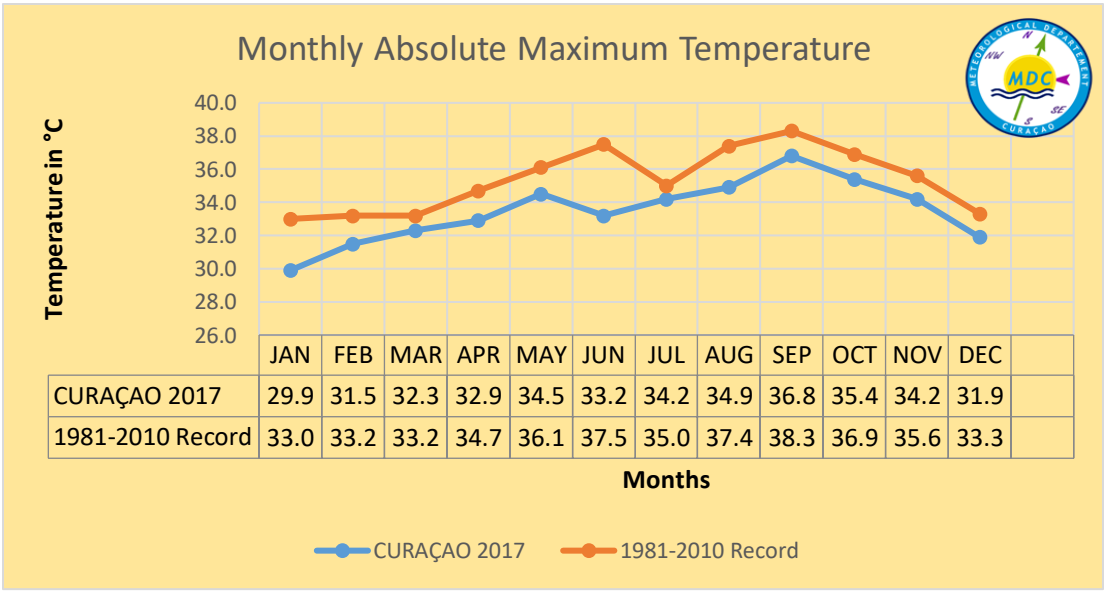
The months of May and June also showed a higher average rainfall amount respectively 38% and 46%. All of the remaining months of 2017 registered below (1981-2010) average amounts of rainfall, October and November showed averages of more than 30% below normal and a very dry September with an extreme 54% below normal. The total rainfall measured at the official measuring station at airport Hato was **518.6** millimeter (30 yr. avg. 601.9 mm.) this was 14% below the 30 yr. avg. (See graph 1).

On the graph depicting days with rainfall (1 millimeter or more) in 2017 we can see a similar trend.



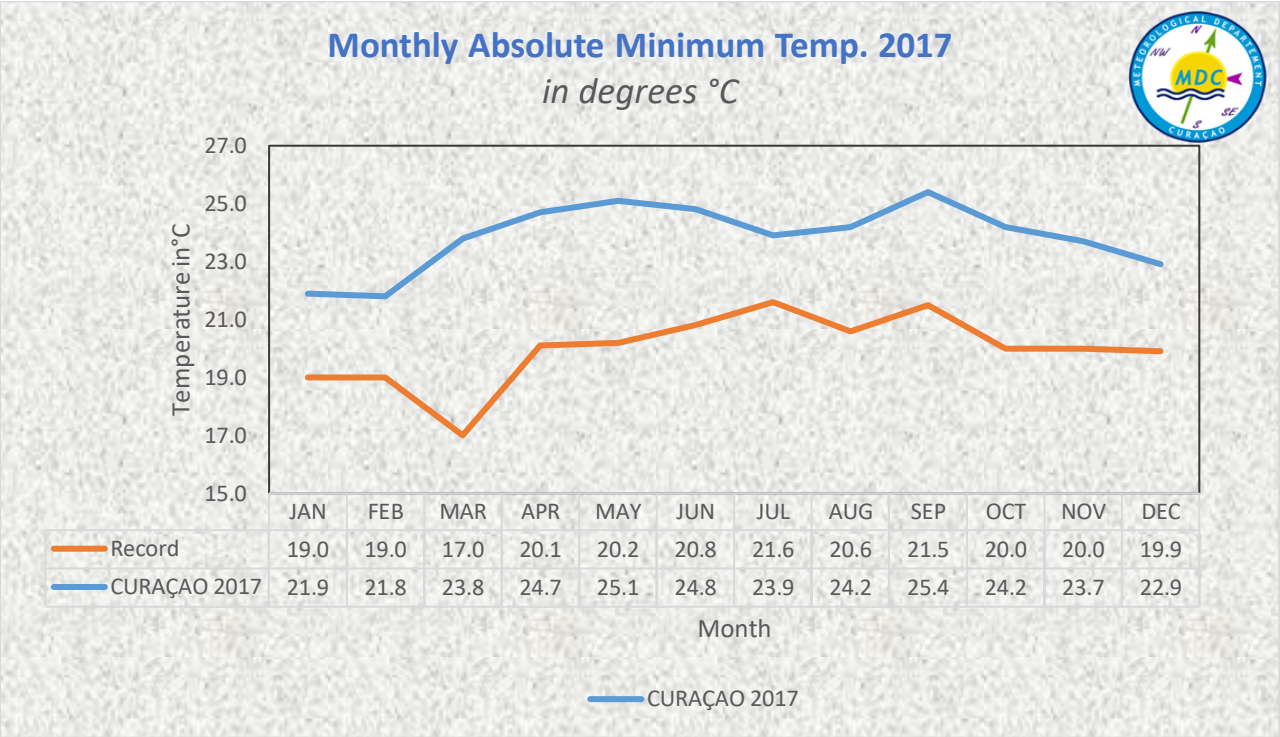
Graph 2

During 2017 the average absolute maximum temperature remained, for Curaçao, below the 30 year climatological normal. The highest temperature of 36.8°C was measured on September 07 at 13:56 lt. Overall, the month of September was the hottest month of 2017. (See graph below)



Graph 3

Monthly averages of the absolute minimum average temperature remained all year above the all-time record. The lowest temperature for 2017 was measured on February 12th at 03:19 lt. 21.8°C. On January the 10th a minimum temperature of 21.9°C was recorded which was only a tenth higher than the February absolute minimum.

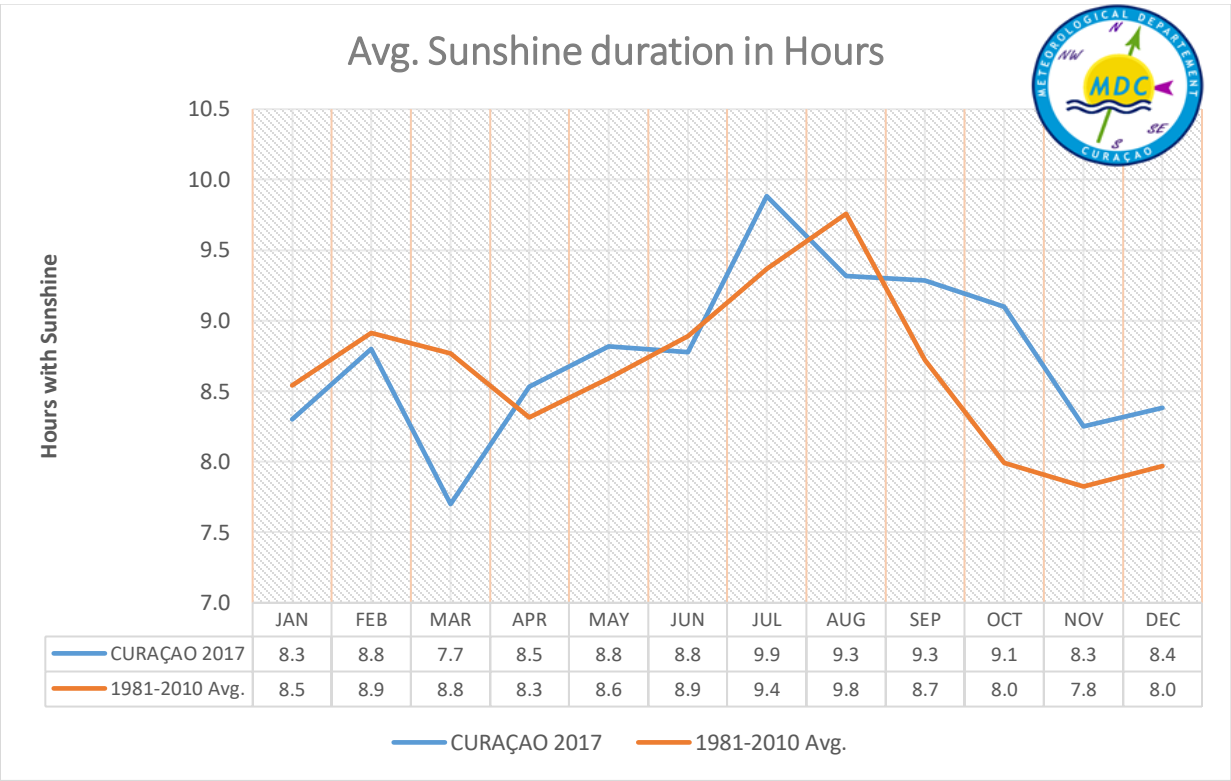


Graph 4

**Record= is all-time record*

Hours with Sunshine

The year round average daily sunshine was 8 hours and 48 minutes. The day with the maximum hours with sunshine (10:24 hours) was on the 4th of January. During that same month the absolute minimum hours with sunshine was observed on the 7th of January and the sun was seen for only 3 hours and 12 minutes. So, mostly dense overcast skies where observed during that day. The months with the highest daily averages of sunshine was as expected, during the summer with a maximum average of 9 hours and 53 minutes in July. (See graph below) The year round average sunshine duration for 2017 lasted 12 minutes longer than the 30 year average (8 hours and 36 minutes).

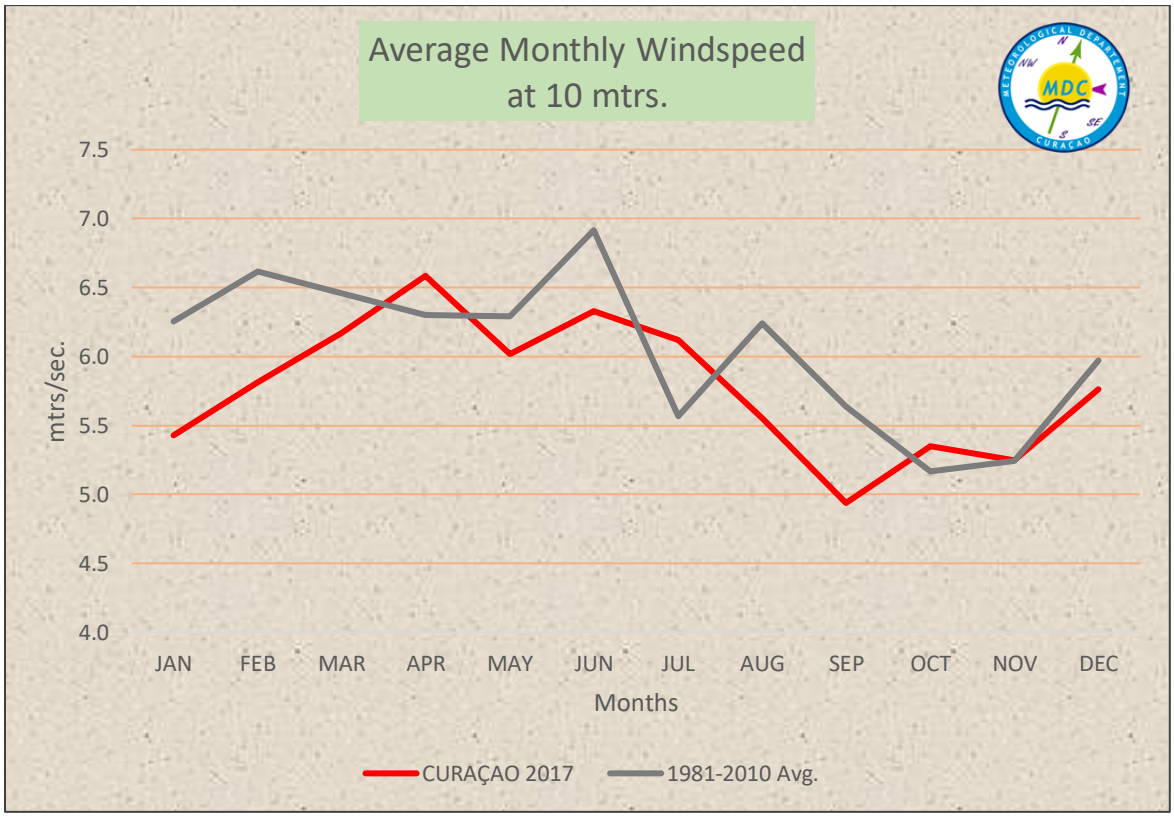


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CURAÇAO 2017	8.3	8.8	7.7	8.5	8.8	8.8	9.9	9.3	9.3	9.1	8.3	8.4
1981-2010 Avg.	8.5	8.9	8.8	8.3	8.6	8.9	9.4	9.8	8.7	8.0	7.8	8.0

Graph 5

Average Wind speed (monthly)

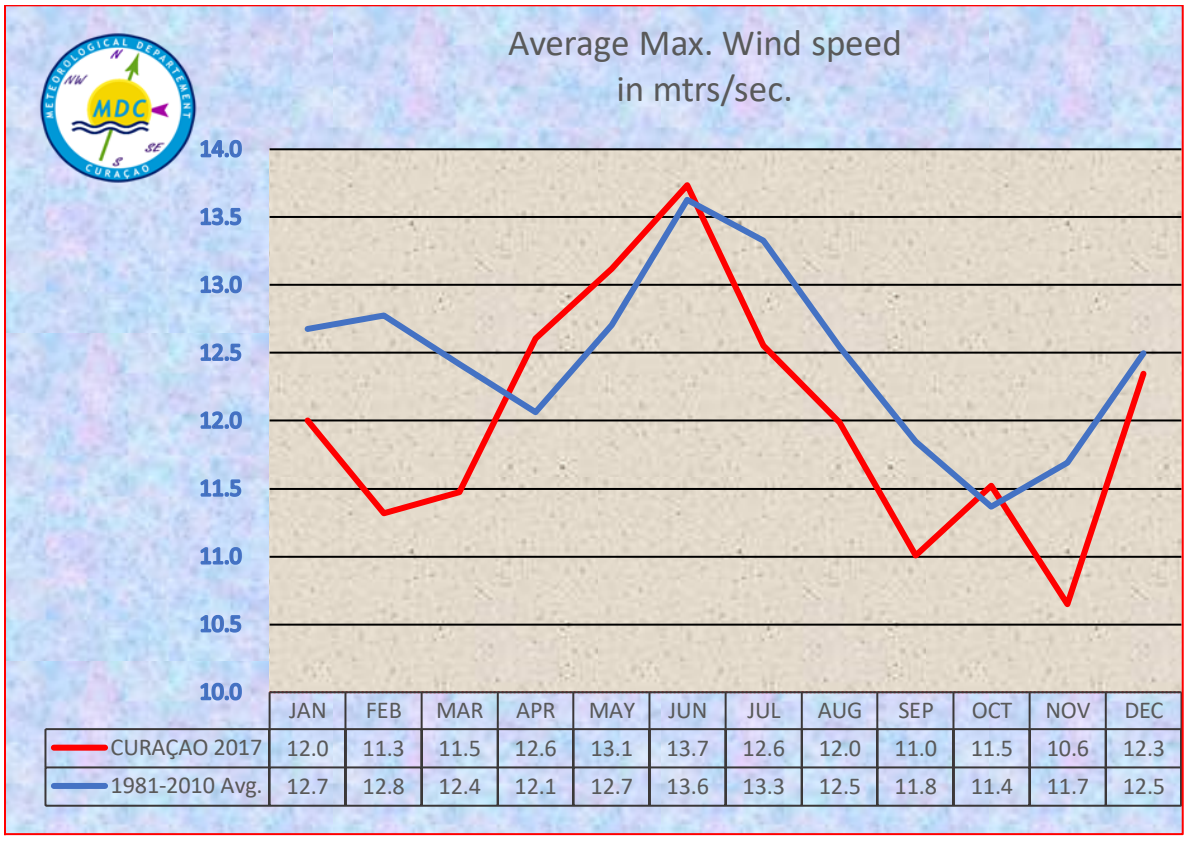
The monthly average wind speed for 2017 remained in general, equal or slightly below the (1981-2010) normal for Curacao. Except for some higher values during early April **6.6** m/s, the month of July **6.1** m/s. and October **5.4** m/s. (Graph 6)



Graph 6

Average maximum wind speed

The average monthly maximum wind speed measured at the official site on the Hato airport showed a similar trend, with slightly higher values during the spring and early summer months.

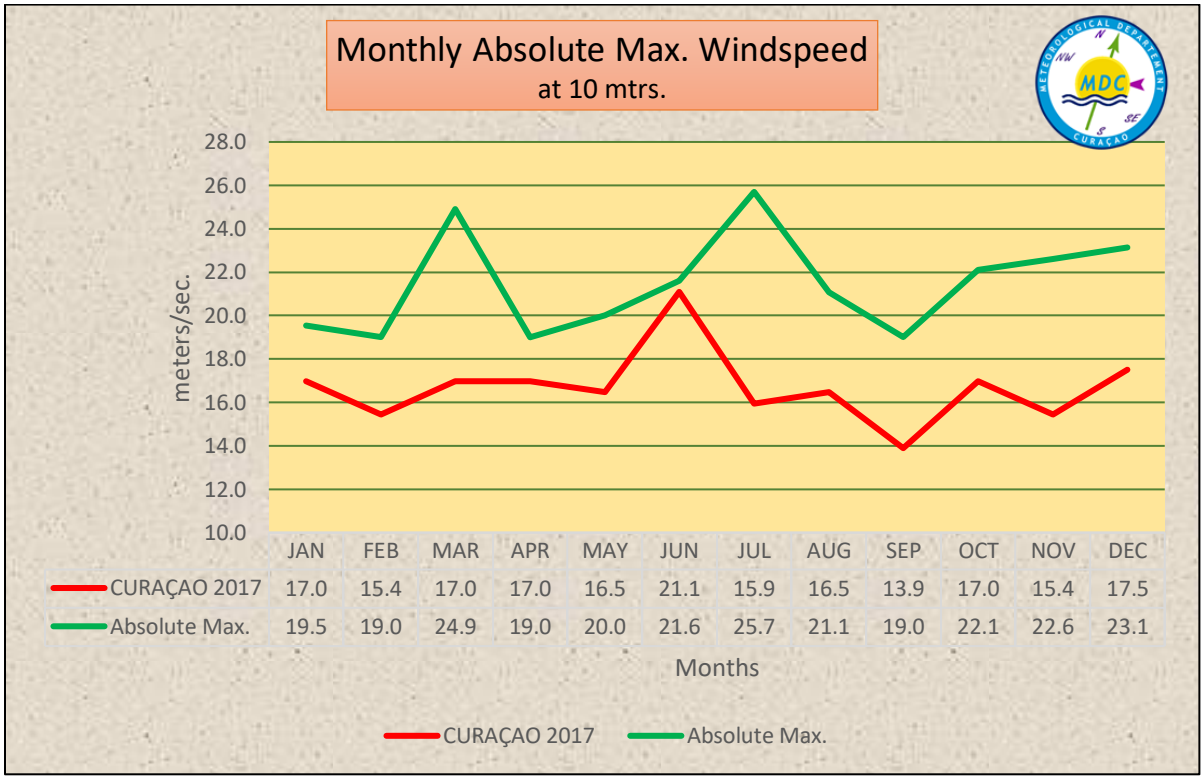


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CURAÇAO 2017	12.0	11.3	11.5	12.6	13.1	13.7	12.6	12.0	11.0	11.5	10.6	12.3
1981-2010 Avg.	12.7	12.8	12.4	12.1	12.7	13.6	13.3	12.5	11.8	11.4	11.7	12.5

Graph 7

Absolute maximum wind speed

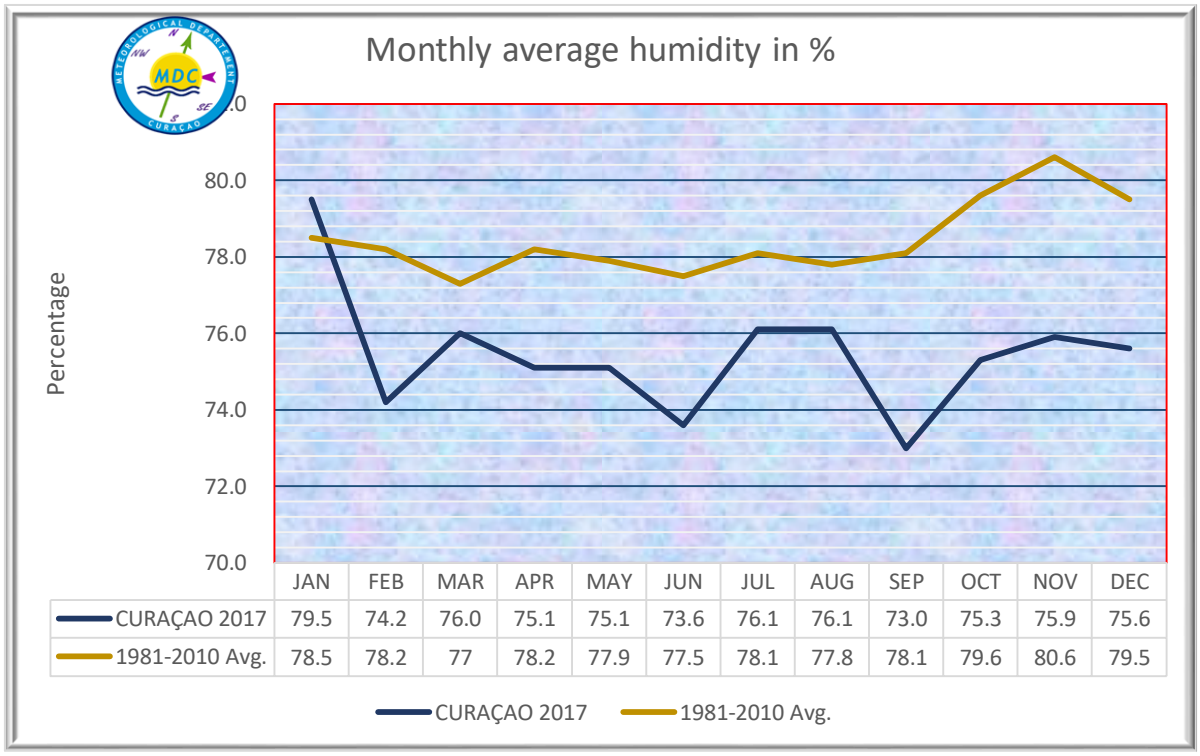
Absolute maximum wind speeds remained well below the 30 year mark throughout 2017. There was a maximum peak in June of 21.6 m/s. However, this also remained below the 30 year absolute maximum wind speed. (See graph 8 below) The month of June experienced the 2017 maximum absolute wind speed, which also remained below the June all time absolute maximum.



Graph 8

Monthly Humidity

The average monthly humidity remained approximately between 3 to 5% lower than the 30 year average over all of 2017 except during the first two weeks of January. (Graph 9)

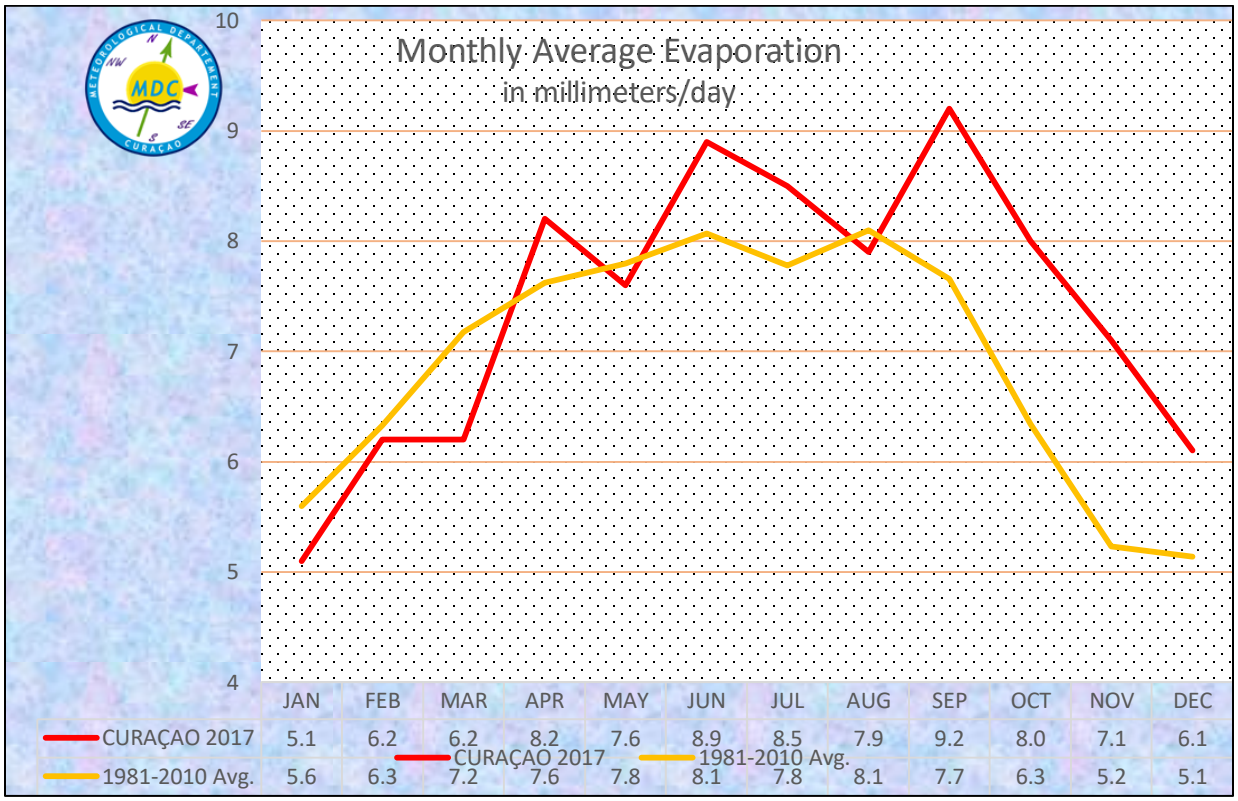


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CURAÇAO 2017	79.5	74.2	76.0	75.1	75.1	73.6	76.1	76.1	73.0	75.3	75.9	75.6
1981-2010 Avg.	78.5	78.2	77	78.2	77.9	77.5	78.1	77.8	78.1	79.6	80.6	79.5

Graph 9

Monthly Average Evaporation

We can notice (on graph:10 below) that during the first 3 months of 2017 and parts of May and August that the daily evaporation was about 1 to 3 mm/day lower than the 30 year average (1981-2010). Three maxima can be observed during the months of; April (8.2 mm.), June (8.9 mm.) and September (9.2 mm.).

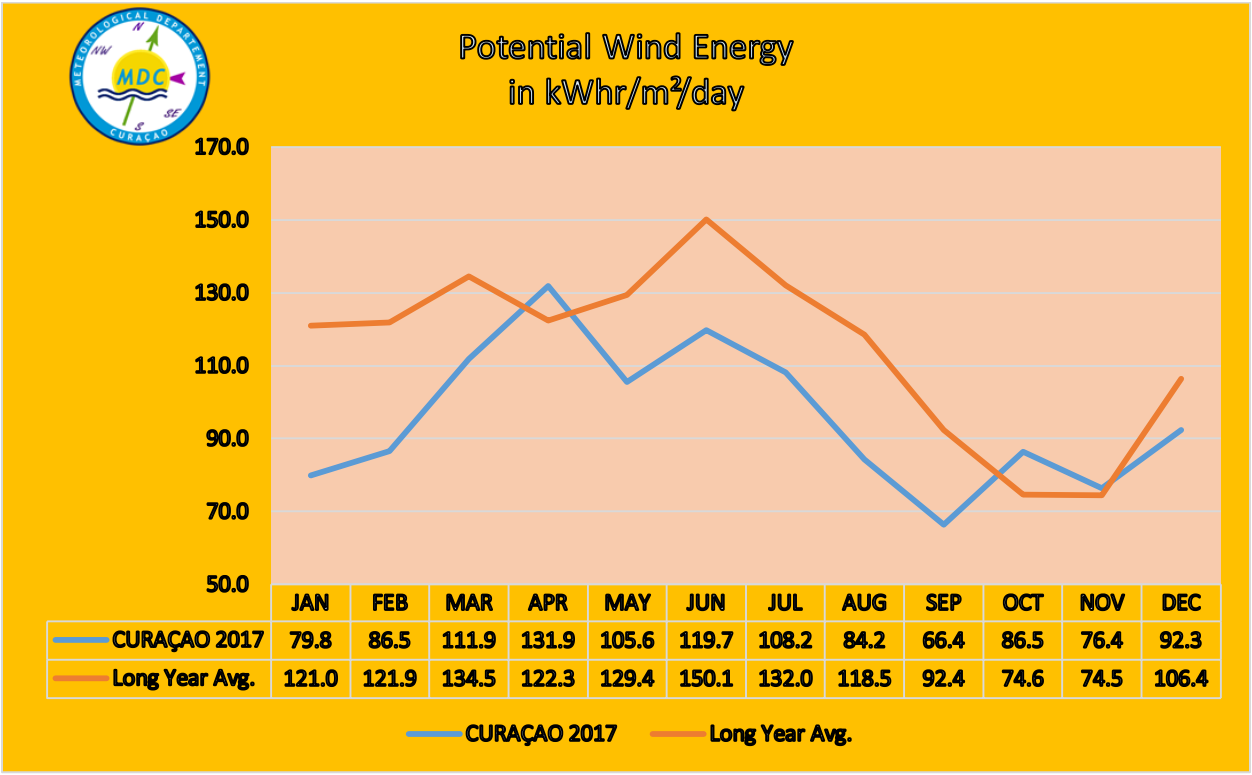


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CURAÇAO 2017	5.1	6.2	6.2	8.2	7.6	8.9	8.5	7.9	9.2	8.0	7.1	6.1
1981-2010 Avg.	5.6	6.3	7.2	7.6	7.8	8.1	7.8	8.1	7.7	6.3	5.2	5.1

Graph 10:

Fig. Evaporation Pan

Potential Wind Energy

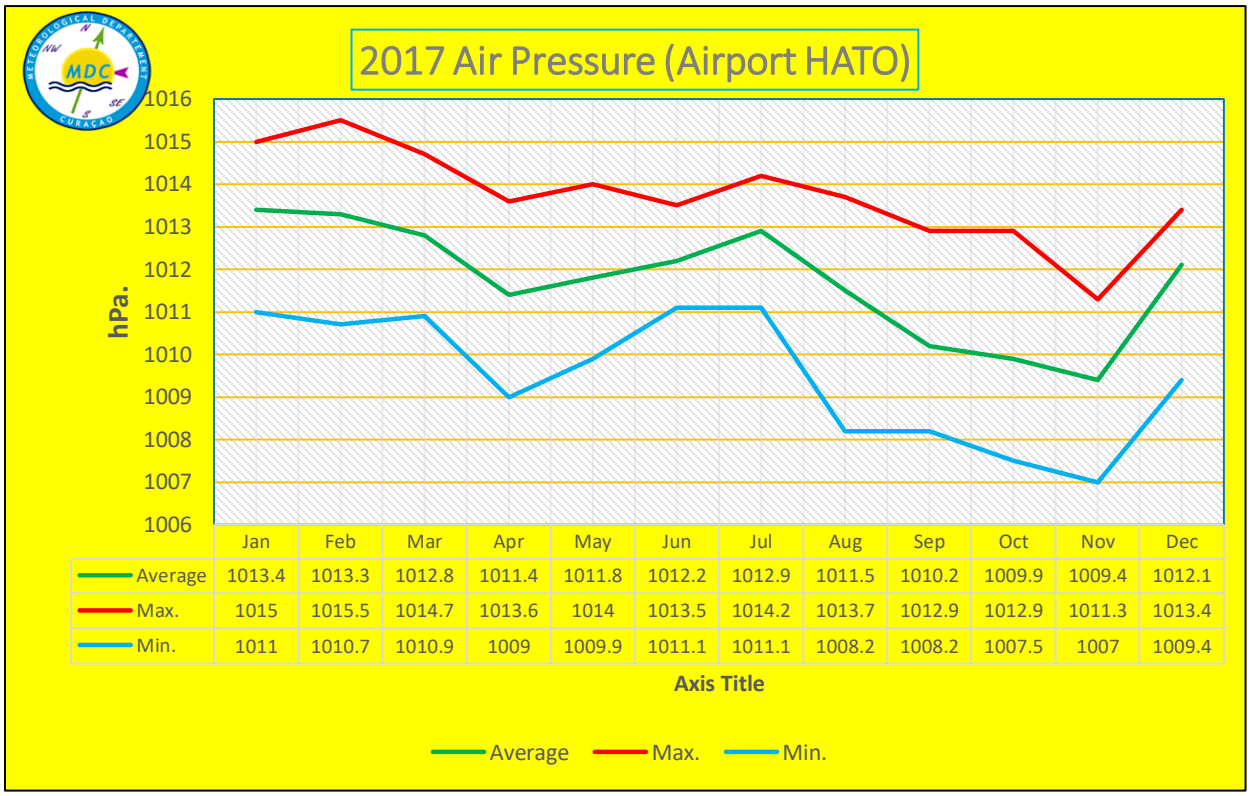


	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CURAÇAO 2017	79.8	86.5	111.9	131.9	105.6	119.7	108.2	84.2	66.4	86.5	76.4	92.3
Long Year Avg.	121.0	121.9	134.5	122.3	129.4	150.1	132.0	118.5	92.4	74.6	74.5	106.4

Graph 11

The potential wind energy remained below the long year average for most months. Only during the months of April, October and November slightly higher values were recorded. This was for the month of April, **131.9** kWh/m²/day (30 yr. avg. 122.9 kWh/m²/day), October **86.5** kWh/m²/day (30 yr. avg. 74.6 kWh/m²/day) and November **76.4** kWh/m²/day (30 yr. avg. 74.5 kWh/m²/day).

Air Pressure (in Hecto-Pascal)

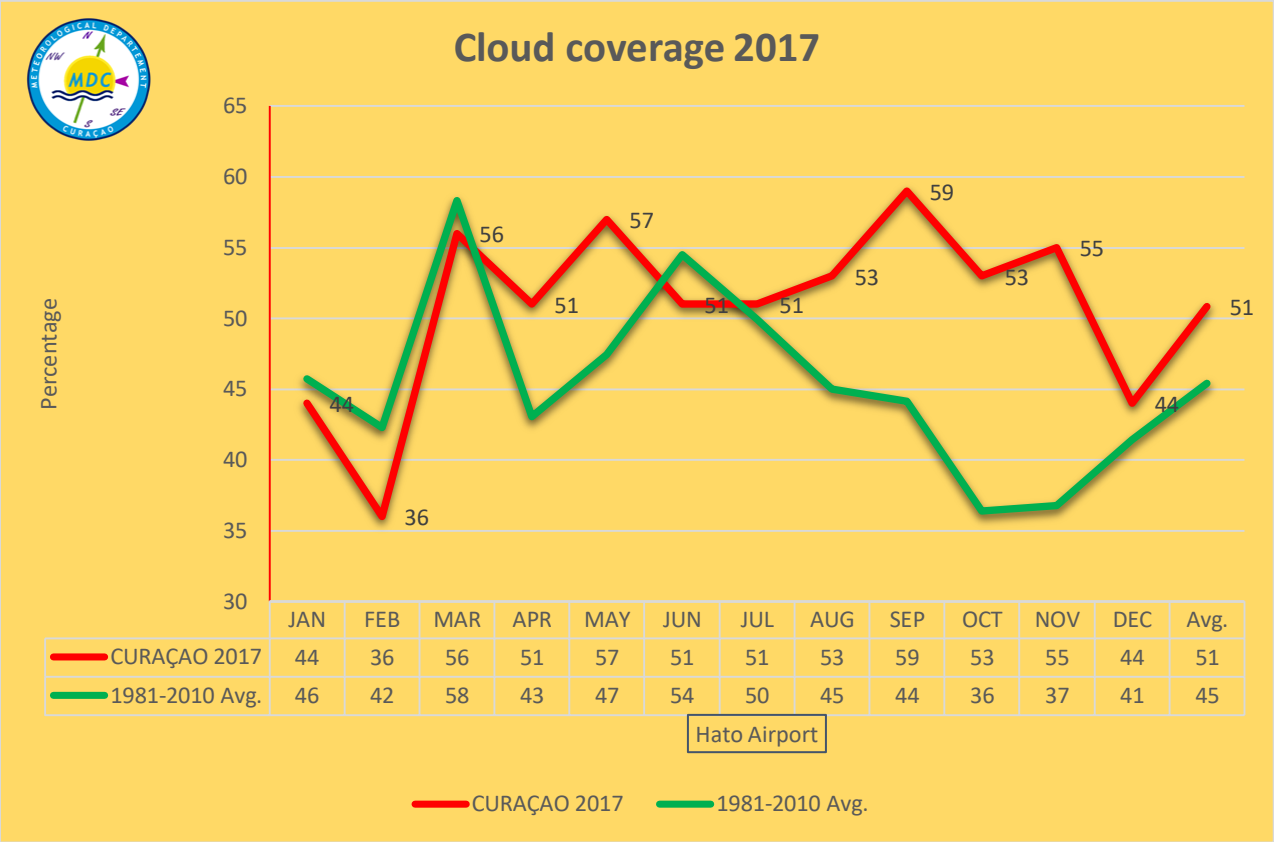


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	1013.4	1013.3	1012.8	1011.4	1011.8	1012.2	1012.9	1011.5	1010.2	1009.9	1009.4	1012.1
Max.	1015	1015.5	1014.7	1013.6	1014	1013.5	1014.2	1013.7	1012.9	1012.9	1011.3	1013.4
Min.	1011	1010.7	1010.9	1009	1009.9	1011.1	1011.1	1008.2	1008.2	1007.5	1007	1009.4

Graph 12

The monthly average air pressure at the official measuring site at the Curaçao International (Hato) airport was 1011.7 HPa. The average maximum air pressure measured during the mid-winter month of February 1015.5 HPa. is caused by the ridge of the Azores high pressure system which normally protrudes deep into the Southeastern Caribbean basin during this season.

Cloud Coverage (in percentage)

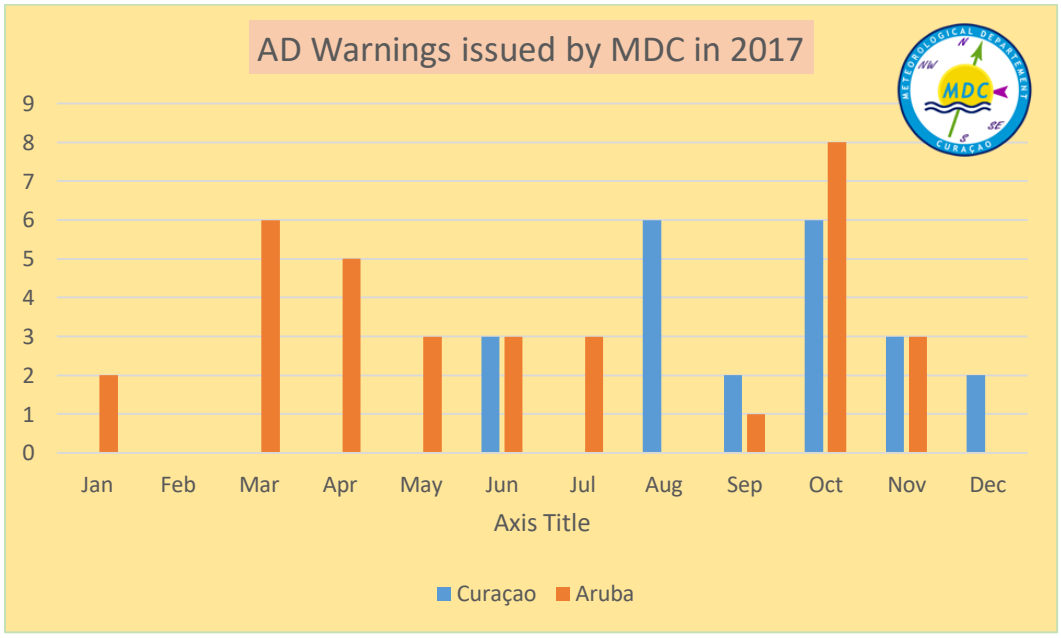


Graph 13

The average cloud coverage for 2017 was 51%. (30 yr. avg. 45%) The maximum average cloud coverage was observed during the month of September (59%). The month with the least average cloud coverage was February this was only, 36%. All measurements where done by the MDC-observers on the roof top at the Curaçao Meteorological Department (MDC). An average increase of 6% in the cloud coverage was recorded compared to the 30 year (1981-2010) mean.

Aerodrome warnings

The Meteorological Forecast and watch office of Curaçao (TNCC) is the authority for issuing Aerodrome Warnings (ADW) for the airports of Curaçao and Aruba. During 2017 a total of 55 ADW were issued of which the majority for strong gusty winds exceeding 30 knots (55 km/hr.) Thirty-three ADW were issued for Beatrix International Airport, Aruba of which most for gusty winds in excess of 30 knots (55 km/hr.) For the Curaçao International Airport twenty two ADW were issued. There was a balanced mix of ADW for potential heavy showers or thundershowers with possible lightning strikes and/or potential gusty winds.



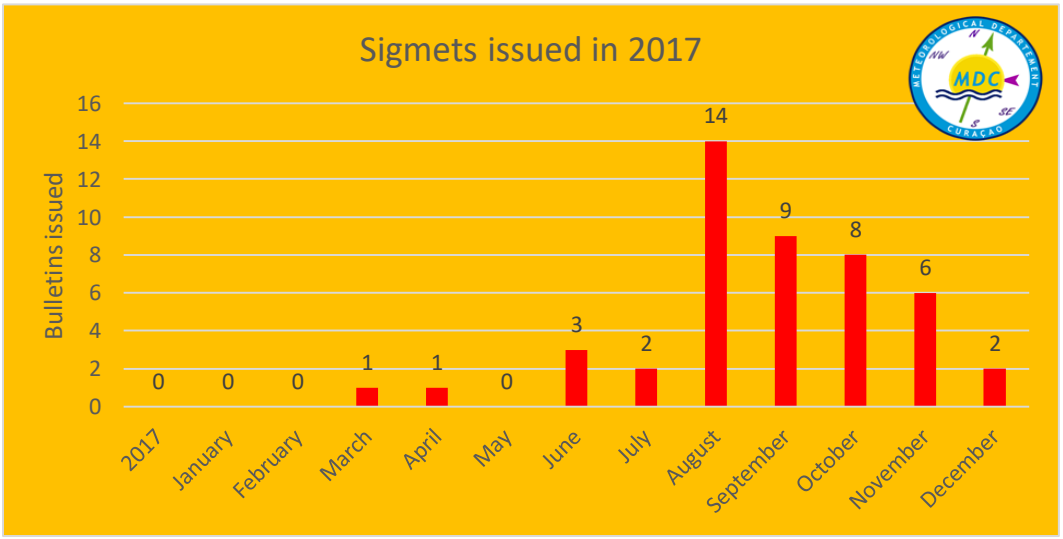
Graph 14

SIGMET*

*A SIGMET is a weather advisory that contains meteorological information concerning the safety of all aircraft flying in a Flight Information Region. There are two types of SIGMETs: convective and non-convective SIGMET's. Convective SIGMET's are valid for up to 4 hours.SIGMET's for tropical cyclones and volcanic ash (non-convective) are valid up to six hours.

During 2017 forty-six SIGMET's were issued by the Meteorological Watch and Forecast Office for the "Curaçao F.I.R." (Flight Information Region). The Curaçao F.I.R. encompasses an airspace of about 300.000 km². In the picture below we can see the dimension of the F.I.R. in the lighter blue colored decagon.

Most SIGMET's issued were related to normal "significant weather" phenomena, except for a SIGMET issued on the 19th of August when the tropical cyclone "Harvey" moved over the Northern part of the Curaçao F.I.R. in an East to West direction.



Graph 15

Conclusion

The year 2017 was a “neutral” year (non- “El Niño/La Niña”). However, average air temperatures where above the 30 year “normal” in Curaçao. This was also the case worldwide. The average maximum and minimum temperatures were also above the 30 year average. Rainfall showed a slightly below normal amount for the island. The same has been observed for the humidity measured at the meteorological ground level. Sunshine hours were also above normal. This naturally contributed to a higher number for the evaporation. The average wind speed measured was slightly below normal.

We can conclude that 2017 was a near “climatological normal” year for Curaçao.

METEOROLOGICAL DEPARTMENT CURAÇAO

CLIMATOLOGICAL DATA 2017

Rainfall in mm.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
CURAÇAO 2017	**96.8**	**11.1**	**24.6**	**6.7**	**29.3**	**32.7**	**33.5**	**32.4**	**23.6**	**69.2**	**78.8**	**79.9**	**518.6**
1981-2010 Avg.	46.0	28.8	14.1	19.4	21.3	22.4	41.3	39.8	49.1	102.0	122.4	95.5	**601.9**
Prcnt vs 30yr avg.	**110.6**	**-61.4**	**74.2**	**-65.4**	**37.6**	**45.9**	**-18.8**	**-18.5**	**-52.0**	**-32.1**	**-35.6**	**-16.3**	**-13.8**

Average air pressure (Hpa.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**1013.4**	**1013.3**	**1012.8**	**1011.4**	**1011.8**	**1012.2**	**1012.9**	**1011.5**	**1010.2**	**1009.9**	**1009.4**	**1012.1**	**1011.7**
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	**1012.6**

Average Wind Speed at 10 m. height (in m/sec.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**5.4**	**5.8**	**6.2**	**6.6**	**6.0**	**6.3**	**6.1**	**5.6**	**4.9**	**5.4**	**5.2**	**5.8**	**5.8**
1981-2010 Avg.	6.3	6.6	6.5	6.3	6.3	6.9	5.6	6.2	5.6	5.2	5.2	6.0	**6.1**

Average Wind Direction at 10 m. in degrees

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**86.0**	**87.0**	**84.0**	**92.0**	**104.0**	**106.0**	**102.0**	**105.0**	**105.0**	**106.0**	**104.0**	**97.0**	**98.2**
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**

Average Maximum Wind Speed at 10 m. (in m/sec.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**12.0**	**11.3**	**11.5**	**12.6**	**13.1**	**13.7**	**12.6**	**12.0**	**11.0**	**11.5**	**10.6**	**12.3**	**12.0**
1981-2010 Avg.	12.7	12.8	12.4	12.1	12.7	13.6	13.3	12.5	11.8	11.4	11.7	12.5	**12.5**

Absolute Maximum Wind Speed at 10 m. (in m/sec.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Max.
CURAÇAO 2017	**17.0**	**15.4**	**17.0**	**17.0**	**16.5**	**21.1**	**15.9**	**16.5**	**13.9**	**17.0**	**15.4**	**17.5**	**21.1**
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 2017

Avg. Sunshine duration in hours

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**8.3**	**8.8**	**7.7**	**8.5**	**8.8**	**8.8**	**9.9**	**9.3**	**9.3**	**9.1**	**8.3**	**8.4**	**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**

Avg. Humidity (in %)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**79.5**	**74.2**	**76.0**	**75.1**	**75.1**	**73.6**	**76.1**	**76.1**	**73.0**	**75.3**	**75.9**	**75.6**	**75.5**
1981-2010 Avg.	78.5	78.2	77	78.2	77.9	77.5	78.1	77.8	78.1	79.6	80.6	79.5	**78.4**

Cloud Coverage(in %)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**44**	**36**	**56**	**51**	**57**	**51**	**51**	**53**	**59**	**53**	**55**	**44**	**51**
1981-2010 Avg.	46	42	58	43	47	54	50	45	44	36	37	41	**45**

Avg. Evaporation (in mm/day)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**5.1**	**6.2**	**6.2**	**8.2**	**7.6**	**8.9**	**8.5**	**7.9**	**9.2**	**8.0**	**7.1**	**6.1**	**7.4**
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/day)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
CURAÇAO 2017	**79.8**	**86.5**	**111.9**	**131.9**	**105.6**	**119.7**	**108.2**	**84.2**	**66.4**	**86.5**	**76.4**	**92.3**	**95.8**
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**

Days with 1.0 mm Rain or more.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
CURAÇAO 2017	**13**	**2**	**7**	**1**	**3**	**8**	**6**	**6**	**3**	**7**	**4**	**17**	**77**
1981-2010 Avg.	8	5	3	7	2	3	6	4	5	8	11	11	**73**

Abs. Max = Absolute maximum
Abs. Min = Absolute minimum
Avg. = Average
Long Year Avg. = Long Year Average

METEOROLOGICAL DEPARTMENT CURAÇAO

CLIMATOLOGICAL DATA 2017

Absolute Minimum Temperature (°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Abs. Min.
CURAÇAO 2017	**21.9**	**21.8**	**23.8**	**24.7**	**25.1**	**24.8**	**23.9**	**24.2**	**25.4**	**24.2**	**23.7**	**22.9**	**21.8**
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 2017	**23.9**	**24.1**	**25.2**	**26.2**	**26.4**	**26.4**	**26.4**	**26.9**	**27.2**	**26.5**	**26.6**	**25.2**	**23.9**
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 2017	**26.2**	**26.7**	**27.2**	**28.1**	**28.5**	**28.6**	**28.8**	**29.2**	**29.8**	**29.0**	**28.4**	**27.5**	**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 2017	**29.0**	**30.0**	**30.5**	**31.5**	**32.1**	**32.1**	**32.3**	**32.9**	**34.0**	**32.7**	**31.5**	**30.5**	**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 2017	**29.9**	**31.5**	**32.3**	**32.9**	**34.5**	**33.2**	**34.2**	**34.9**	**36.8**	**35.4**	**34.2**	**31.9**	**36.8**
1981-2010 Record	33.0	33.2	*33.2*	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 SUMMARY

Year 2017

Station: Hato, Airport

Rain				
Rainfall total		:	518.6	mm
Rainfall percentage total/long-term average		:	-15	%
Rainfall 24 hour's maximum date:	November 19	:	33.7	mm
Rainfall amount of days >= 1.0 mm		:	77	days
Hours with rainfall		:	327	hours
Hours with rainfall percentage/long-term average		:	-32	%

Evaporation				
Evaporation year average		:	7.4	mm
Evaporation total		:	2693.8	mm
Evaporation maximum/month date:	May 09	:	15.7	mm

Sunshine				
Sunshine duration average		:	8 50	hours:min
Sunshine percentage total/normal		:		%
Sunshine absolute max./month date	January 04	:	10 24	hours:min
Sunshine absolute min./month date:	January 07	:	3 12	hours:min
Solar radiation monthly average		:		Whr/m2 /day
Solar radiation absolute max./month date:		:	63,798	Whr/m2 /day
Solar radiation absolute min./month date:		:	0	Whr/m2 /day

Temperature				
Temperature average		:	28.2	℃
Temperature maximum average		:	31.6	℃
Temperature absolute max. date/time:	September 07 13:56	:	36.8	℃
Temperature minimum average		:	25.9	℃
Temperature absolute min. date/time:	February 12 3:19	:	21.8	℃
Relative humidity average		:	75.5	%

Wind				
Wind speed average		:	11.2	kt
Wind speed avg. max		:	23.4	kt
Wind speed abs. max. date/time:	June 20 22:07	:	41.0	kt
Wind vector average		:	97	°
Wind energy potential total *		:	1149469	Whr/m2
Wind energy average *		:	37080	Whr/m2 /day
Wind energy potential maximum * date:		:	51514	Whr/m2 /day
Wind energy potential minimum * date:		:	19415	Whr/m2 /day

Remarks

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

++