Meteorological Service of the Netherlands Antilles & Aruba

Climatological Report 2008

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Cover : Several significant weather events, like a few land spouts, affected the islands of the Netherlands Antilles and Aruba.

Year 2008 Global Temperature Ties as Eighth Warmest on Record

The year 2008 tied with 2001 as the eighth warmest year on record for the Earth, based on the combined average of worldwide land and ocean surface temperatures through December. For December alone, the month also ranked as the eighth warmest globally, for the combined land and ocean surface temperature. The assessment is based on records dating back to 1880.

Global Temperature Highlights

The combined global land and ocean surface temperature from January-December was 0.49°C above the 20th Century average of 13.9°C Since 1880, the annual combined global land and ocean surface temperature has increased at a rate of 0.05°C per decade. This rate has increased to 0.16°C per decade over the past 30 years.

Separately, the global land surface temperature for 2008, through December, was sixth warmest, with an average temperature 0.81°C above the 20th Century average of 8.5°C.

The global ocean surface temperature for 2008, through December, was 0.37°C above the 20th Century average of 16.1°C and ranked tenth warmest.

Other Global Highlights for 2008

The United States recorded a preliminary total of 1,690 tornadoes during 2008, which is well above the 10-year average of 1,270 and ranks as the second highest annual total since reliable records began in 1953. The high number of tornado-related fatalities during the first half of the year made 2008 the 10th deadliest with a 2008 total of 125 deaths.

Northern Hemisphere snow cover extent in December was 16.95 million square miles (43.91 million square kilometers). This was 0.17 million square miles (0.43 million square kilometers) above the 1966-2008 December average. Northern Hemisphere snow cover extent was below average for most of 2008.

Arctic sea ice extent in 2008 reached its second lowest melt season extent on record in September. The minimum of 1.80 million square miles (4.67 million square kilometers) was 0.80 million square miles (2.09 million square kilometers) below the 1979-2000 average minimum extent.

Netherlands Antilles

Tropical storm Omar affects the ABC and the SSS islands

Out of a tropical wave developed tropical depression Fifteen during the morning of Monday, October 13, 2008. Its center was located near 14.8 degrees north and 69.6 degrees west or about 325 kilometers (220 miles) north of Curaçao. This tropical depression was upgraded to Tropical Storm *Omar* on Tuesday morning (October 14) and later in the evening became Hurricane Omar. The northeastward movement of hurricane Omar took the hurricane in the direction of the SSS islands. Only tropical storm force winds were experienced on St. Maarten, St. Eustatius and Saba during the passage of hurricane Omar as the center remained over sea. For more information on Omar see the Hurricane Season 2008 overview.
Various land spouts were observed during 2008 on Curaçao and Aruba.
The strongest one occurred on August 23 on Curaçao and was estimated to be between category 0 and 2 on the Enhanced Fujita tornado scale.

Rainfall outlook 2009

Average rainfall for the Netherlands Antilles

The year 2008 ended with a La Niña phase dominating the weather over the our islands. That's the main reason of the above average rainfall during our 2008 rainfall season (+56%).
This La Niña phenomenon is expected to last till May/June 2009 and is forecast to weaken thereafter. For the rest of the year, the majority of the models forecast neutral conditions. Some models predict a weak El Niño.
For the ABC islands the forecast is average rainfall for the 2009 rainfall season. Sea Surface Temperatures (SST) will be around the average in the Pacific, the Atlantic Ocean and the Caribbean Sea. For the SSS islands this means average rainfall during 2009.

2009 Atlantic Basin Hurricane Season Outlook

The 2009 hurricane season forecast includes 12 named storms and six hurricanes. (Normal is 9-10 named storms and 6 hurricanes). Of the six hurricanes, three will develop into major hurricanes (category three or higher). The forecast shows near normal conditions.
A normal hurricane season does not exclude a direct hit for one or more of our islands. The population of the ABC and SSS islands of the Netherlands Antilles must prepare, as always, for the upcoming hurricane season.

Hurricane Season 2008

Tropical cyclone activity during the 2008 Atlantic hurricane season was above average. Sixteen tropical storms occurred of which eight became hurricanes and five strengthened into major hurricanes. These numbers are far above the long-term averages of 11, 6 and 2, respectively. In terms of the accumulated cyclone energy (ACE) index, 2008 had 167% of the long-term median ACE, almost as much ACE as 2006 and 2007 combined. The main system for the islands of the Netherlands Antilles and Aruba undoubtedly was tropical storm and later hurricane *Omar*. This system affected both the ABC as the SSS Islands, which is a rarity due to both its location and the track it took after it developed.

Early Start

Tropical storm ***Arthur*** formed on the last day of May and lasted into very early June. On average, a tropical storm occurs in the Atlantic Basin during June about every other year.
The development of *Arthur* appears to have been the result of a combination of the low- to mid-level remnants of Eastern Pacific tropical storm *Alma* and a westward-moving tropical wave over the Caribbean Sea. *Arthur* formed on May 31 while centered about 80 kilometers (50 miles) northwest of Belize City (over land) as a tropical storm with maximum winds of about 75 km/h (45 mph) which would be its peak intensity.
The center of the cyclone moved slowly toward the northwest and inland over the Yucatan peninsula of Mexico. Winds of tropical storm force however continued over portions of the northwestern Caribbean Sea until early on June 1 when the system weakened to a tropical depression. The depression then turned toward the west and eventually southwest, dissipating near the northern border between Guatemala and Mexico by very early the next day.

Extremely heavy rainfall, with storm totals of up to 380 mm (15 inches) caused devastating floods in Belize. Five deaths were directly attributable to *Arthur* in that country. The Belize National Emergency Organization estimates that total damages were about 78 million U.S. dollars.

Long Lasting *Bertha*

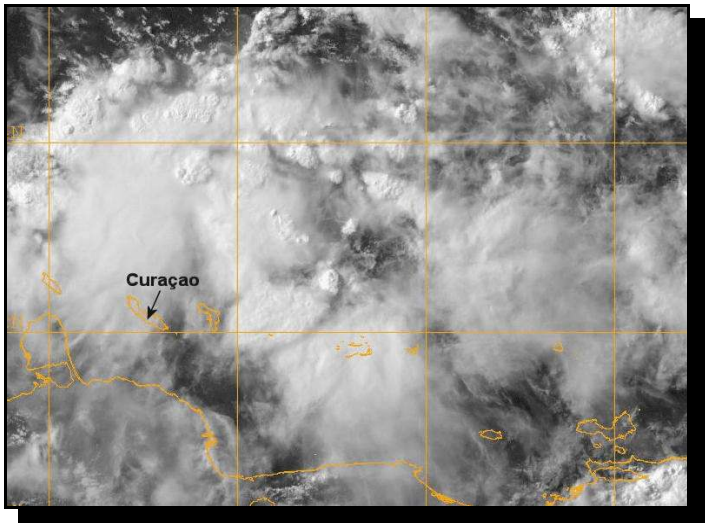
Bertha developed from a strong tropical wave that moved off the west coast of Africa on first day of July. The system gradually became better organized and became a tropical depression early on July 3 over the far eastern Atlantic, about 305 kilometers (190 miles) southeast of the Cape Verde Islands. The depression strengthened into a tropical storm a short time later while passing south of the Cape Verde Islands. *Bertha's* strength changed little during the next couple of days as it moved quickly northwestward over cooler waters. Late on July 6, *Bertha* strengthened as it reached warmer waters and it became a hurricane early the next day about 1370 (850 miles) kilometers east of the SSS Islands. Bertha turned northwestward and rapidly intensified to a peak intensity of 195 km/h (120 mph), category three strength early on July 8. Later that day, increased shear caused *Bertha* to weaken, followed by re-intensification on the next day as the shear decreased. During the next couple of days, *Bertha* turned north with a decrease in forward speed. On July 12 and 13, it stalled about 300 kilometers (200 miles) southeast of Bermuda and gradually weakened to a tropical storm. The next day the cyclone began moving northwestward, with the center passing about 65 kilometers east of Bermuda. After passing Bermuda, *Bertha's* forward speed slowed down again and the storm turned eastward and then southeastward. Bertha accelerated northeastward and reached hurricane strength again on July 18. *Bertha* passed about 725 kilometers (450 miles) southeast of Cape Race, Newfoundland before becoming extratropical over the North Atlantic on July 20. The extratropical low continued northeastward toward Iceland where it merged with a larger lower pressure area.
Bertha brought tropical storm conditions to Bermuda during its close passage on the 14th. Hurricane force wind gusts were experienced at some elevated locations on Bermuda. However, only minor

damage was reported. Bertha's seventeen days as a tropical cyclone makes it the longest-lived July Atlantic Basin tropical cyclone on record.

Cristobal formed from an area of disturbed weather associated with a broad area of low pressure that moved northeastward from the Gulf of Mexico across Florida. The system continued to move northeastward near the east coast of the United States and became a tropical depression on July 18 about 105 kilometers (65 miles) southeast of Charleston, South Carolina. The depression continued moving slowly toward the northeast and became tropical storm Cristobal on the next day. About 360 kilometers (225 miles) southwest of Cape Hatteras, North Carolina. While *Cristobal* moved northeastward near the North Carolina coast, the coast escaped from the strongest winds since most of the associated weather was located to the east of the center. *Cristobal* moved away from the U.S. coast with increasing forward speed and then reached its maximum intensity of 105 km/h (65 mph) on July 21, about 1165 kilometers (725 miles) southwest of Halifax, Nova Scotia in Canada. *Cristobal* then moved northeastward and became extratropical on July 23 about 610 kilometers (380 miles) east of Halifax.

Disturbance Threatened ABC Islands

Dolly originated from a tropical wave that emerged from Africa on July 11. The system moved rapidly westward and generated a surface low pressure area about 2575 kilometers (1600 miles) east of the Southeastern Caribbean islands on July 13. The low moved generally westward over the next several days and crossed the Southeastern Caribbean islands early on July 17. As the system traversed the eastern and central Caribbean, it had a broad low-level circulation with winds to tropical storm force in squalls but no definite center of circulation.



Before Dolly became a tropical depression, it was threatening the weather in the ABC Islands on July 17
Image Courtesy of US Navy

The Meteorological Service issued a ***Special Tropical Disturbance Statement*** for the ABC Islands, since this system appeared to become a direct threat for the weather on these islands. Only a few rain and thundershowers developed on the 18th on these islands.

On July 20, when the system reached the western Caribbean, a well-defined circulation center formed and tropical storm *Dolly* was born about 480 kilometers (300 miles) east of Chetumal, Mexico. The storm moved northwestward and temporarily became disorganized while its center was reforming near the northeastern Yucatan peninsula. *Dolly* reorganized over the Gulf of Mexico on July 21 and headed northwestward toward the western Gulf of Mexico coast. On the next day, the cyclone turned toward the northwest and strengthened into a hurricane. *Dolly* slowed in forward speed and reached a peak intensity of near 160 km/h (100 mph) on July 23, shortly before its eye made landfall on South Padre Island, Texas a short distance southeast of Port Mansfield. After landfall, the cyclone steadily weakened. It became a tropical storm early on the next day and a tropical depression later that day as it crossed the Rio Grande River while continuing to dump heavy rains along its path. *Dolly's* surface circulation dissipated over northern Mexico on July 25 but its remnants aloft moved over New Mexico on July 26 and 27, while continuing to produce heavy rains. The system lost its identity as it approached

the Texas panhandle early on July 28. One person drowned in rough surf in the Florida panhandle and preliminary damage totals range from 750 million to 1 billion U.S. dollars.

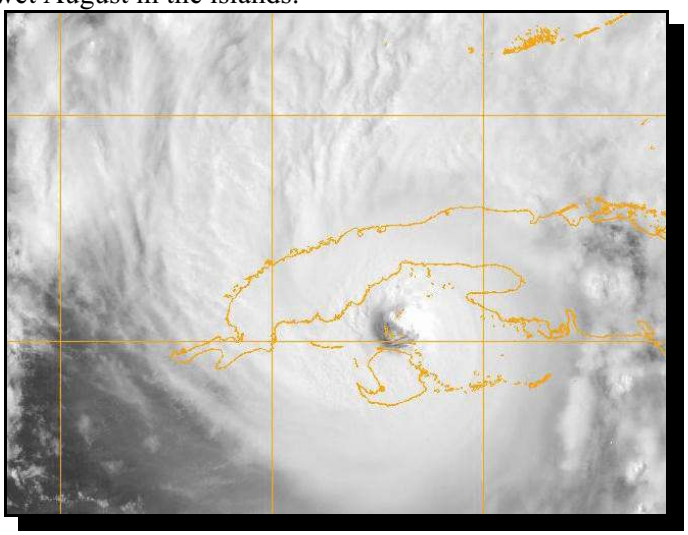
Edouard was a short-lived tropical storm that formed as a depression in the Gulf of Mexico about 255 kilometers (160 miles) southeast of the mouth of the Mississippi river on August 3. The depression moved slowly westward and strengthened into a tropical storm later that day with its intensity reaching 80 km/h (50 mph) early on August 4. *Edouard* weakened slightly but re-strengthened late on the same day as it approached the Upper-Texas coast. *Edouard* made landfall around 7 A.M. local time on August 5 between High Island and Sabine Pass at the McFaddin National Wildlife Refuge with maximum sustained winds estimated at 105 km/h (65 mph). *Edouard* moved inland and weakened to a depression late on August 5 before dissipating over Northwest Texas late on August 6. The effects of *Edouard* were relatively minimal. Some minor coastal flood damage was reported in Terrebonne Parish, Louisiana as *Edouard* passed through the northern Gulf of Mexico.
Little damage was reported along the Upper-Texas coast, mostly limited to flooding in a small number of homes. Rainfall amounts to near 150 mm (6 inches) were reported with the maximum occurring in Baytown, Texas and some roadways were briefly under water. There were no deaths reported in association with *Edouard*.

Lots of Rain with *Fay*

Fay was a long-lived and slowly-moving tropical storm that spent most of its life centered near or over land, dumping heavy rains that produced damaging and deadly floods over portions of the Greater Antilles and Florida. Originating from a tropical wave, *Fay* formed on August 15 as a tropical storm with maximum winds of about 65 km/h (40 mph) as it crossed the eastern coast of Hispaniola. Its strength changed little as it traversed that island and the Windward Passage (between Hispaniola and Cuba) on the following day. The storm gained a little strength with maximum winds of about 80 km/h (50 mph) on August 17 as its center passed just offshore the southern coast of eastern Cuba.
Responding to a break in a subtropical ridge over Florida, *Fay* turned northwestward over central Cuba the next day. Maximum winds increased to about 95 km/h (60 mph) as the storm moved into the Florida Straits and the center of the cyclone passed over the lower Florida Keys late on August 18. *Fay* turned northeastward on the next day, making landfall early that day on the southwestern coast of the Florida peninsula at Cape Romano with maximum winds of 95 km/h (60 mph). After moving inland, *Fay* unusually strengthened, exhibiting what resembled a classical eye in radar and satellite imagery and it reached its peak intensity of about 105 km/h (65 mph) as it passed over the western shores of Lake Okeechobee. In contrast, during August 20-23, continued interaction with the landmass of northern Florida prevented strengthening and *Fay's* maximum winds remained 80-95 km/h (50-60 mph) during most of that period. The center of *Fay* made two brief reappearances over water, off the northeastern Florida coast and over Apalachee Bay on respectively August 20-21 and early on August 23. Under the influence of a high pressure ridge over the eastern United States, *Fay* headed slowly northwestward over the Florida panhandle on that same day, finally weakening to a depression early on the next day. It remained a depression for the next couple of days as it moved slowly over the southeastern United States and eventually degenerated into a remnant low over northern Alabama on August 26. Due to *Fay's* very slow motion, storm-total rainfall amounts in some areas were staggering, including a few locations in east-central Florida that received more than 600 mm (two feet) of rain.
Fay's rain-induced floods caused significant damages and were directly responsible for thirteen deaths in the Dominican Republic, Haiti and Florida. The estimated damage in the U.S.A. alone was about US$560 million. No amounts were available for the damage caused by *Fay* in the Caribbean countries.

Devastating *Gustav*

Gustav was a major hurricane originating from a tropical wave that emerged from the west coast of Africa on August 13. The wave first showed signs of organization on August 18. However, development did not begin in earnest until the system was over the southeastern Caribbean Sea on August 24. A tropical depression formed on the next day about 175 kilometers (110 miles) northeast of Bonaire. Its influence over the weather in the ABC Islands was felt in the form of a few heavy thundershowers over sections of these islands combined with shifting wind directions. This system was a major contributor to a wet August in the islands.



Gustav, as its large eye was located between the Island of Youth and western Cuba during the afternoon of August 30. Image courtesy of U.S. Navy

The depression strengthened rapidly as it moved northwestward, becoming a tropical storm later that day. *Gustav* became a hurricane early on August 26 and made landfall later that day on the southwestern peninsula of Haiti as a category one hurricane. The cyclone moved slowly westward just north of the southwestern peninsula of Haiti on August 27, then turned westward early on the next day. *Gustav* resumed a westward motion later that day and moved over Jamaica as a tropical storm. On August 29, *Gustav* turned northwestward and re-intensified into a hurricane as it approached the Cayman Islands. The cyclone passed through the Cayman Islands early on August 30 as a category 1 hurricane and rapidly intensified into a major hurricane later that day. *Gustav* made landfall in the Cuban province of Pinar del Rio near Punta Carragua late on that same day as a strong category 4 hurricane with maximum sustained winds near 240 kmh (150 mph). *Gustav* emerged into the southeastern Gulf of Mexico early on August 31 as a category 3 hurricane and accelerated northwestward across the Gulf. It made its final landfall near Cocodrie, Louisiana on September 1 as a category two hurricane. After landfall, *Gustav* weakened to a tropical depression over northwestern Louisiana on September 2, then became extratropical over the Mid-Mississippi Valley on September 4. The remnant low of *Gustav* was absorbed over the central Great Lakes on the next day.

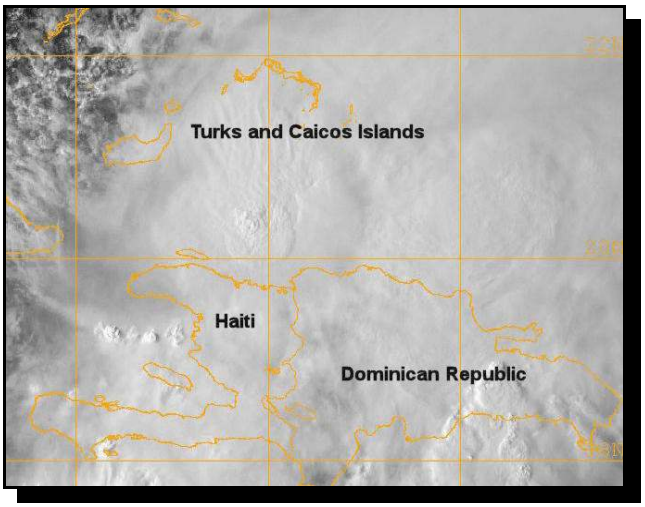
Gustav left a long trail of death and destruction. Major wind and storm surge damage occurred during its landfall in Cuba while heavy rains in Haiti caused destructive mudslides. Strong winds, high storm surges and heavy rains also caused damage in Louisiana, although monetary estimates were not available yet early January. The latest estimate of the death toll from *Gustav* indicated by media reports is 122, of which at least 75 occurred in Haiti. However, this estimate is highly uncertain due to the subsequent effects of *Hanna* and *Ike* on the areas affected by *Gustav* and the difficulties of distinguishing between direct and indirect deaths.

Haiti Gets Hit Again

Hanna formed from a tropical wave that moved off the west coast of Africa on August 19. Associated shower and thunderstorm activity gradually increased as the wave progressed westward across the Atlantic and on August 26 the wave spawned an area of low pressure about 890 kilometers (550 miles) northeast of the SSS Islands.

Additional development during the next couple of days led to the formation of a tropical depression about 560 kilometers northeast of the SSS Islands on August 28. The depression became a tropical

storm six hours later. *Hanna* moved westward over the next several days, passing about 300 kilometers (200 miles) north of St. Maarten and Puerto Rico.
Persistent vertical wind shear from an upper-level low to the west of *Hanna* kept the storm from significantly strengthening. On September 1, *Hanna* began moving southwestward and strengthened into a hurricane that afternoon. The cyclone reached a peak intensity of 130 km/h (80 mph) as its center passed over portions of the Caicos Islands early on the next day. Strong shear weakened the hurricane later that day as it continued to move very slowly southward. Over the next day or so, *Hanna* weakened to a tropical storm and made a counter-clockwise loop between the Turks and Caicos Islands and the northern coast of Hispaniola. *Hanna* then moved north of the Turks and Caicos Islands late on September 3 and began moving northwestward, passing just east of the central Bahamas on September 4. The next day, the cyclone moved just east of the northwestern Bahamas and then turned northward, passing about 240 kilometers (150 miles) east of the coast of North Florida. *Hanna* accelerated northward and made landfall with 110 km/h (70 mph) winds during the early morning hours of September 6 near the border of North and South Carolina. *Hanna* weakened but remained a tropical storm as it passed over North Carolina and eastern Virginia. The storm turned northeastward and moved along the Mid-Atlantic coast.



Although "only" a tropical storm at that time, Hanna *was causing heavy rain over Haiti on September 2.*
Image Courtesy of U.S. Navy

Hanna became extratropical as it exited the coast of Massachusetts early on September 7. The extratropical remnants of *Hanna* moved across southeastern Canada, then turned eastward and merged with a frontal boundary after passing St. John's, Newfoundland on September 8.

Reports indicate that *Hanna* was responsible for very heavy rainfall in Haiti that resulted in an estimated 500 fatalities. *Hanna* produced minor wind and flood damage in the Turks and Caicos Islands. In the United States, damage was relatively minor in nature but occurred over a large area, totaling an estimated 160 million U.S. dollars.

Devastating *Ike*

Ike originated from a well-defined tropical wave that moved off the coast of West Africa on August 28 and became a tropical depression on September 1 about 2370 kilometers (1470 miles) east of the SSS Islands. The depression quickly strengthened to a tropical storm later that day but then went through a more gradual intensification for the next two days as it moved northwest over the tropical Atlantic. *Ike* became a hurricane on September 3 and rapidly intensified to a major hurricane later that day. Additional strengthening continued to category four status as it achieved a peak intensity of 235 km/h (145 mph) on September 4, when it was located 885 kilometers (550 miles) northeast of the SSS Islands.
Thereafter, northeasterly shear increased over the system when strong high pressure built over the western Atlantic and Ike weakened a bit as it moved southwestward from September 5 to 6.
The weakening trend was short-lived and *Ike* regained category four status just before moving across the Turks and Caicos Islands and Great Inagua island in the southeastern Bahamas early on September 7.

Ike continued westward and made landfall along the northeast coast of Cuba in the province of Holguin early on September 8 with maximum sustained winds estimated to be 200 km/h (125 mph). *Ike* then moved across eastern Cuba for several hours, re-emerged off the south coast later that day and maintained category 1 status as it moved northwestward along the south coast of Cuba. *Ike* made a second landfall in Cuba over the extreme southeastern part of the province of Pinar del Rio on September 9 with winds of 130 km/h (80 mph) and moved into the southeastern Gulf of Mexico later that day.
Ike developed a large wind field as it moved northwestward across the Gulf of Mexico over the next three days and gradually intensified as it approached the Texas coast. It made landfall along the north end of Galveston Island in the early morning hours of September 13 as a category two hurricane with maximum sustained winds of 175 km/h (110 mph). The hurricane weakened as it moved inland across eastern Texas and Arkansas and then toward the Ohio Valley where its extratropical remnants produced wind gusts to hurricane force.
Ike was a major Cape Verde hurricane that caused extensive damage and many deaths across portions of the Caribbean and along the coasts of Texas and Louisiana. It is estimated that flooding and mud slides from *Ike* killed 74 people in Haiti and two in the Dominican Republic. No deaths were reported in the Turks and Caicos islands and the southeastern Bahamas, although about 70 to 80 percent of the houses on Great Inagua island sustained some damage. *Ike* also caused extensive wind and storm surge damage as it crossed the island of Cuba where seven deaths were reported. Although Ike produced some wind damage across southeast Texas and southwest Louisiana, the destruction from storm surge was the most significant aspect of the hurricane, particularly along the Bolivar Peninsula east of Galveston.
Ike was responsible for the deaths of 103 persons in Hispaniola, Cuba and the United States of America. In Haiti alone, 74 people lost their lives due to the passage of this system but only two persons died in the Dominican Republic. Thanks to mass evacuations in Cuba, only seven deaths were reported in this island nation. Material damage was extensive to both houses and buildings as to crops. Texas was the U.S. state with the most casualties: 20. Most of these died from drowning in *Ike's* storm surge. Many more people (64) died from indirect causes like electrocution, carbon monoxide poisoning and pre-existing health problems. Significant damage was also caused in the Turks and Caicos Islands and in the southeastern Bahamas as well. The remnants of *Ike* also caused wind damage and several dozen indirect deaths across portions of the Mississippi and Ohio Valleys.

Josephine developed from a well-organized tropical wave that departed the west coast of Africa late on August 31. A tropical depression formed on September 2, located about 275 kilometers (170 miles) southeast of the Cape Verde Islands. The depression became a tropical storm six hours later as the system was moving westward. *Josephine* reached a peak intensity of 95 km/h (65 mph) on September 3 while the system was located about 490 kilometers (305 miles) southwest of the Cape Verde Islands. Thereafter, a combination of moderate to strong southwesterly wind shear and cooling waters caused the storm to slowly weaken during the next couple of days. Early on September 6, *Josephine* weakened to a tropical depression and six hours later dissipated as a tropical cyclone because it was unable to generate significant thundershower activity.
The remnant low of *Josephine* continued to move generally westward for the next several days before dissipating about 840 kilometers (520 miles) east of Guadeloupe.

Kyle originated from an area of low pressure that formed near the Eastern Caribbean Islands on September 19. The low moved slowly toward the northwest and then drifted over western Puerto Rico and the Dominican Republic for a couple of days. Once the low moved northward, away from Hispaniola, it developed a well-defined center and became a tropical storm late on September 25. *Kyle* moved on a general northward track and passed well to the west of Bermuda on the morning of September 27 and became a hurricane later on that day. It peaked in intensity on the next morning with maximum sustained wind speeds near 140 km/h (85 mph). *Kyle* then accelerated

northward with no significant change in strength and moved over western Nova Scotia, Canada, late on that same day. It continued northward and lost tropical characteristics as it approached New Brunswick.
The low pressure system which preceded *Kyle* produced torrential rains, damaging flash floods and mud slides over Puerto Rico which led to six deaths in this island. The effects of *Kyle* in Canada were primarily in the form of uprooted trees and broken limbs, resulting in power outages.

Laura originated from a non-tropical low pressure system over the central North Atlantic Ocean. It formed as a subtropical storm with 95 km/h (60 mph) winds early on September 29 about 1600 kilometers (1000 miles) west of the Azores Islands. *Laura* initially moved northwestward but it soon turned northward. On September 30, the system made the transition to a tropical storm. *Laura* turned northward and lost tropical characteristics on October 1 about 480 kilometers (300 miles) east of Cape Race, Newfoundland, Canada. The extratropical cyclone continued over the North Atlantic for a few days and lost its identity by October 4. There were no reports of damage or casualties associated with *Laura*.

Tiny *Marco*

Marco formed out of a broad area of low pressure that had persisted over the Northwestern Caribbean and Yucatan peninsula for several days at the end of September. By October 4, the low became better defined near Belize, but then moved inland over the Yucatan peninsula. As the low approached the Bay of Campeche on October 5, the cloud pattern gained organization and the system became a tropical depression early on October 6 while centered over the Terminos lagoon in the state of Campeche. The depression quickly strengthened to a tropical storm and its winds reached 95 km/h (65 mph) early on October 7 as it moved to the northwest. *Marco* did not strengthen further and made landfall between Tuxpan and Veracruz on that same morning. The cyclone weakened rapidly after making landfall and dissipated later that day. It is estimated that at times the tropical storm force winds extended no more than about 20 kilometers (12 miles) from the center. Although the historical record on storm size is very short, dating back only to 1988, *Marco's* 20 kilometer (12 miles) extent of tropical storm force winds makes it the smallest tropical storm on record in the Atlantic Basin. There have been no reports of casualties or significant damage.

Nana was a weak and short-lived tropical storm that developed from a tropical wave on October 12 about 1500 kilometers (925 miles) west of the Cape Verde Islands. *Nana* became a tropical storm later that day. As it moved steadily westward, strong southwesterly upper-level winds caused the system to weaken into a tropical depression on October 13. The system degenerated into a remnant low pressure system on the next day about 2100 kilometers (1300 miles) east of the Eastern Caribbean islands and eventually dissipated late on October 15 about 1600 kilometers (1000 miles) northeast of the SSS Islands.

Omar Brings Rain, Strong Winds and Rough Seas to Our Islands

Omar formed from a well organized tropical wave that moved westward from the coast of Africa at the end of September. The wave moved slowly across the tropical Atlantic and reached the Eastern Caribbean Sea on October 10. During the morning of Monday, October 13, tropical depression *Fifteen* developed with its center near 14.8 degrees north and 69.6 degrees west or about 325 kilometers (220 miles) north of Curaçao. Since strong southwesterly winds were expected, resulting in rough seas in the south and west coastal areas of the ABC Islands, a cautionary statement was issued earlier that morning for owners of small craft and coastal facilities.
Initially, this system was forecast to drift toward the northwest and, after about a day (Tuesday the 14th), it would turn toward the northeast while increasing its forward speed. Instead, it became stationary and started to drift that evening toward the southeast. This development resulted in a further increase of cloudiness, (thunder)shower activity and “moderate” to “strong” southwesterly

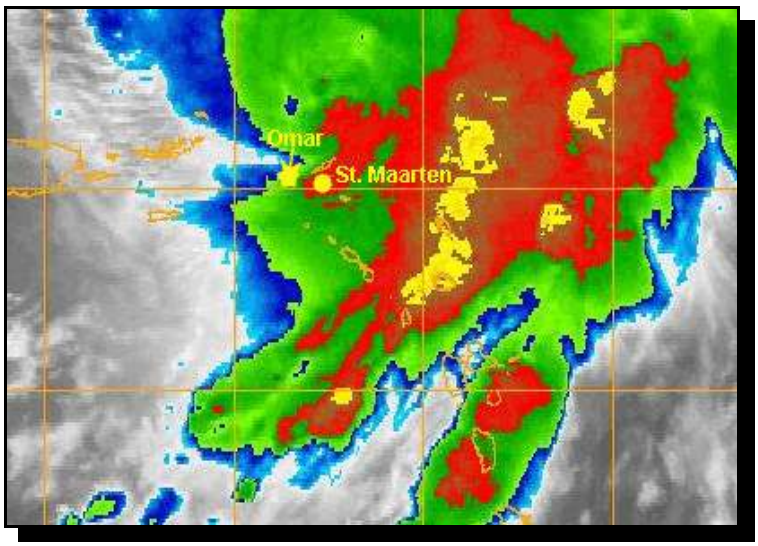
winds with gusts to “tropical storm” force over the ABC Islands. Because of the increased winds and seas, the cautionary statement was upgraded by the Meteorological Service to a **Small Craft Warning** during the early hours of Tuesday morning.

Large waves generated by Omar battering the coast of Bonaire *Image courtesy of Marianela González*

The tropical depression was upgraded to Tropical Storm *Omar* on Tuesday morning (October 14). The closest point of approach to the ABC Islands occurred during the early afternoon, when the center of *Omar* was located about 180 kilometers (110 miles) north of Curaçao. The official meteorological stations in the ABC Islands recorded wind speeds of mainly “fresh” to “near gale” and “tropical storm” force were recorded only in wind gusts. These strong southwesterly winds generated large waves which caused beach erosion and significant damage to coastal facilities. On all three islands a considerable number of houses experienced roof damage, while several trees were uprooted because of the “near gale” southwesterly winds.

Several periods with steady rain of light to moderate intensity combined with occasional (heavy) thunderstorm activity resulted in large amounts of rain in the ABC Islands. Especially sections of Aruba experienced significant flooding. Omar finally started to move toward the northeast during the afternoon. The strong winds over the ABC Islands however continued to blow through the early morning of Wednesday.

A **Tropical Storm Warning** and a **Hurricane Watch** were issued for the **SSS Islands** during the late afternoon of October 14. *Omar* became a hurricane during the early evening and the Hurricane Watch was upgraded to a Hurricane Warning later at 11 P.M. It continued to intensify on the next day as it was moving toward the northeast at an increasing forward speed. It reached Category Two intensity during the early evening of Wednesday, October 15, as it started to approach the northeastern Caribbean. A large area with rain reached the SSS Islands during the afternoon. As Omar was approaching the SSS Islands, it rapidly strengthened to Category Three intensity later that same evening.



Omar, as it was located near its closest point to St. Maarten. Most of the associated clouds were located east of the islands but the actual center was just west of the SSS Islands. *Image courtesy of US Navy*

The winds in the SSS Islands actually started to pick-up from the east on Wednesday after 10 P.M. As the eye of *Omar* moved west of these islands, the wind speed continued to increase gradually to tropical storm force while the direction shifted to the west. Wind speeds to hurricane intensity at St. Maarten’s Juliana Airport were observed only in gusts between 3 and 4 A.M. on Thursday, October 16. The strong southwesterly winds caused high waves and a storm surge which resulted in

damaging coastal flooding over sections of the SSS Islands. During the passing of category three *Omar*, the center remained well away from the islands {about 105 kilometers (65 miles) west of St. Maarten}, so that mainly "tropical storm" conditions were experienced, while the islands remained outside the area of sustained hurricane winds. Nevertheless, widespread damage was experienced to coastal facilities, buildings and infrastructure. The heaviest rain in St. Maarten was recorded between Thursday midnight and 2 A.M. and in Statia between midnight and 1 A.M. After 4 A.M., no more rain was observed in the islands during that morning.
Later that day, strong southwesterly upper level winds caused rapid weakening to a category One hurricane. A temporary decrease in these strong upper level winds allowed *Omar* to re-intensify during the next days while it moved rapidly northeastward over the open Atlantic. However, increased upper level winds and cooler sea surface temperatures caused *Omar* to weaken and it decayed to a remnant low on October 18 about 1400 kilometers (865 miles) southeast of Cape Race, Newfoundland in Canada. This low moved slowly northeastward and dissipated early on October 21 about 1300 kilometers (800 miles) west of the Azores Islands.

Omar directly affected the islands in the Northeastern Caribbean, including the SSS Islands, with damage from winds, tides and surf reported in these areas. Swells generated by the hurricane affected the south and west facing shores of other islands in the Eastern Caribbean. There are no reports of casualties from *Omar*. A total amount of the damage caused by this system in all the affected islands and countries was not known yet in early March 2009.

Tropical depression ***Sixteen*** formed about 80 kilometers (50 miles) northeast of Cabo Gracias a Dios on the Nicaragua/Honduras border out of a broad area of low pressure in the Western Caribbean on October 14. The sprawling system was never able to gain much organization as it moved along the north coast of Honduras. The center of the depression moved inland over northeast Honduras just after 6 A.M. on October 15 and dissipated early on the next day.
The depression, its precursor low and its remnants caused flooding in portions of Costa Rica, Nicaragua, Honduras, El Salvador and Guatemala. Floods caused by the depression were responsible for nine deaths in the region.

Major Hurricane to Conclude the Season

Paloma, the second strongest November Atlantic hurricane on record, formed from a broad area of disturbed weather that persisted over the southwestern Caribbean Sea for several days in early November. A tropical wave that moved west off the coast of Africa on October 23, moved into this area on November 4, increasing the coverage and organization of showers and thunderstorms. The disturbance developed into a tropical depression on November 5 about 185 kilometers (115 miles) east of Cabo Gracias a Dios along the Nicaragua/Honduras border. The depression moved slowly to the northwest and became a tropical storm on November 6 about 135 kilometers (85 miles) southeast of Cabo Gracias a Dios. Later that day, *Paloma* turned toward the north and began to rapidly intensify, becoming a hurricane early on the next day about 450 kilometers (280 miles) southwest of Montego Bay, Jamaica. *Paloma* continued to rapidly intensify as it turned to the northeast and moved very close to the Cayman Islands of Little Cayman and Cayman Brac on November 7 and 8. As Paloma continued northeast toward the southern coast of Cuba, it reached a peak intensity of 235 km/h (145 mph) on November 8, when it was located about 55 kilometers (35 miles) southwest of Santa Cruz del Sur in Cuba. As vertical wind shear increased, Paloma began to weaken, making landfall near Santa Cruz del Sur late on November 8 with an estimated intensity of 200 km/h (125 mph).

After landfall, *Paloma* turned toward the north, slowed and rapidly weakened due to strong upper level winds and interaction with land. *Paloma* weakened into a tropical storm on November 9 near Camagüey, Cuba and then to a tropical depression early on the next day, about 25 kilometers (15 miles) southwest of Camagüey. The depression degenerated into a remnant area of low pressure

about 65 kilometers (40 miles) north of Camagüey later that day when it lost all heavy thunderstorm activity. The remnant low of *Paloma* moved slowly northward and then made a loop off the north-central coast of Cuba on November 10 and 11. On November, the remnant area of low pressure moved south and then southwestward across central Cuba into the Northwestern Caribbean. The low turned toward the northwest and moved over the western tip of Cuba on the 12th and emerged into the southeastern Gulf of Mexico on the next day. The remnants of *Paloma* then turned toward the north and eventually reached the Florida Panhandle on November 14. *Paloma* directly impacted the Cayman Islands and Cuba with high winds, storm surge and heavy rainfall. Damage was reported in these areas but no direct casualties or fatalities in association with *Paloma*. The greatest impacts from this system occurred on Cayman Brac and Little Cayman. On Cayman Brac nearly every building on the island was damaged or destroyed, according to media reports. Damage on Little Cayman appears to have been less severe, but trees and power lines along with some buildings were significantly damaged. An official monetary estimate of damages from the Cayman Islands is not available as of this writing, but media reports from Cayman Net News suggest damages were between U.S.$15 and $20 million. According to the Cuban government, *Paloma* caused around U.S.$1.4 billion in damage on that island nation.

Trop. Depr. Nr.	Name	Period	Min. air pressure	Maximum wind
1	T.S. Arthur	May 31 - June 1	1005 hPa	75 km/hr
2	Hurricane Bertha	July 3 - 20	948 hPa	195 km/hr
3	T.S. Cristobal	July 19 - 23	1000 hPa	105 km/hr
4	Hurricane Dolly	July 20 - 24	964 hPa	160 km/hr
5	T.S. Edouard	August 3 - 5	997 hPa	105 km/hr
6	T.S. Fay	August 15 - 24	986 hPa	105 km/hr
7	Hurricane Gustav	August 25 - September 2	941 hPa	240 km/hr
8	Hurricane Hanna	August 28 - September 7	978 hPa	130 km/hr
9	Hurricane Ike	September 1 - 14	935 hPa	235 km/hr
10	T.S. Josephine	September 2 - 5	994 hPa	105 km/hr
11	Hurricane Kyle	September 29 - October 1	984 hPa	130 km/hr
12	T.S. Laura	September 27 - 28	993 hPa	95 km/hr
13	T.S. Marco	October 6 - 7	998 hPa	105 km/hr
14	T.S. Nana	October 12 - 13	1005 hPa	65 km/hr
15	Hurricane Omar	October 14 - 18	959 hPa	200 km/hr
17	Hurricane Paloma	November 6 - 9	943 hPa	235 km/hr

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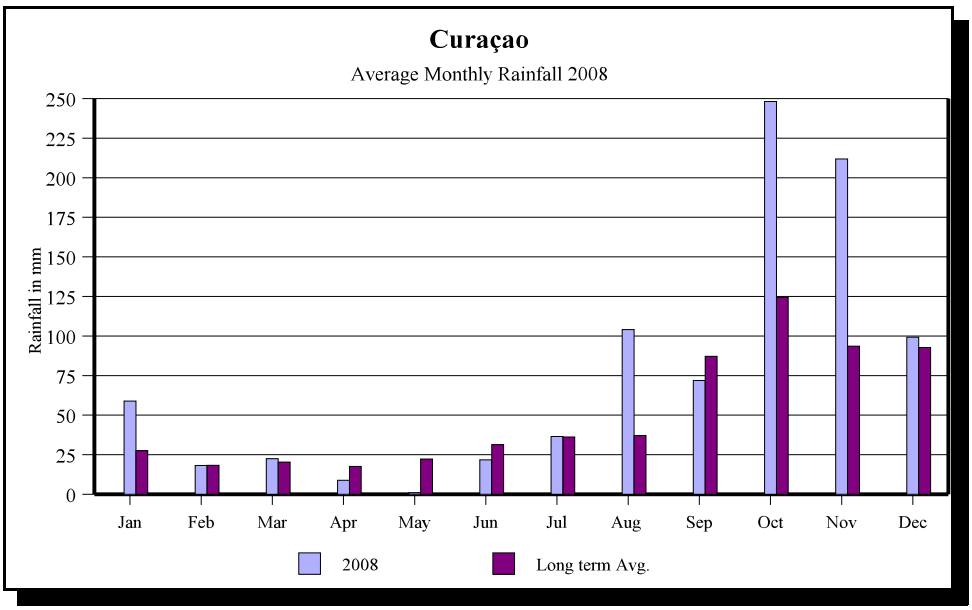
ABC-Islands

Curaçao

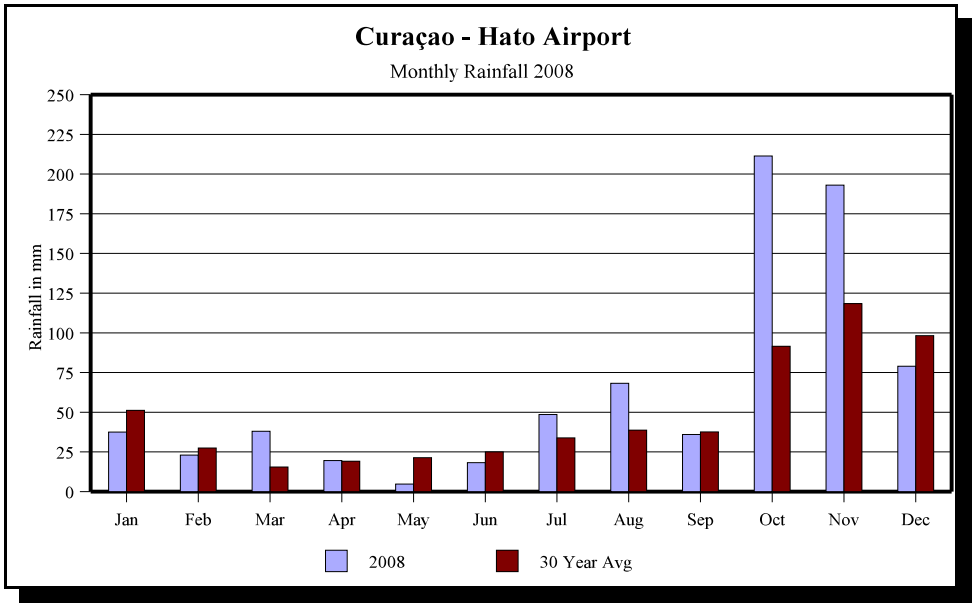
RAINFALL

With 56 % above the long term average, the year 2008 can be considered a wet year. Three rainfall stations {Kas di Orashon Emaus (Soto), San Juan and Colonia} broke the 1000 mm mark. The island-average rainfall in 2008 was 892.4 mm (normal 572.8 mm). When analyzing the individual data from the rain gauge network, the rainfall station at *Kas Di Orashon "Emaus"* in Soto received the highest annual total of 1081.7 mm during 2008. The maximum 24-hour rainfall total for Curaçao was 80.6 mm and was measured at rainfall station Kas Di Orashon "Emaus" on November 21. The highest monthly total for 2008 was 337.8 mm, measured in October at (again) rainfall station *Kas Di Orashon "Emaus"*.
The highest sum of rain days (days with rainfall greater than or equal to 1.0 mm) for 2008 was 115 days and was observed at rainfall station Colonia.



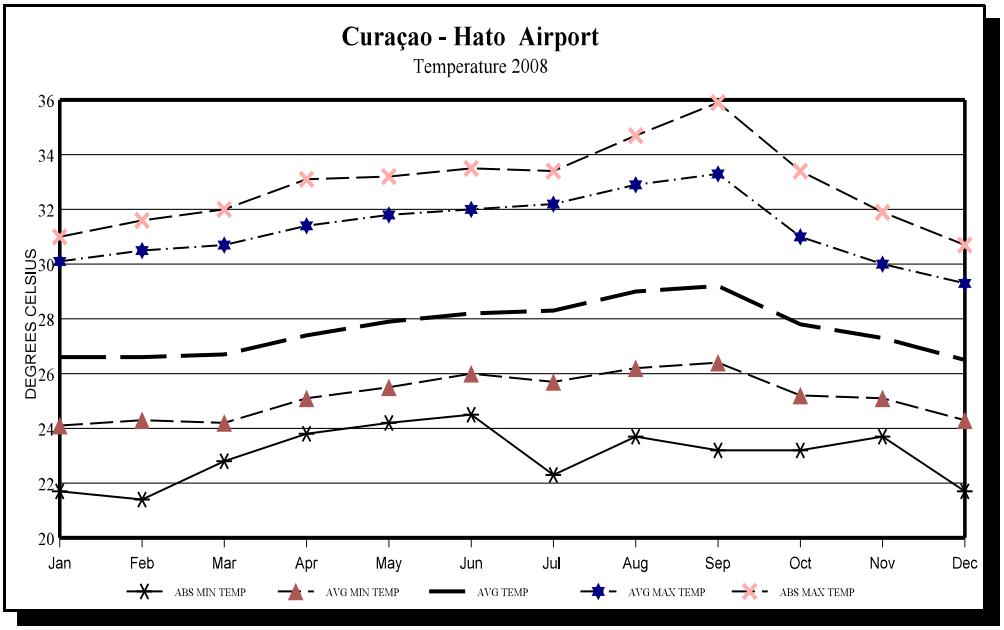
Rainfall data from Hato rainfall station

The annual rainfall total for Hato in 2008 was 776.8 mm, 40% above the 30-year average of 1971-2000 (average 553.4 mm). The wettest month of 2008 was October with a monthly total of 211.4 mm and the driest one was May with 4.8 mm. The month with the highest percentage above it's long term average was March with 168% above normal.
The 24-hour maximum of 52.2 mm and the one hour maximum of 37.8 mm were recorded on November 25, 2008.
The maximum intensity per minute of 2.2 mm was recorded on January 14. The maximum rainfall duration in minutes was 168 minutes, recorded on October 8.
The number of days with rainfall greater or equal to 1.0 mm was 85 days (normal 70).
The total number of hours with rainfall for 2008, recorded at Hato International Airport, was 324.
The number of days with thunder was 36 (normal 23 days).



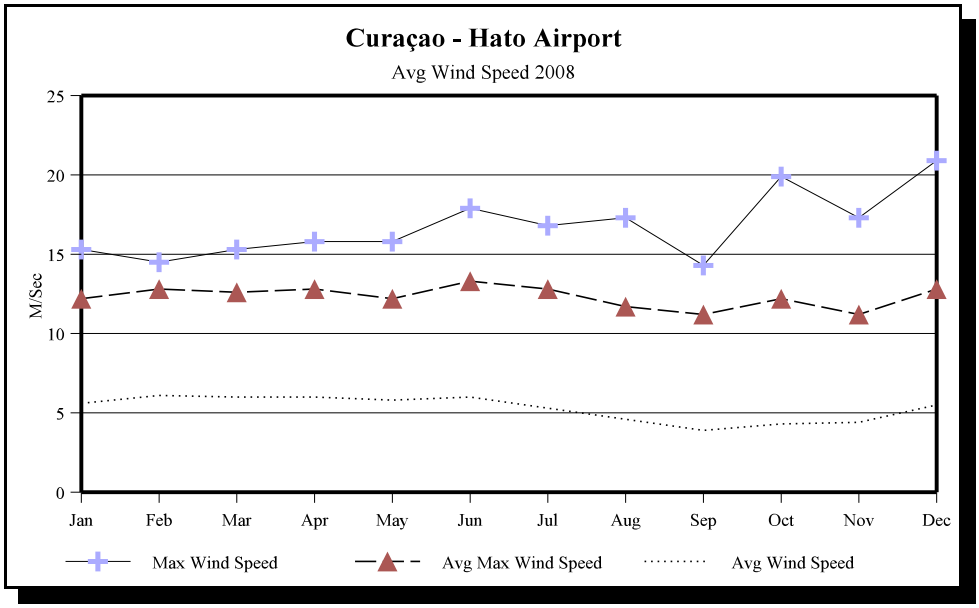
TEMPERATURE

The average air temperature as recorded at Hato International Airport in the year 2008 was 27.6°C (normal 27.8°- standard deviation 0.8°). September was the warmest month with a daily average temperature of 29.2°C (normal: 28.9°C). The highest average maximum temperature of 33.3°C was also recorded in September.(normal: 32.6°C).
The absolute maximum temperature was 35.9°C and was recorded on September 8 at 14:53 hours (Absolute maximum record of 38.3°C was established on September 11, 1996). The hottest day of 2008 was also September 8 with a 24-hour average temperature of 30.4°C.
December was the coolest month with a daily average temperature of 26.5°C. January was the month with the lowest average minimum temperature of 24.1°C .
The absolute minimum temperature of 21.4°C was recorded on February 3, 2008 at 06:43 hours.
The coolest day of the year was November 18 with a 24-hour average temperature of 25.2°C.



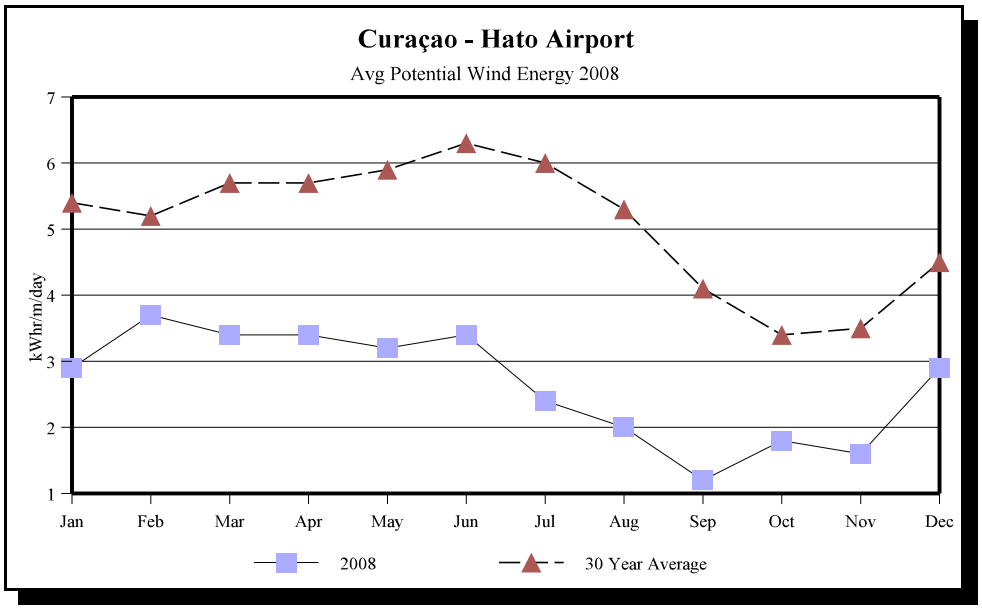
WIND

The average wind speed for the year 2008 was 5.3 m/sec (19.1 km/hr) (normal 6.6 m/sec - 23.8 km/hr) at a height of 10 meters above surface level.
February had the highest monthly average wind speed of 6.1 m/sec (22.0 km/hr) and October had the lowest monthly average wind speed 3.9 m/sec (14.0 km/hr).
The highest wind gust 20.9 m/sec (75.2 km/hr) was recorded on December 25 at 05:36 lt at Hato International Airport.



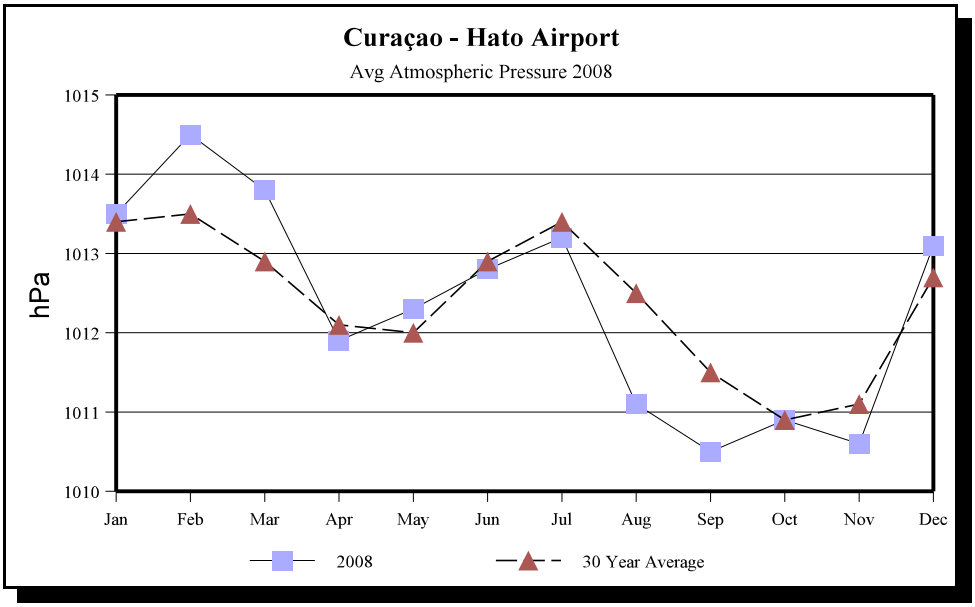
POTENTIAL WIND ENERGY

The total potential wind energy (at 10m height and wind speeds ≥4 m/sec) for the year 2008 was 974.6kWh/m^2. This total is about 53% below the normal value of 1830.9 kWh/m^2/yr.
The daily average for 2008 was 2.7 kWh/m^2/day.



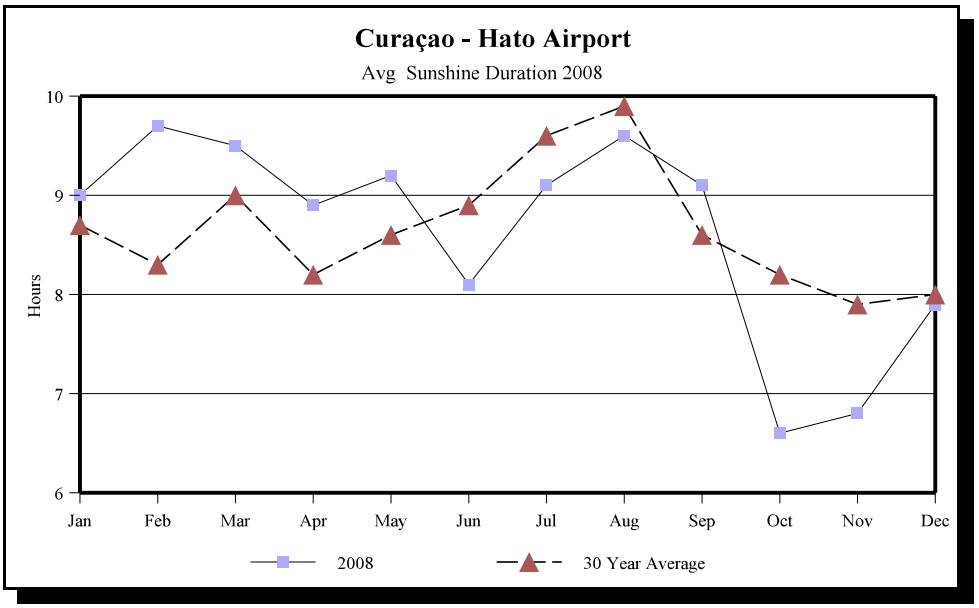
ATMOSPHERIC PRESSURE

The average atmospheric pressure recorded at Hato Airport in the year 2008 was 1012.4 hPa. The maximum atmospheric pressure of 1019.0 hPa was recorded on February 19, 2008 while the minimum 1003.7 hPa was recorded on October 14 (courtesy of *Omar*).



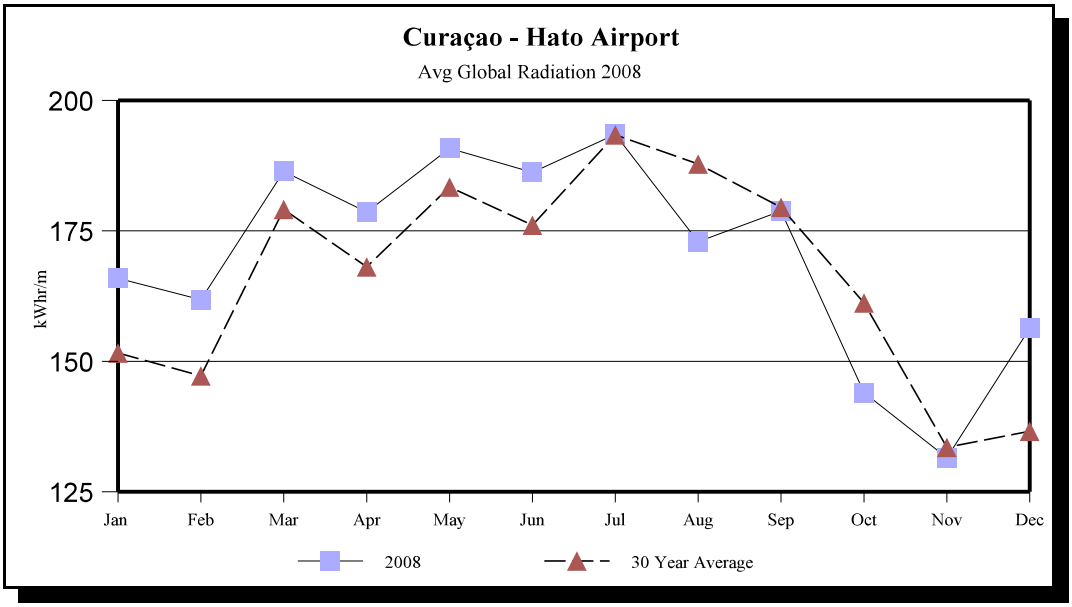
SUNSHINE DURATION

The total sunshine duration for the year 2008 was 3166.5 hours, 71.5% of the maximum possible duration (4428 hrs). The average daily sunshine duration was 8 hours and 36 minutes. The sunniest month was February with a daily average sunshine duration of 9 hours and 42 minutes while the month with the least sunshine was October with a daily average of 6 hours and 36 minutes. The day with the maximum sunshine duration, 12 hours and 6 minutes, was May 21, 2008.



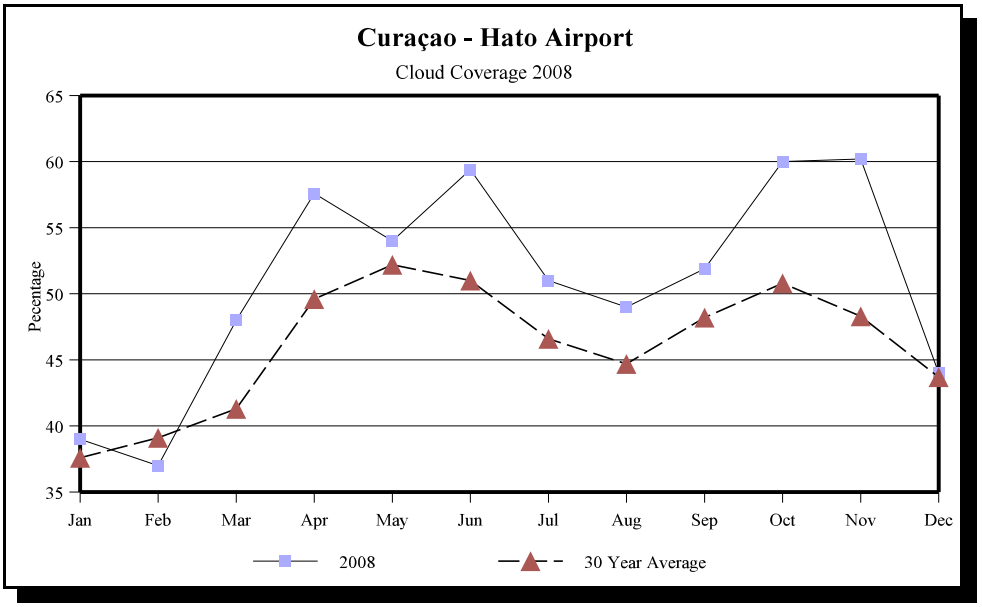
GLOBAL RADIATION

The total annual global radiation for 2008 as recorded at Hato Airport was 2047 kWh/m^2 about 2.5% above the long term annual average (1997.5 kWh/m^2). June was the month with the highest monthly total radiation of 193.5 kWh/m^2.



CLOUD COVERAGE

The average cloud cover for the year 2008 was 50.9%. The highest total cloud coverage per month, 60.2% was observed in November and the lowest total cloud coverage for 2008, 37%, was observed in February.

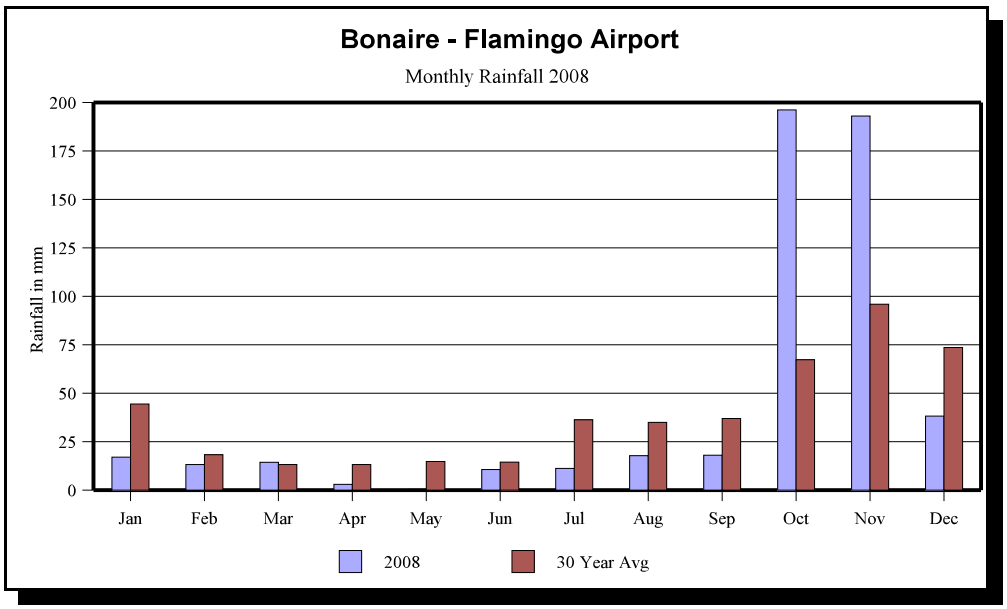


Bonaire

RAINFALL

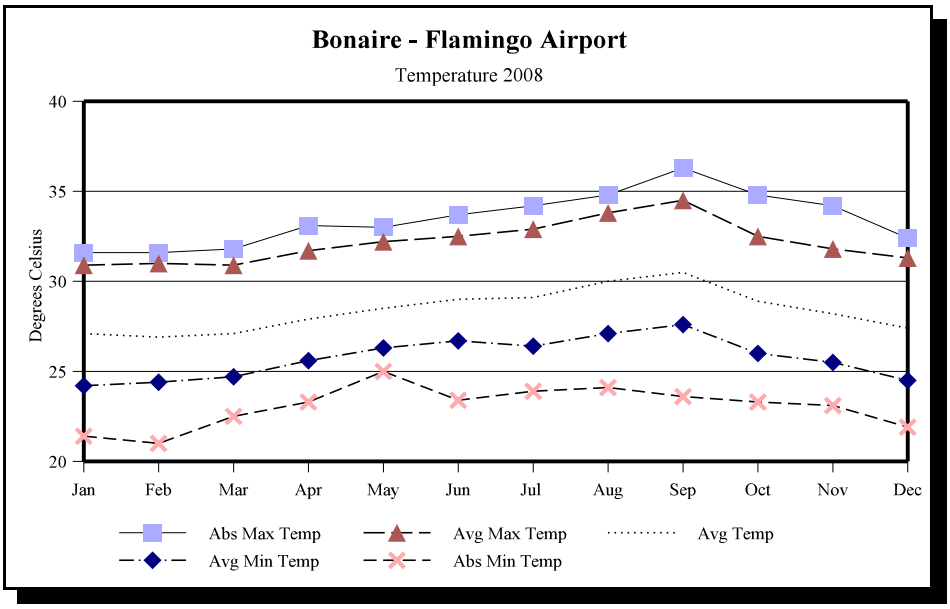
The rainfall total, in the year 2008, as recorded at the Flamingo Airport of Bonaire was 532.2 mm, 15% above normal (normal 1971-2000 is 463.3 mm). October was the wettest month of the year with a total of 196.2 mm while May was the driest month with 0.4 mm.
The 24-hour maximum was 40.6 mm recorded on October 14, 2008 and can be attributed to *Omar*.
The number of days with rainfall greater than or equal to 1.0 mm totaled 71,6% above normal (67 days)

The total rainfall for 2008 measured at the BOPEC rainfall station was 734.5mm. In comparison with the total rainfall for the Flamingo airport this is about 40% higher**.**



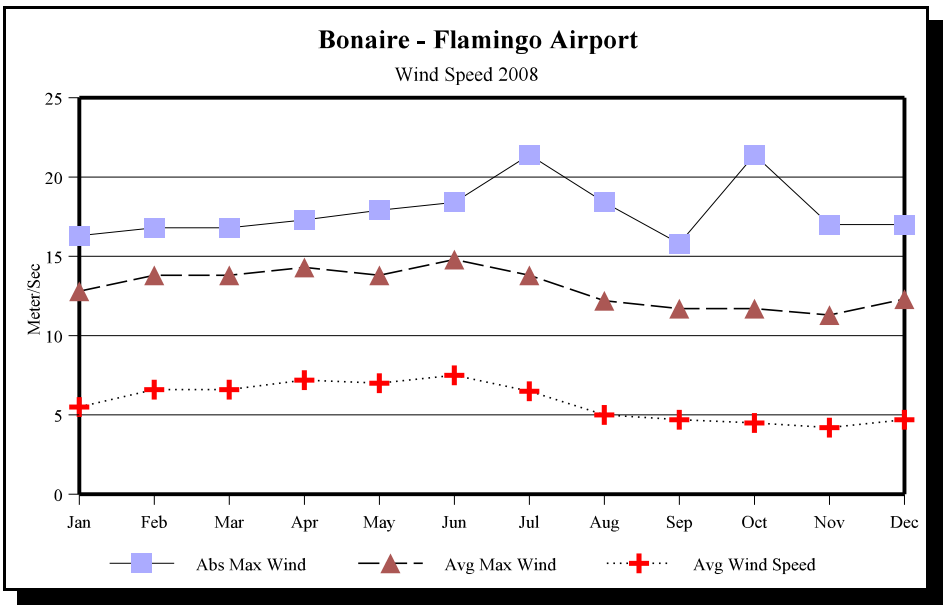
TEMPERATURE

The average air temperature recorded at the Flamingo Airport of Bonaire in the year 2008 was 28.4°C (normal 28.0). The month of September was the warmest month with an average temperature of 30.5°C. September had the highest value for the average maximum temperature of 34.5°C. The absolute maximum temperature for 2008 was 36.3°C and was recorded on September 3 at 14:45 hours. The warmest day of 2008 was September 8 with a 24-hour average temperature of 31.6°C.
The lowest monthly average temperature and the lowest average minimum temperature for 2008, were both recorded in September respectively 26.9°C and 24.4 °C. The absolute minimum temperature of 21.0°C was recorded on September 2 at 07:08 hours.
The day with lowest 24-hour average temperature, 24.5°C was recorded on September 2, 2008.



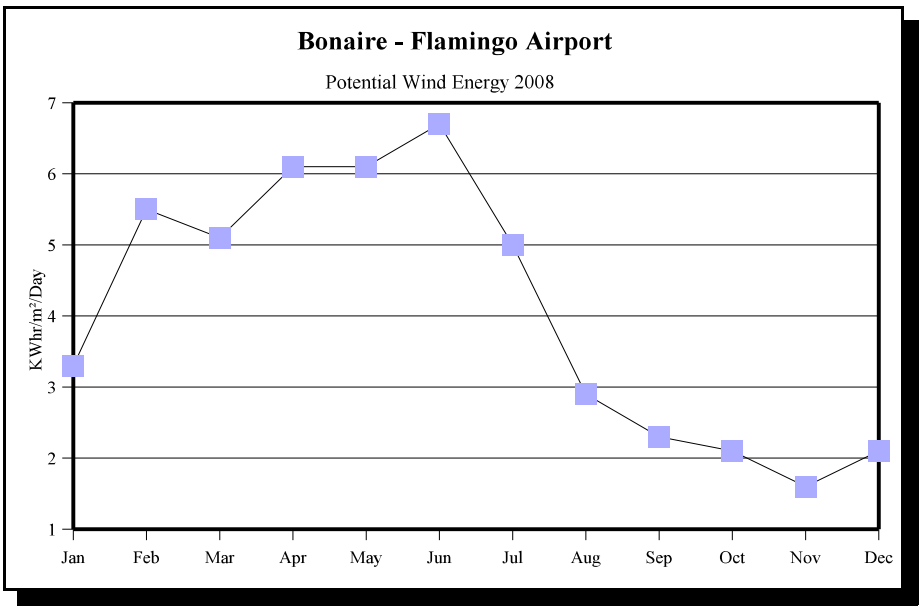
WIND

The average wind speed of 2008 recorded at the Flamingo Airport was 5.8 m/sec (20.9 km/hr) at 10 metre height above surface level.
The highest monthly average wind speed, 7.5 m/sec (27.0 km/hr), was recorded in June 2008.
November had the lowest monthly average wind speed of 4.2 m/sec (15.1 km/hr).
The highest wind gust of 21.6 m/sec (74 km/hr) was recorded on July 14 at 13:15 and on October 15 at 3:24 local time. The latter gust was caused by *Omar*.



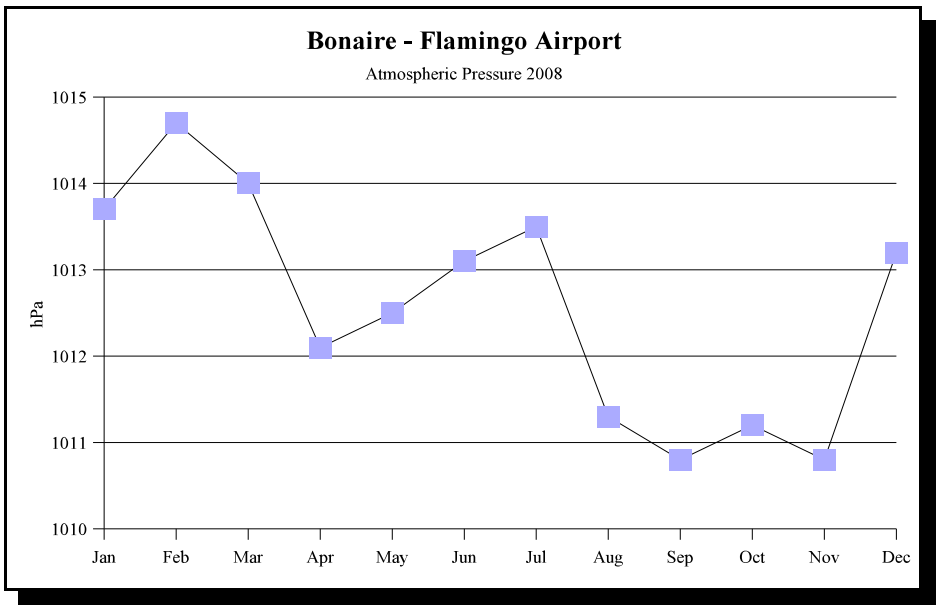
POTENTIAL WIND ENERGY

The total potential wind energy (at 10 meter height and wind speeds ≥4 m/sec) for the year 2008 was 1473 kWh/m^2. The daily average for 2008 was 4.1 kWh/m^2/day.



ATMOSPHERIC PRESSURE

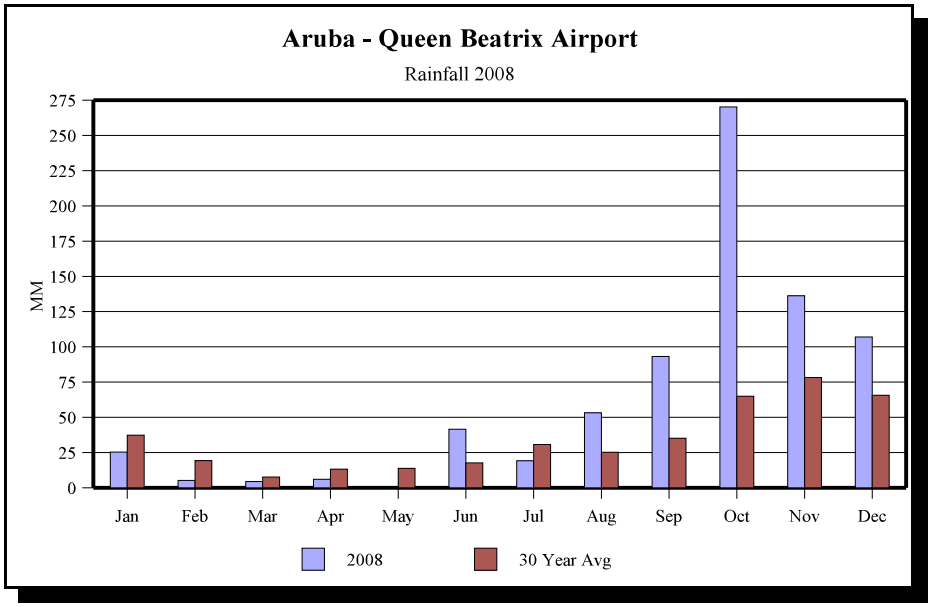
The average atmospheric pressure recorded at Flamingo Airport over the year 2008 was 1012.6 hPa. The maximum atmospheric pressure of 1019.1 hPa was observed on February 19 while the minimum atmospheric pressure of 1003.8 hPa was recorded on October 14.



ARUBA

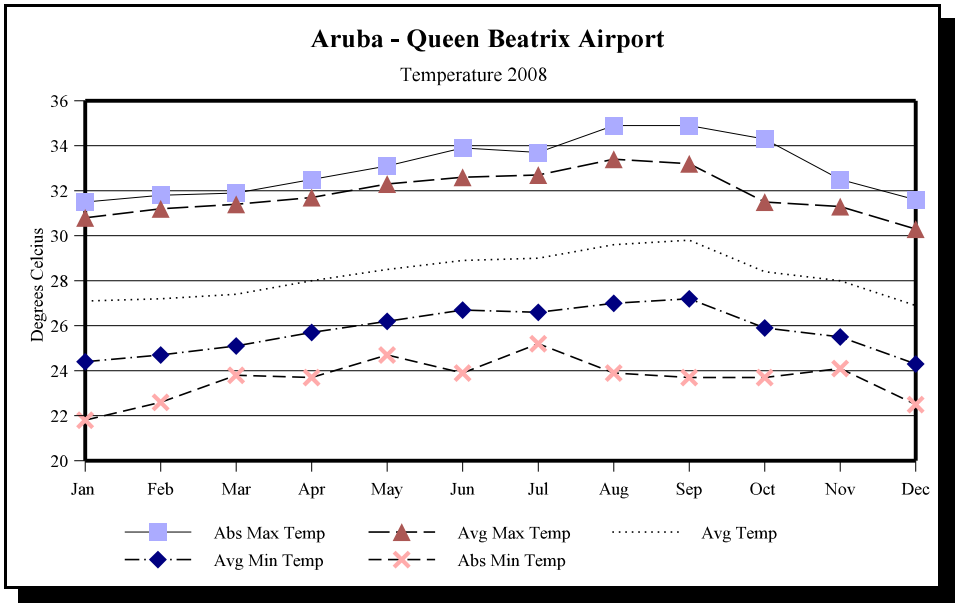
RAINFALL

The total rainfall, recorded at the Queen Beatrix Airport for the year 2008 was, with 762.0 mm, 86.7% above average (409 mm). The wettest month was October with a total rainfall of 270.2 mm. The 24-hour maximum rainfall of 101.6 mm was recorded on October 15 and was caused by *Omar*. This a new record for October on Aruba. The old record of 90.7mm dated from October 1988. The number of days with precipitation greater than or equal to 1.0 mm was 79 days (normal 62).



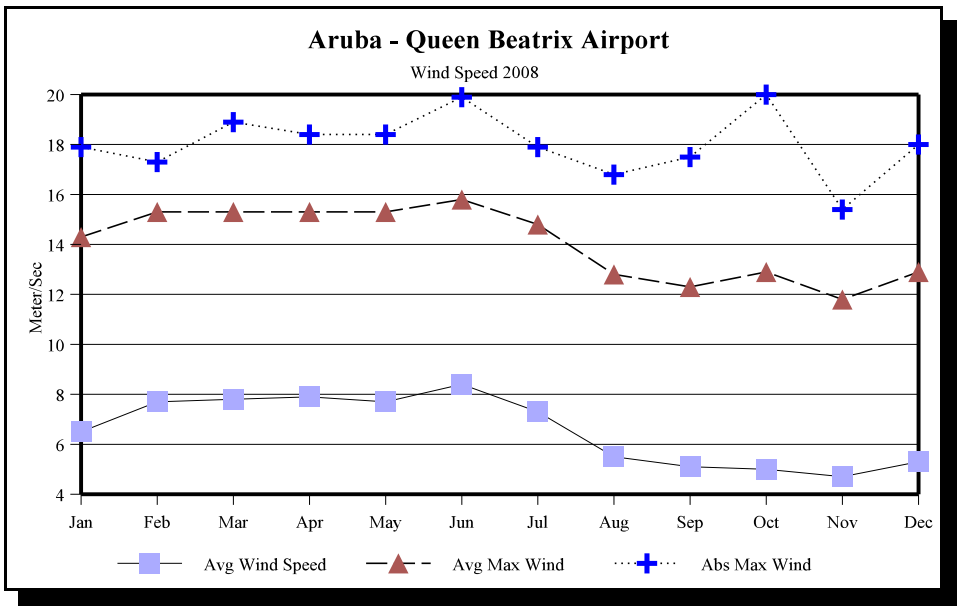
TEMPERATURE

The average air temperature as recorded at Queen Beatrix Airport in the year 2008 was **28.2**°C (normal 27.8°). The warmest month of 2008 was September with an average temperature of 29.8°C. The highest monthly average maximum temperature of **33.4**°C was recorded in August. The hottest day of 2008 was 9 September with a 24 hour average of 30.9 °C.
The absolute maximum temperature of **34.9**°C was recorded on August 30, at 14:22 hours and on September 26 at 13:49 local time.
December was the coolest month with an average temperature of **26.9**°C and it was also the month with the lowest monthly average minimum temperature of **24.3**°C. The coolest day of 2008 was December 17 with an average temperature of **25.6°**C.
The absolute minimum temperature was **21.8**°C and was recorded twice during 2008 respectively on January 28 at 06:56 and on December 21 at 03:27 hours.



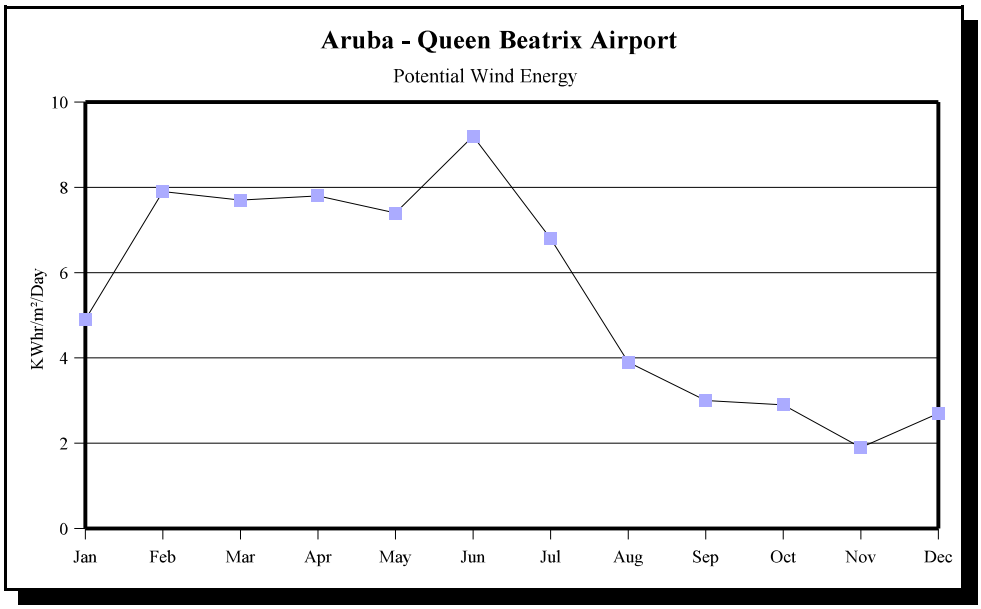
WIND

The average wind speed, at 10 meters of height, for the year 2008, as recorded at Queen Beatrix Airport, was 6.6 m/sec (23.8 km/hr).
June was the month with the highest average wind speed of 8.4 m/sec (30.2 km/hr) and November had the lowest average wind speed 4.7 m/sec (16.9 km/hr).
The highest wind gust of 20.0 m/sec (72 km/hr) was recorded on October 14 at 08:09 local time (Omar).



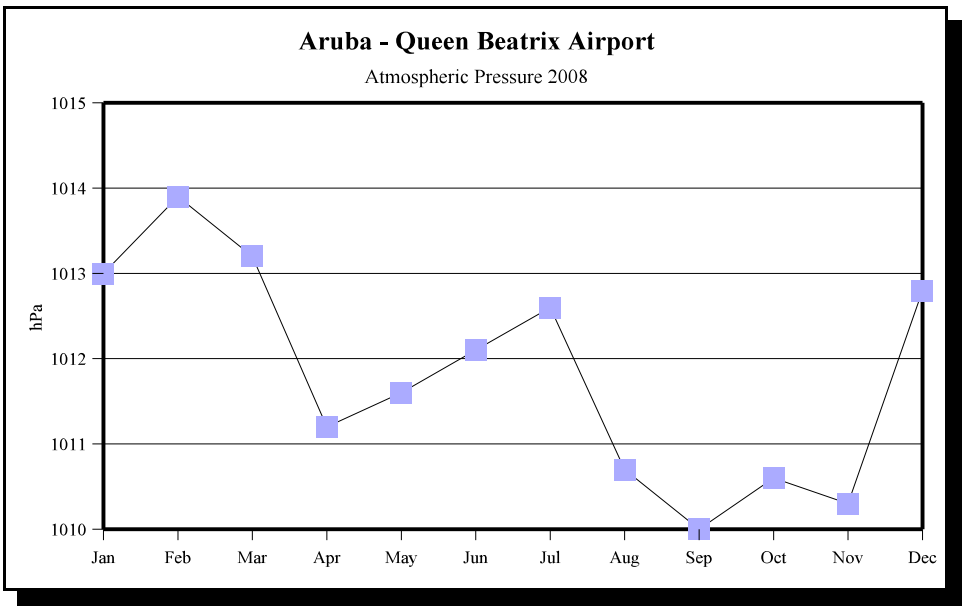
POTENTIAL WIND ENERGY

The total potential wind energy (at 10m height and wind speeds ≥4 m/sec) for the year 2008 was 2006 kWh/m^2. The daily average for 2008 was 5.5 kWh/m^2/day.



ATMOSPHERIC PRESSURE

The average atmospheric pressure recorded at Queen Beatrix Airport over the year 2008 was 1011.8 hPa. The maximum atmospheric pressure of 1018.3 hPa was observed on February 19 while the minimum atmospheric pressure of 1003.4 hPa was recorded on October 14.



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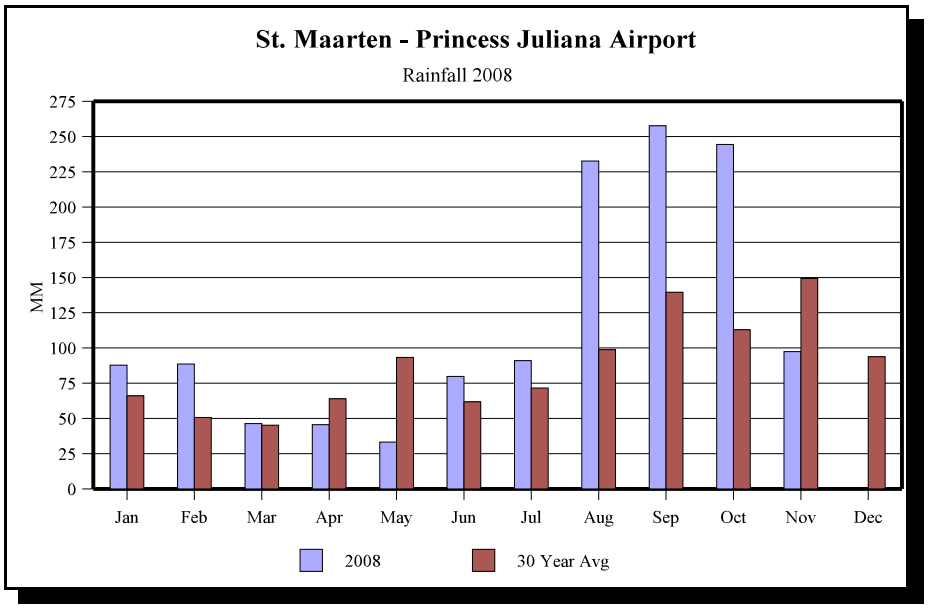
SSS ISLANDS

St. Maarten

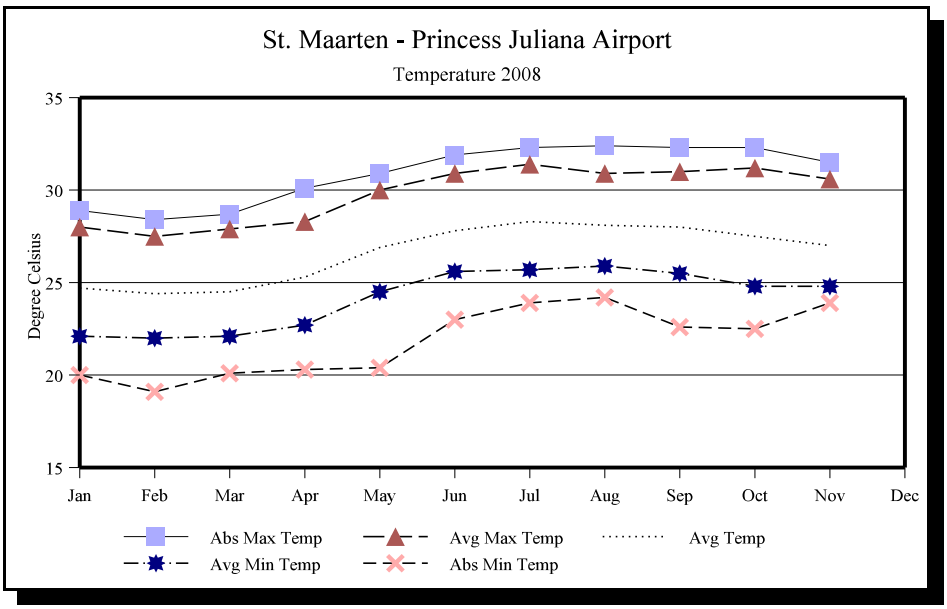
RAINFALL

The total rainfall for 2008, as recorded at the Princess Juliana Airport was 1304.4 mm. September was the wettest month with a monthly total of 257.6 mm. The 24-hour maximum was 139.4 mm recorded on October 16, 2008 and was caused by the passage of Hurricane *Omar*. The number of days with precipitation greater than or equal to 1.0 mm was 136. Due to technical problems, the data from St. Maarten is available only from January thru November 2008.



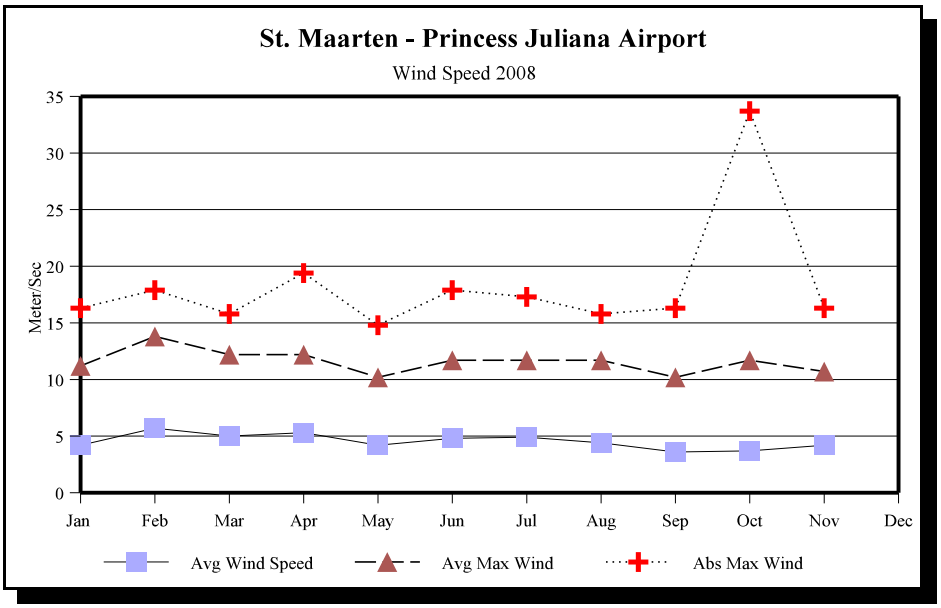
TEMPERATURE

The average air temperature as recorded at Princess Juliana Airport over the year 2008 was **26.6**°C (normal 27.2°). With 28.3°C July was the warmest month and also was the month with the highest monthly average maximum temperature of **31.4**°C.
The absolute maximum temperature was **32.4**°C and was recorded on August 25 at 13:45 local time. The hottest day of 2008 was recorded on August 6 with a 24-hour average temperature of **29.2**°C.
February was the month with the lowest monthly average temperature of **24.4**°C and was also the month with the lowest average minimum temperature of **22.0**°C for 2008.
The absolute minimum temperature **19.1**°C was recorded on February 1 at 03:45 local time.
With a temperature of **22.6**°C, February 1 was also the coolest days of 2008.



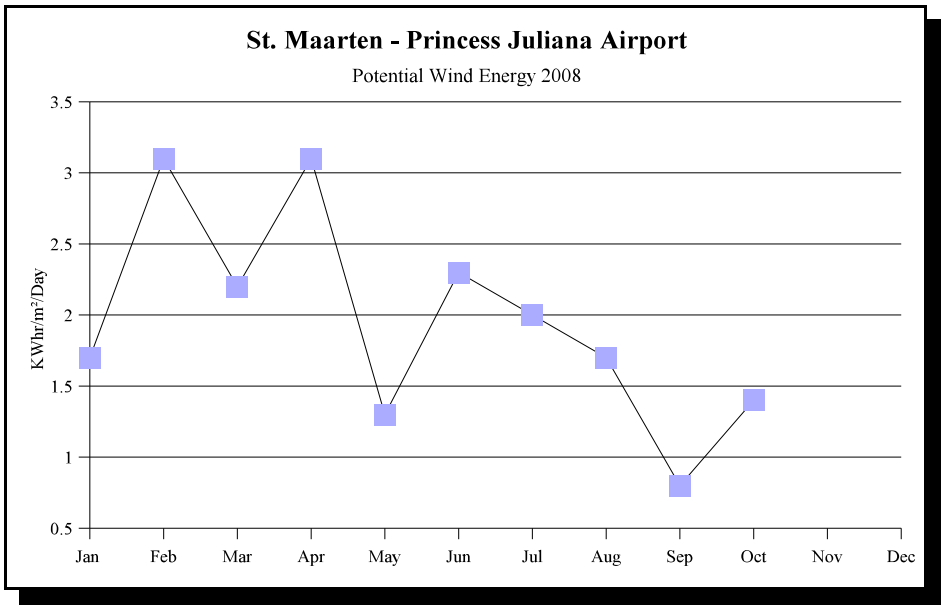
WIND

The average wind speed of 2008 (Jan thru Nov) as recorded at the Princess Juliana airport, was 4.5 m/sec (16.2 km/hr) at 10 m height above surface level. February had the highest average wind speed of 5.7 m/sec (20.5 km/hr). The lowest monthly average wind speed of 3.6 m/sec (13.0 km/hr) was recorded in October 2008.
The highest 24-hour average wind speed of 8.0 m/sec (28.7km/hr) was recorded on July 23 2008.
The highest wind gust 33.7 m/sec (121.3 km/hr) was recorded on October 16 at 03:10 local time and was caused by hurricane *Omar*.



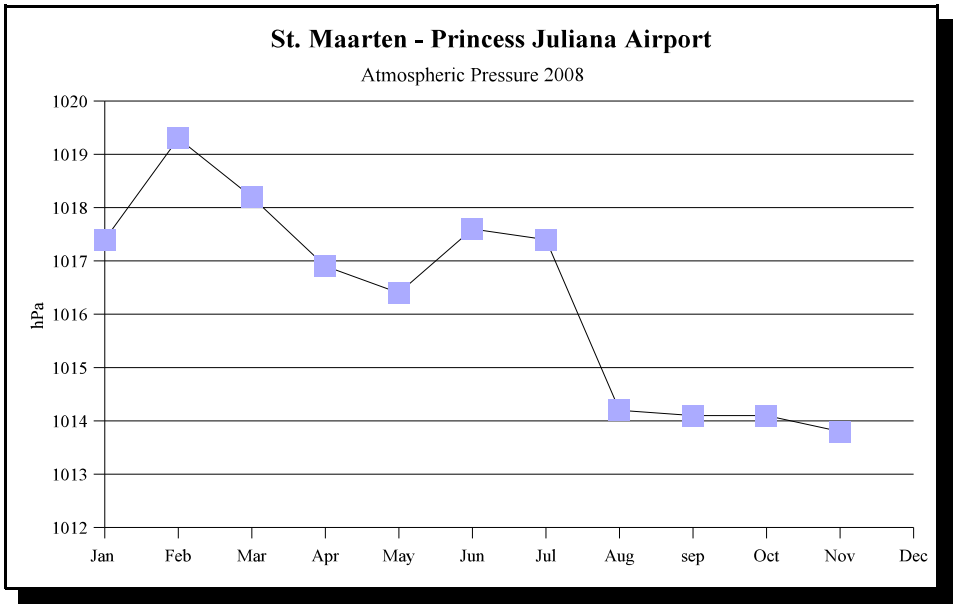
POTENTIAL WIND ENERGY

The total potential wind energy (at 10m height and wind speeds ≥4 m/sec) for the year 2008 (Jan thru Oct) was 2006 kWh/m^2. The daily average for 2008 was 5.5 kWh/m^2/day.



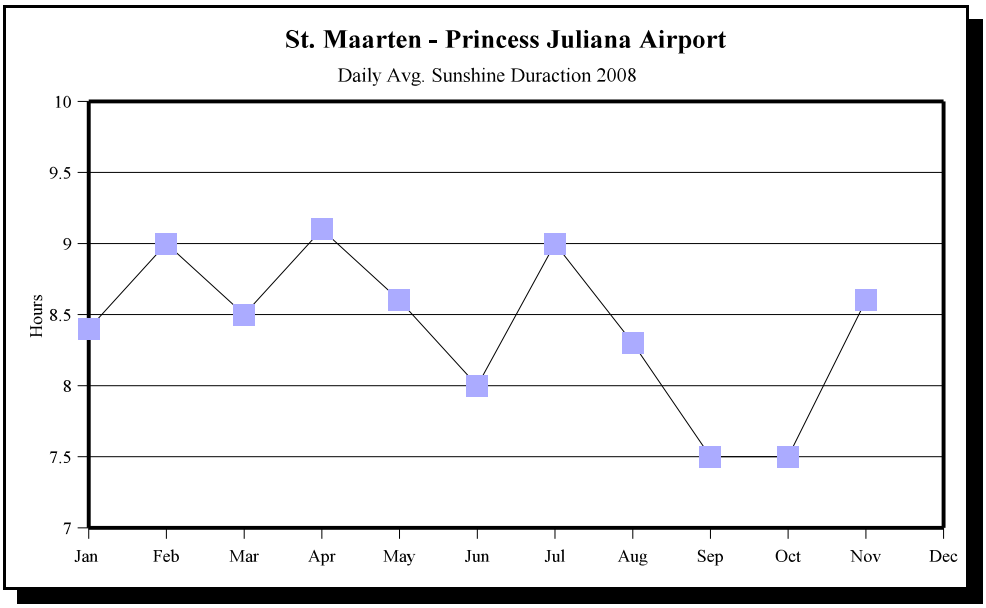
ATMOSPHERIC PRESSURE

The average atmospheric pressure, recorded at Princess Juliana Airport, during the year 2008 (Jan thru Nov) was 1016.3 hPa. The maximum atmospheric pressure of 1023.6 hPa was recorded on February 19, while the minimum atmospheric pressure of 1002.0 hPa was recorded on October 16.



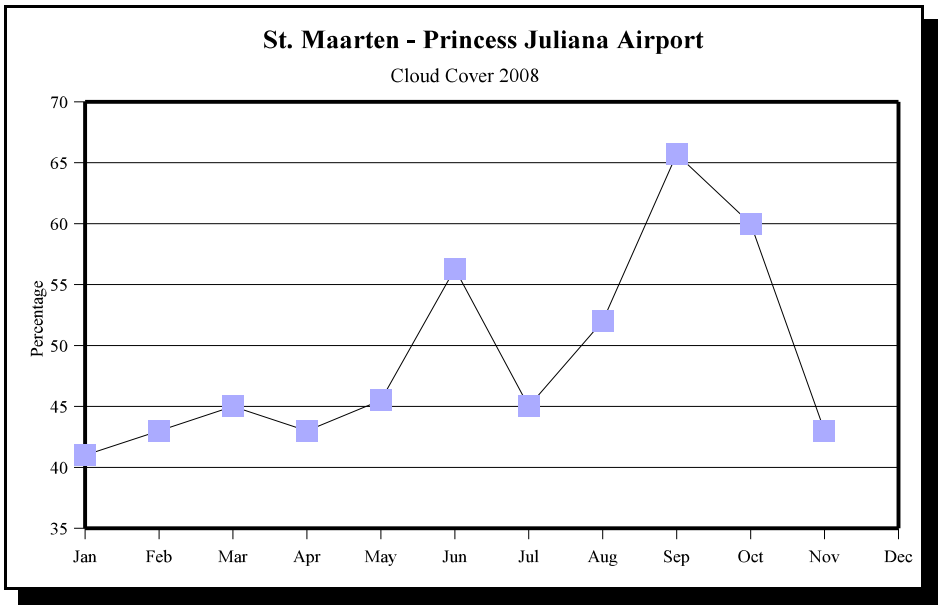
SUNSHINE DURATION

The total sunshine duration for 2008 (Jan thru Nov), as recorded at the Princess Juliana Airport, was 2823.5 hours. The daily average sunshine duration in 2008 was 8 hours and 24 minutes. The sunniest month was April with a daily average sunshine duration of 9 hours and 06 minutes. The months with least sunshine during 2008 were September and October with a daily average of 7 hours and 30 minutes. The maximum daily sunshine duration for the past year was 11 hours and 30 minutes and was recorded on May 19, 2008.



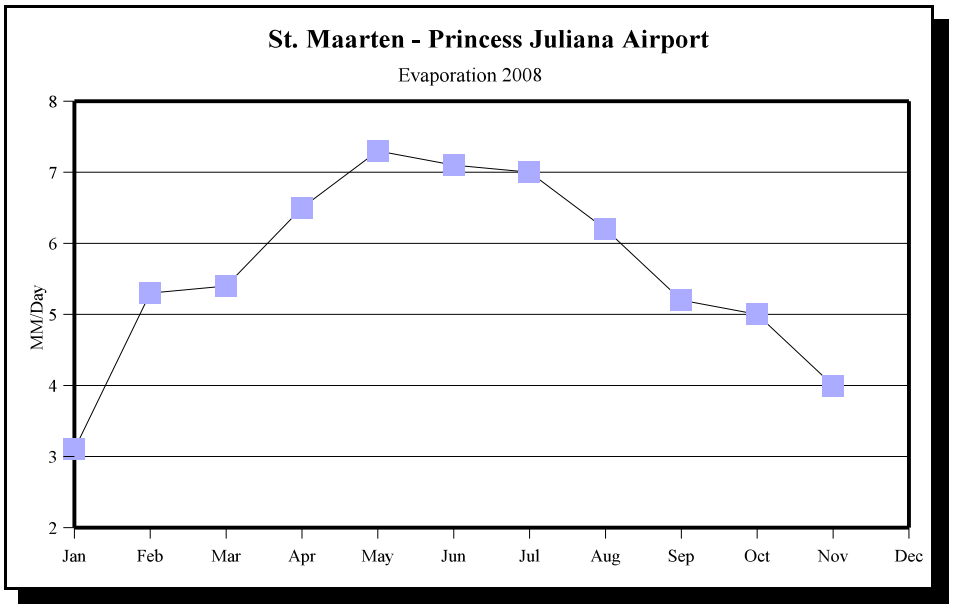
CLOUD COVERAGE

The daily average cloud coverage for St. Maarten over the year 2008 (Jan thru Nov) as recorded at Princess Juliana Airport was 49.1%. The highest monthly average cloud cover of 66% was observed in September while January had the lowest cloud coverage value of 41%.



EVAPORATION

The average daily evaporation, measured at the Princess Juliana Airport, in the year 2008 (Jan thru Nov) was 5.8 mm per day. May had the maximum average evaporation value for 2008 of 7.3 mm per day while January had the lowest value of 3.1 mm per day.



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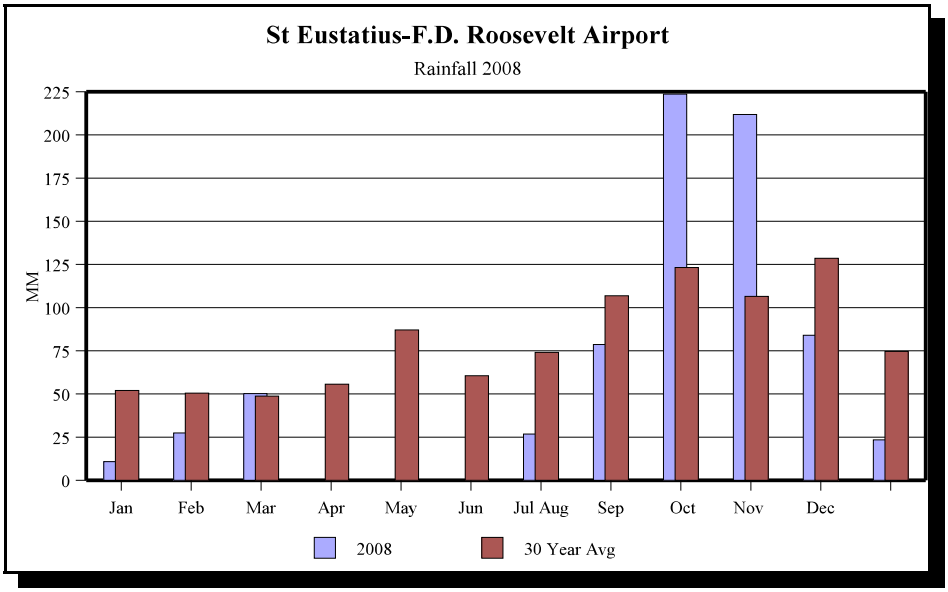
St. Eustatius

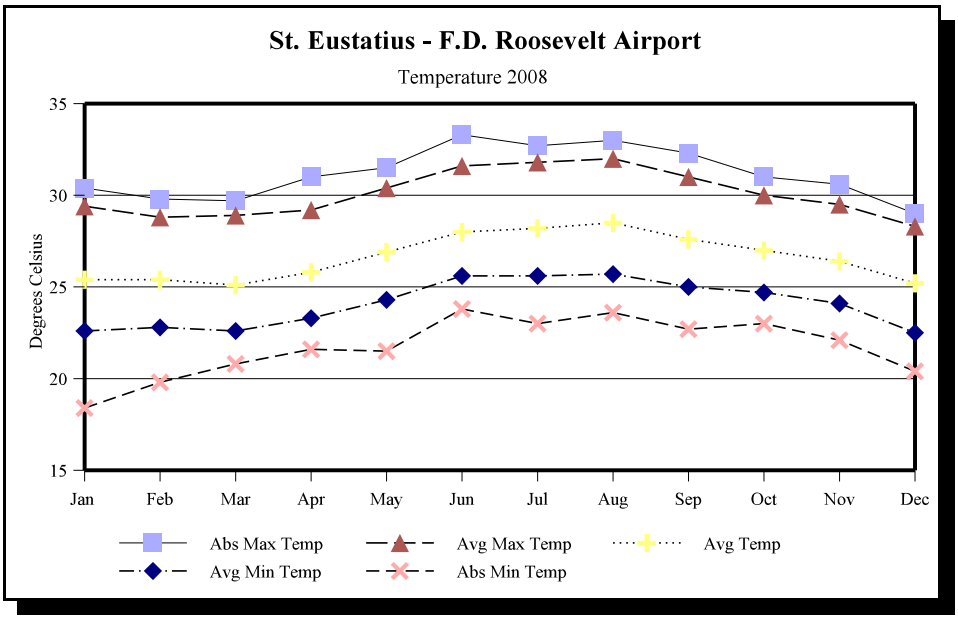
RAINFALL

Especially due to the passage of hurricane Omar in mid October, this month was very wet.
November was wet as well due to the presence of various active disturbances.
Due to technical problems with the rainfall gauges during the months April, May and June 2008 the Meteorological Service cannot produce a complete data set for the year 2008.



TEMPERATURE

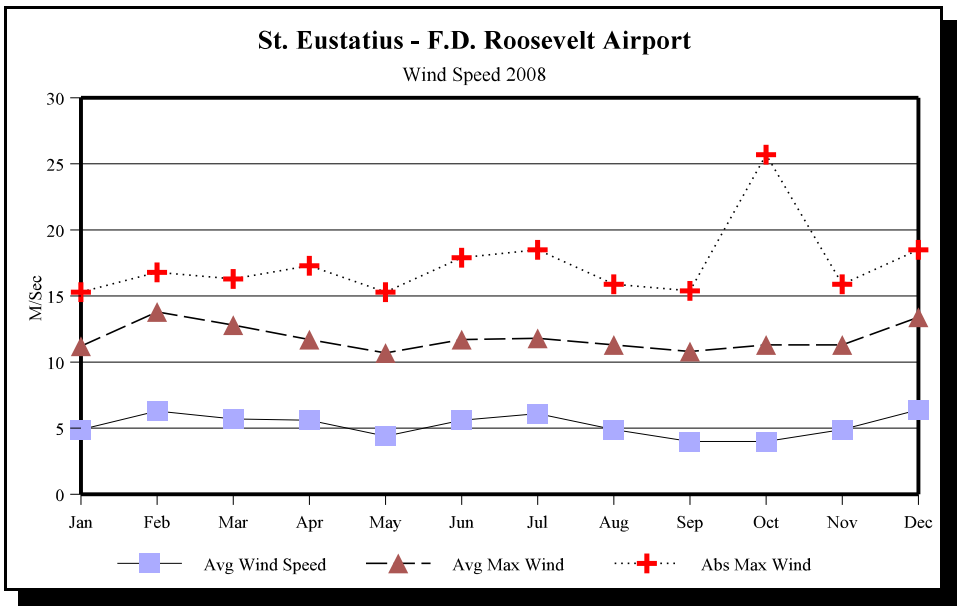
The average air temperature as recorded at Roosevelt Airport over the year 2008 was **26.6**°C (normal 26.9°). August was the warmest month with an average temperature of **28.5**°C and had also the highest average maximum temperature of **32.0**°C. The absolute maximum temperature, **33.3**°C, was recorded on June 14 at 12:35 hours. The hottest day of 2008 was on August 22.



March was the coolest month with an average temperature of **25.1**°C. The lowest monthly average minimum temperature of **21.8**°C was recorded in January and in March. The absolute minimum temperature was **18.4**°C and was recorded on January 9 at 06:06 hours local time.
The coolest days of 2008 fell on January 9 and February 1, both with an average temperature of **23.6**°C.

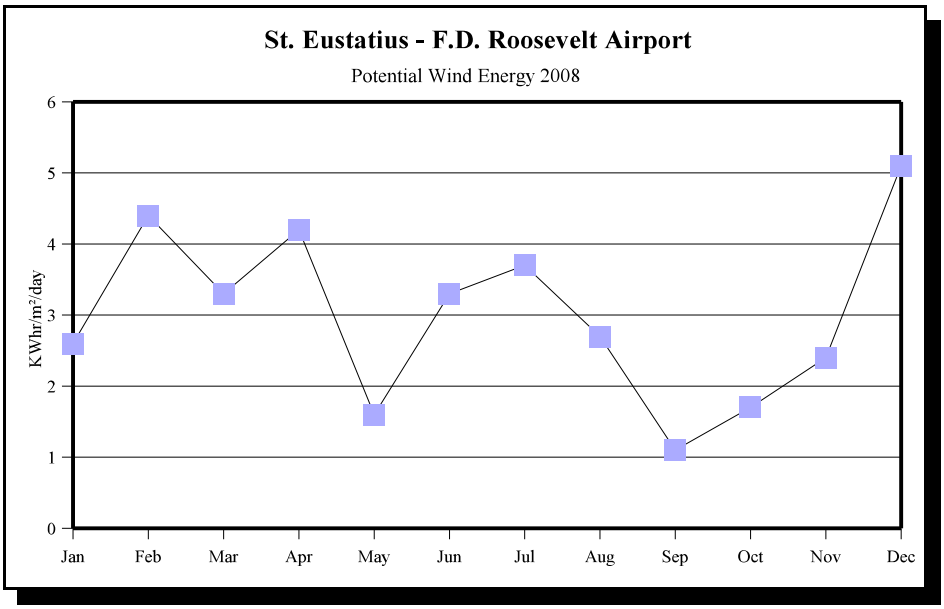
WIND

The average wind speed for 2008, at 10 m of height, recorded at the Roosevelt Airport was 5.2 m/sec (18.7 km/hr). December was the month with the highest average wind speed 6.4 m/sec (23.0 km/hr). September and October had the lowest average wind speed of 4.0 m/sec (14.4 km/hr). The highest wind gust 25.7 m/sec (92.5 km/hr) was recorded on October 16 at 08:09 local time.



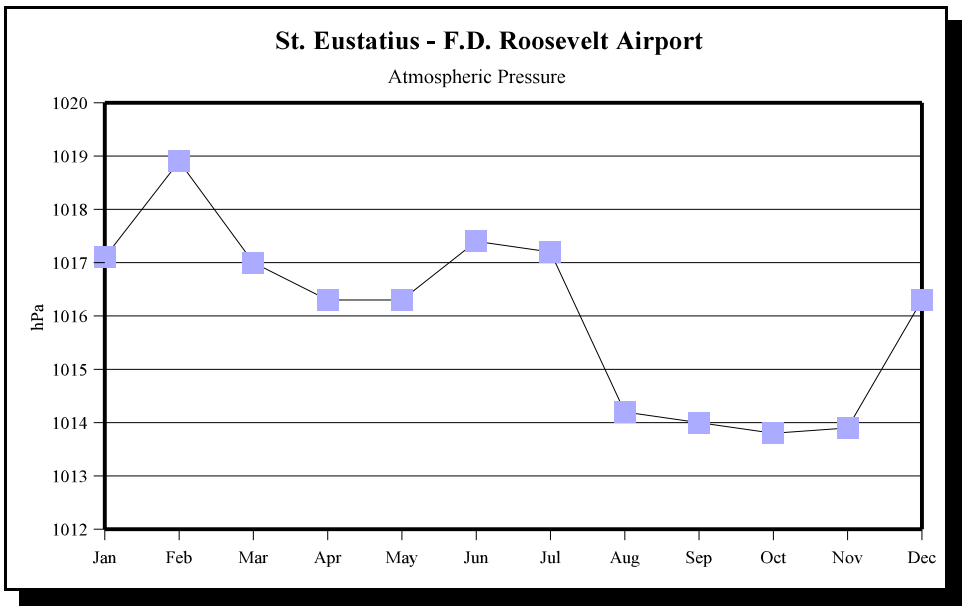
POTENTIAL WIND ENERGY

The total potential wind energy (at 10m height and wind speeds ≥4 m/sec) for the year 2008 was 1074 kWh/m^2 The daily average for 2008 was 3.0 kWh/m^2/day.



ATMOSPHERIC PRESSURE

The average atmospheric pressure recorded at F.D. Roosevelt Airport the year 2008 was 1016.0 hPa. The maximum atmospheric pressure of 1023.2 hPa was recorded on the February 19 while the minimum atmospheric pressure of 1004.7 hPa was recorded on October 16.



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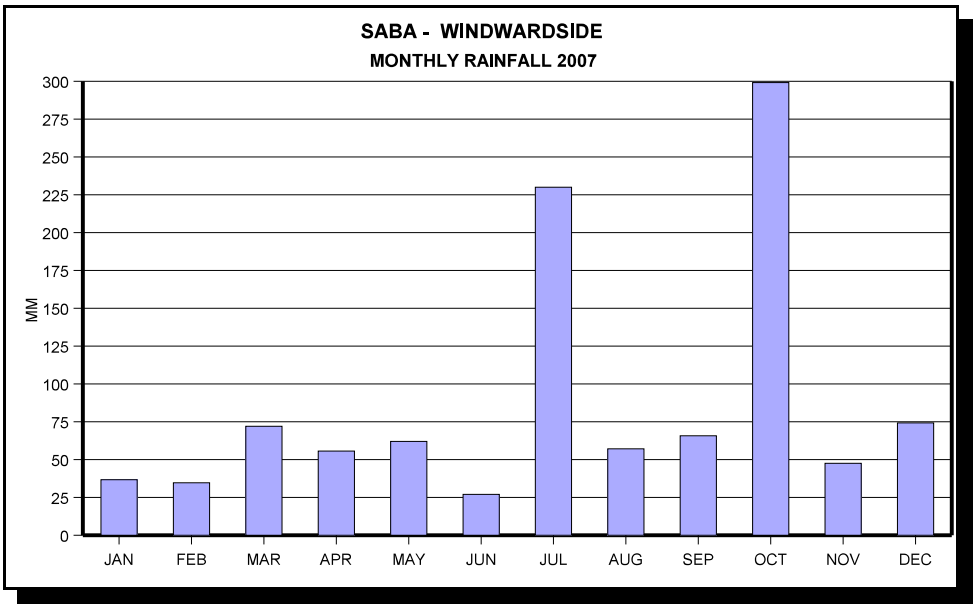
Saba

RAINFALL

The total rainfall for the year 2007 measured at Windwardside, Saba was 1061.8 mm; just above the long-term average of 1050.4 mm.
October was the wettest month with a total of 299.2 mm while June was the driest month with a total of 27.0 mm. The 24-hour maximum for 2007 was 191.0 mm measured on July 20.
The number of days with rainfall 1.0 mm or more was 51.



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METEOROLOGICAL SERVICE NETHERLANDS ANTILLES & ARUBA

CLIMATOLOGICAL DATA 2008

Total Rainfall (in mm)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	37.5	23.0	38.0	19.6	4.8	18.2	48.6	67.7	36.0	211.4	193.0	79.0
St. Maarten	87.8	88.6	46.4	45.6	33.2	79.8	91.0	232.6	257.6	244.4	97.4	---.--
Aruba	25.4	5.2	4.4	6.0	0.6	41.6	19.2	53.2	93.2	270.2	136.2	107.0
Bonaire	17.0	13.2	14.4	3.0	0.4	10.6	11.2	17.8	18.0	196.2	193.0	38.2
St. Eustatius	10.8	27.4	50.2	--.--	--.--	--.--	26.8	78.6	223.6	211.8	84.0	23.4

Average Temperature (in ° Celsius)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	26.6	26.6	26.7	27.4	27.9	28.2	28.3	29.0	29.2	27.8	27.3	26.5
St. Maarten	24.7	24.4	24.5	25.3	26.9	27.8	28.3	28.1	28.0	27.5	27.0	---.--
Aruba	27.1	27.2	27.4	28.0	28.5	28.9	29.0	29.6	29.8	28.4	28.0	26.9
Bonaire	27.1	26.9	27.1	27.9	28.5	29.0	29.1	30.0	30.5	28.9	28.2	27.4
St. Eustatius	25.4	25.4	25.1	25.8	26.9	28.0	28.2	28.5	27.6	27.0	26.4	25.2

Absolute Maximum Temperature (in ° Celsius)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	31.0	31.6	32.0	33.1	33.2	33.5	33.4	34.7	35.9	33.4	31.9	30.7
St. Maarten	28.9	28.4	28.7	30.1	30.9	31.9	32.3	32.4	32.3	32.3	31.5	---.--
Aruba	31.5	31.8	31.9	32.5	33.1	33.9	33.7	34.9	34.9	34.3	32.5	31.6
Bonaire	31.6	31.6	31.8	33.1	33.0	33.7	34.2	34.8	36.3	34.8	34.2	32.4
St. Eustatius	30.4	29.8	29.7	31.0	31.5	33.3	32.7	33.0	32.3	31.0	30.6	29.0

Absolute Minimum Temperature (in ° Celsius)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	21.7	21.4	22.8	23.8	24.2	24.5	22.3	23.7	23.2	23.2	23.7	21.7
St. Maarten	20.0	19.1	20.1	20.3	20.4	23.0	23.9	24.2	22.6	22.5	23.9	---.--
Aruba	21.8	22.6	23.8	23.7	24.7	23.9	25.2	23.9	23.7	23.7	24.1	22.5
Bonaire	21.4	21.0	22.5	23.3	25.0	23.4	23.9	24.1	23.6	23.3	23.1	21.9
St. Eustatius	18.4	19.8	20.8	21.6	21.5	23.8	23.0	23.6	22.7	23.0	22.1	20.4

Average Minimum Temperature (in ° Celsius)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	24.1	24.3	24.2	25.1	25.5	26.0	25.7	26.2	26.4	25.2	25.1	24.3
St. Maarten	22.1	22.0	22.1	22.7	24.5	25.6	25.7	25.9	25.5	24.8	24.8	---.--
Aruba	24.4	24.7	25.1	25.7	26.2	26.7	26.6	27.0	27.2	25.9	25.5	24.3
Bonaire	24.2	24.4	24.7	25.6	26.3	26.7	26.4	27.1	27.6	26.0	25.5	24.5
St. Eustatius	22.6	22.8	22.6	23.3	24.3	25.6	25.6	25.7	25.0	24.7	24.1	22.5

Average Maximum Temperature (in ° Celsius)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	30.1	30.5	30.7	31.4	31.8	32.0	32.2	32.9	33.3	31.0	30.0	29.3
St. Maarten	28.0	27.5	27.9	28.3	30.0	30.9	31.4	26.8	31.0	31.2	30.6	---.--
Aruba	30.8	31.2	31.4	31.7	32.3	32.6	32.7	33.4	33.2	31.5	31.3	30.3
Bonaire	30.9	31.0	30.9	31.7	32.2	32.5	32.9	33.8	34.5	32.5	31.8	31.3
St. Eustatius	29.4	28.8	28.9	29.2	30.4	31.6	31.8	32.0	31.0	30.0	29.5	28.3

METEOROLOGICAL SERVICE NETHERLANDS ANTILLES & ARUBA

CLIMATOLOGICAL DATA 2008

Average Wind Speed (in m/sec)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	5.6	6.1	6.0	6.0	5.8	6.0	5.3	4.6	3.9	4.3	4.4	5.5
St. Maarten	4.2	5.7	5.0	5.3	4.2	4.8	4.9	4.4	3.6	3.7	4.2	--.--
Aruba	6.5	7.7	7.8	7.9	7.7	8.4	7.3	5.5	5.1	5.0	4.7	5.3
Bonaire	5.5	6.6	6.6	7.2	7.0	7.5	6.5	5.0	4.7	4.5	4.2	4.7
St. Eustatius	4.9	6.3	5.7	5.6	4.4	5.6	6.1	4.9	4.0	4.0	4.9	6.4

Average Max. Wind Speed (in m/sec)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	12.2	12.8	12.6	12.8	12.2	13.3	12.8	11.7	11.2	12.2	11.2	12.8
St. Maarten	11.2	13.8	12.2	12.2	10.2	11.7	11.7	11.7	10.2	11.7	10.7	---.--
Aruba	14.3	15.3	15.3	15.3	15.3	15.8	14.8	12.8	12.3	12.9	11.8	12.9
Bonaire	12.8	13.8	13.8	14.3	13.8	14.8	13.8	12.2	11.7	11.7	11.3	12.3
St. Eustatius	11.2	13.8	12.8	11.7	10.7	11.7	11.8	11.3	10.8	11.3	11.3	13.4

Absolute Max. Wind Speed (in m/sec)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	15.3	14.5	15.3	15.8	15.8	17.9	16.8	17.3	14.3	19.9	17.3	20.9
St. Maarten	16.3	17.9	15.8	19.4	14.8	17.9	17.3	15.8	16.3	33.7	16.3	---.--
Aruba	17.9	17.3	18.9	18.4	18.4	19.9	17.9	16.8	17.5	20.0	15.4	18.0
Bonaire	16.3	16.8	16.8	17.3	17.9	18.4	21.4	18.4	15.8	21.4	17.0	17.0
St. Eustatius	15.3	16.8	16.3	17.3	15.3	17.9	18.5	15.9	15.4	25.7	15.9	18.5

Average Potential Wind Speed (in kWh/m²)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	2.9	3.7	3.4	3.4	3.2	3.4	2.4	2.0	1.2	1.8	1.6	2.9
St. Maarten	1.7	3.1	2.2	3.1	1.3	2.3	2.0	1.7	0.8	1.4	--.--	--.--
Aruba	4.9	7.9	7.7	7.8	7.4	9.2	6.8	3.9	3.0	2.9	1.9	2.7
Bonaire	3.3	5.5	5.1	6.1	6.1	6.7	5.0	2.9	2.3	2.1	1.6	2.1
St. Eustatius	2.6	4.4	3.3	4.2	1.6	3.3	3.7	2.7	1.1	1.7	2.4	5.1

Air Pressure (in hPa)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	1013.5	1014.5	1013.8	1011.9	1012.3	1012.8	1013.2	1011.1	1010.5	1010.9	1010.6	1013.1
St. Maarten	1017.4	1019.3	1018.2	1016.9	1016.4	1017.6	1017.4	1014.2	1014.1	1014.1	1013.8	------.--
Aruba	1013.0	1013.9	1013.2	1011.2	1011.6	1012.1	1012.6	1010.7	1010.0	1010.6	1010.3	1012.8
Bonaire	1013.7	1014.7	1014.0	1012.1	1012.5	1013.1	1013.5	1011.3	1010.8	1011.2	1010.8	1013.2
St. Eustatius	1017.1	1018.9	1017.0	1016.3	1016.3	1017.4	1017.2	1014.2	1014.0	1013.8	1013.9	1016.3

Sunshine Duration (in hours)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	9.0	9.7	9.5	8.9	9.2	8.1	9.1	9.6	9.1	6.6	6.8	7.9
St. Maarten	8.4	9.0	8.5	9.1	8.6	8.0	9.0	8.3	7.5	7.5	8.6	8.7

Cloud Coverage (in %)

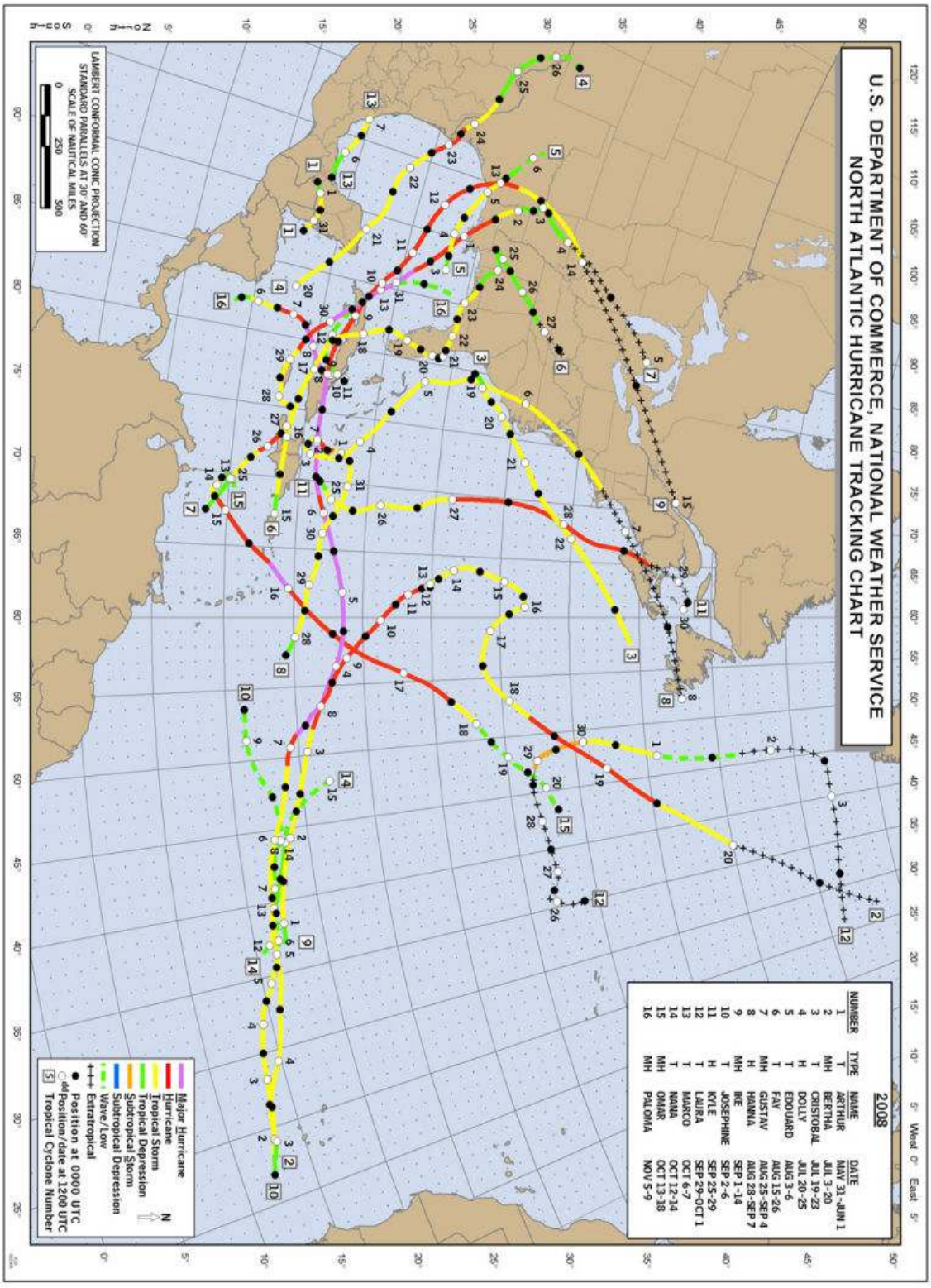
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	39.0	37.0	48.0	57.6	54.0	59.4	51.0	49.0	51.9	60.0	60.2	44.0
St. Maarten	41.0	43.0	45.0	43.0	45.5	56.3	45.0	52.0	65.7	60.0	43.0	39.7
Bonaire	47.7	48.0	50.2	56.2	56.1	57.6	51.7	52.0	55.0	65.8	63.6	45.9

Average Evaporation per Day (in mm)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	5.2	6.1	6.7	7.2	7.6	7.5	--.--	--.--	--.--	5.4	4.9	5.1
St. Maarten	3.1	5.3	5.4	6.5	7.3	7.1	7.0	6.2	5.2	5.0	4.0	5.6

Average Global Radiation (in kWh/m²)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Curaçao	165.9	161.8	186.4	178.6	190.8	186.2	193.5	172.9	178.8	144.0	131.5	156.3
St. Maarten	138.6	155.0	174.1	158.0	191.8	160.5	181.4	152.8	165.3	-----.--	-----.--	-----.--



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