



ANNOUNCEMENTS

This issue presents a summary of Caribbean weather and climate for the year 2011. CAMI will begin an e-discussion on issues related to weather and climate in agriculture, particularly issues that arose during the 2011 CAMI farmers' forums. So stay tuned. CAMI completed training in Crop Simulation Modelling using the DSSAT software during January 2012. The next training workshop is on crop water use and irrigation.

The Caribbean and the world is getting hotter, with 2011 being one of the warmest years on record, and humans are to blame, says a report by the World Meteorological Organization. Based on reports coming out of WMO, Global temperatures in 2011 are currently the tenth highest on record and are higher than any previous year with a La Nina event, which has a relative cooling influence. Last year (2011), the global climate was influenced heavily by the strong La Nina, a natural phenomenon usually linked to extreme weather in Asia-Pacific, South America and Africa, which developed in the tropical Pacific in the second half of 2010 and continued until May 2011.

REGIONAL OVERVIEW ON RAINFALL FOR 2011

Over the calendar year, rainfall conditions in the eastern Caribbean, including Guyana, were normal to above normal. Trinidad and Tobago were normal; Grenada and Antigua moderately wet; St. Lucia very wet; Barbados and St. Vincent extremely wet; Dominica exceptionally wet; and Guyana abnormally wet in the west and normal in the east. Jamaica was abnormally wet, and rainfall in Belize ranged from moderately dry in the west to normal in the extreme north and south.

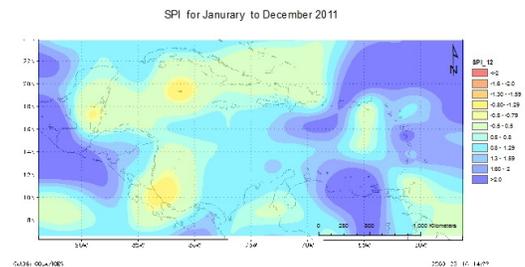


Figure 1. Standardised Precipitation Index (SPI) for the Caribbean for the 12 month period January to December, 2011. More information on the SPI can be viewed at <http://63.175.159.26/~cdpmn/spimonitor.html>.

For the quarter January to March 2011, the eastern portion of the chain was normal to wet. Trinidad was extremely to exceptionally wet whilst Tobago, Grenada and St. Vincent were extremely wet. Barbados experienced abnormally wet conditions, but Dominica was moderately wet. Conditions in St. Lucia and Antigua were normal. Conditions in Guyana ranged from Moderate to exceptionally wet. Jamaica was normal for the period and Belize moderately dry.

For the second quarter, rainfall totals were normal to above normal in the eastern Caribbean. Grenada was normal; Tobago abnormally wet; St. Vincent and Antigua moderately wet; Dominica very wet; and Barbados and St. Lucia extremely wet. Rainfall in Guyana ranged from normal in the west to abnormally dry in the east. Jamaica experienced rainfall from abnormally wet in the west to very wet in the east. Belize's rainfall was normal.

For the period July to September 2011, apart from Tobago that was moderately dry and Trinidad normal, the eastern Caribbean had above normal

rainfall for the three month period. Grenada and Barbados were abnormally wet; St. Lucia moderately wet; St. Vincent and Antigua, extremely wet. Conditions in Guyana ranged from normal in the west to moderately dry in the east. Jamaica experienced very wet conditions in the extreme west but this changed to normal toward the east. In Belize the rainfall experienced ranged from normal in the south to moderately wet in the north

islands of the eastern Caribbean was normal to above normal. Tobago, St. Vincent, St. Lucia, and Antigua were normal; and Barbados abnormally wet. Conditions in Guyana ranged from moderately wet in the north to normal in the south during the three month period. Jamaica was normal and Belize normal to abnormally dry.

NATIONAL OVERVIEWS OF WEATHER AND CLIMATE FOR 2011

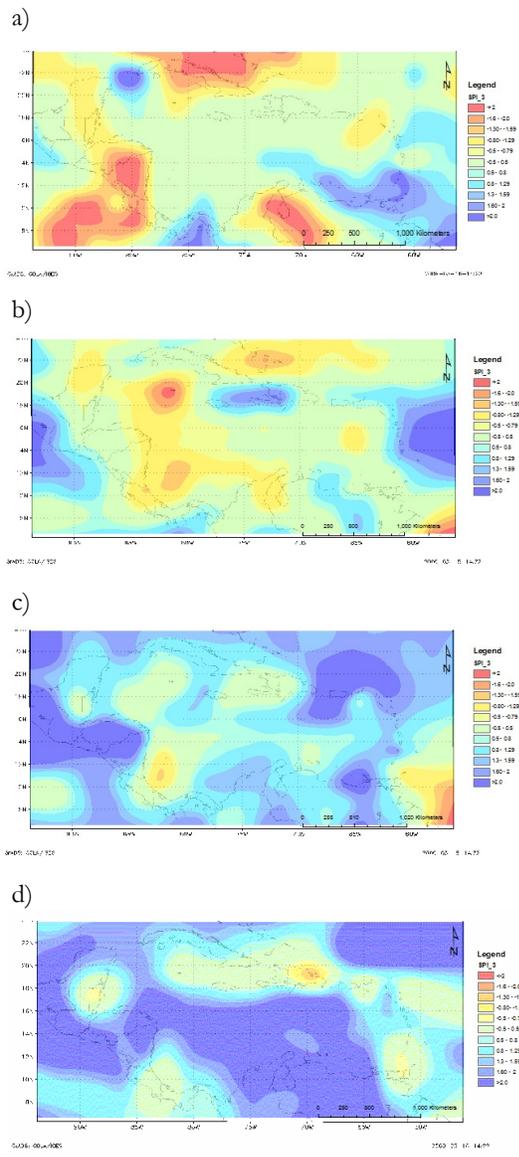


Figure 2. SPI maps for the Caribbean for the four quarters of 2011; a) January to March; b) April to June; c) July to September; and d) October to December. More information on the SPI can be viewed at <http://63.175.159.26/~cdpmn/spimonitor.html>

In the final quarter of the year, apart from Grenada and Trinidad that were abnormally dry, rainfall in the

Antigua and Barbuda

Antigua experienced above normal rainfall during 2011. The total for the year was 1609.60 mm; which was 136% of the normal total (1981 – 2010). This is the highest total for a year since 1992 and the 9th highest on record. The main rain-producers were low level troughs, which were responsible for around 40% of the total. Prolonged heavy showers produced minor to moderate flash floods in low lying and flood prone areas in May, August, September, November and December. At Coolidge, the 156 rainfall days (≥ 1 mm) experienced for the year were well above normal and second on record only to 1988; meanwhile, there were 43 heavy rainfall days (≥ 10 mm), which is now the highest on record. The mean temperature (temp) of 26.5°C was below normal, and the mean daily maximum and minimum temps were well below and near normal respectively.

It was a frustrating year for all farmers as the above normal rainfall had a major impact on production. Many farmers were not able to prepare their fields as planned and some after many tries gave up all together with hopes of better conditions for 2012. Some planting was done but persistent soggy soil resulted in crop losses due to root rot, bacterial and fungal diseases. Overall crop production for 2011 was about 35% below normal.

Barbados

The 2011 Atlantic Hurricane season produced nineteen named systems, six of which became hurricanes and three becoming major hurricanes. However, none of these systems had a **direct** impact on rainfall this year, unlike 2010 when the passage of

“Tomas” accounted for 304.8 of 457.2mm of rainfall measured at the Airport in October that year.

As a result, rainfall levels in 2011 fell short of those of the previous year by about 203.2 mm. The 2011 total reached 1681mm, which represents about 457.2mm above the 30-year normal and the fifth highest rainfall year between 1942 and the present. With the exception of October, each month’s rainfall total was also well above the long-term average. The year also produced a ‘very wet’ dry season with cumulative rainfall of 507.2mm during the period January to May; this was almost twice the 30-year cumulative average of 257.8mm for this period with April alone producing some 143.3mm or twice the 30-year average for that month. On average, there were four to five more rain days ($\geq 1\text{mm}$) per month than the long-term average.

Extreme maximum temperatures during the year 2011 were marginally lower than those of 2010, showing differences of just 0.1 to 0.8°C. However, the lowest minimum temperatures were generally cooler this year when compared with those of 2010; the lowest minimums showed differences of between 1.1 and 1.8°C. The absolute lowest minimum of 20°C was observed on December 19th.

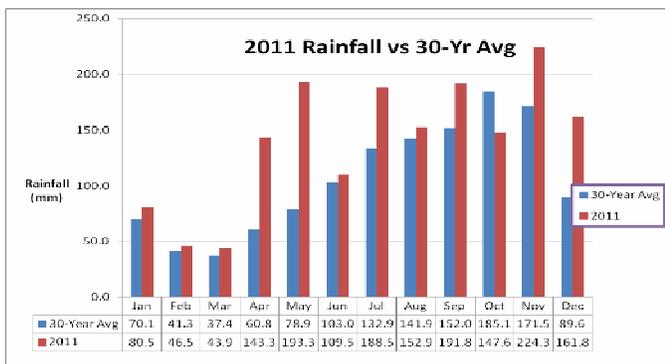


Figure 3. Monthly rainfall totals for 2011 at Grantley Adams Airport in Barbados compared with the 30 year average

Belize

The first quarter of the year (January to March) normally represents the period for the highest incidence of frontal incursions. The year 2011 saw 4 crossing the country in January, 2 in February and 1 in March. No minimum temperature or rainfall records were broken during the quarter. However, low temperatures in January ranged between 12 to

19°C at the beginning of January. Baldy Beacon, which is located at an altitude near 3,000ft, recorded the lowest temperature of 10°C in mid January. February traditionally represents the start of the dry season. This year was quite different as most stations measured rainfall totals well above average. Rainfall amounts ranged from 40mm in the north to 160mm in the south. For March, high temperatures reached near 38°C at Chaa Creek in western Belize. The second quarter (April to June) represents a continuation of the warm and mostly dry weather. Rainfall is very limited and for many stations the total rainfall was nil. Many more stations recorded maximum temperatures ranging between 37 to 44°C. Central Farm in the west of the country recorded 44°C, followed by Chaa Creek with 40°C, Belize Zoo with 39°C and Belmopan and Hershey in central Belize with 38°C. Barton Creek in the west recorded the highest one day total of 97mm. In June, the rainy season showed several locations over northern and central Belize registering rainfall totals well above normal. Some 24 hour totals included 141mm at Belize Zoo, 99mm at Tower hill and 92mm at Central Farm. Big Falls Plantation in the south recorded the highest 24 hour total with 190mm. July showed all stations registering totals above normal. The International Airport recorded the highest 24 hour total for July of 102mm, followed by Punta Gorda town with 99mm.

August to October is the heart of the rainy season. For August, Punta Gorda recorded the highest one day total of 251mm. September witnessed several stations in the south registering high rainfall values. Punta Gorda recorded a one day total of 258mm, followed by Savannah with 120mm and Barton Creek in the west with 120mm. In October, the International Airport recorded the highest one day rainfall total of 106mm followed by La Democracia with 128mm. Rainfall totals measured above normal for southern, central and coastal Belize. In November, three (3) cold fronts crossed the country. Low temperatures fell to 10°C at Badly Beacon in the Mountain Pine Ridge. For most stations, the mean minimum temperature for November ranged below normal. For December lowest temperatures ranged from 10°C at Rio Bravo in northwest Belize to 12°C at Tower hill and Libertad in the north.

In comparing this year's temperature and rainfall statistics, the weather pattern appeared generally normal. The months when temperatures would normally be cooler were as expected. Rainy season months were also as normal even though the favoured location for highest rainfall (the extreme south) registered rainfall totals which broke the previous records for highest monthly total. Punta Gorda's rainfall total in July and September of 1468mm and 950mm were record setting. No records were broken with respect to the extremes in temperature. The majority of anomalies for rainfall occurred in February, when rainfall totals for many stations exceeded their normal.

Dominica

During 2011, Canefield Airport recorded 2458.5mm of rainfall. This is a record yearly total replacing that which was set in 1998 (2204.2mm) representing 142% of the 29 year average (1982-2010). Maximum rainfall was recorded in September when 416.6mm were recorded. This was followed closely by July when 410.6mm were recorded. Rainfall from Ophelia on 28th September (157.4mm) represents the maximum daily amount recorded for the year. January and July both produced record breaking rainfall amounts at the Canefield Airport.

Average temperature for 2012 was 27.5°C, which is normal for the Canefield Airport. 29.8°C was the highest monthly average recorded in June and 25.1°C was the lowest average, recorded in February. The maximum temperature recorded was 34.2°C on 9th June while the minimum was 18.4°C recorded on 13th March.

3937.6mm of rainfall were recorded at the Melville Hall Airport during 2011. This year's total amount has also broken the previous record set in 2004 by 205.8mm. November recorded the highest rainfall, while the lowest amount was recorded in February which is expected at both stations. November's rainfall was 93% greater than the long term average while February's total was 24% less than its average. The maximum daily rainfall was 158.9mm recorded on November 27th. July produced record breaking rainfall at Melville Hall.

The percentage of rainfall at both Canefield and Melville Hall during the dry season was more than

than 50% greater than the long-term average, whereas during the wet season it was greater than the long term average but by less than 40%.

The average air temperature at Melville Hall for 2011 was 26.7°C. This is the lowest yearly average in the past 30 years with the months of May, July, August, September, November and December recording its lowest monthly average. The warmest month was June with 28.7°C while the coolest month was March with 25.2°C. Maximum temperature for the year was 33.6°C recorded on June 9th and the minimum temperature was 19.5°C recorded on March 14th.

Grenada

During the year 2011 Grenada experienced a very unusual weather pattern which affected the agricultural sector significantly. Normally the dry season begins in January and ends in May which is characterized by some light rainfall in the early part and a distinct dry period for mid March to May. However the year 2011 was marked with a very wet dry season. The first 4 months of the year, plus the months of July, September and October can be categorized as above average rainfall months.

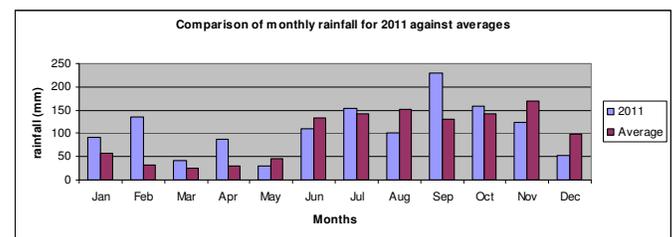


Figure 4. Monthly rainfall totals for 2011 in Grenada compared with the average

The periods of prolong and sometimes intense rainfall during 2011 impacted the agricultural sector both positively and negatively. Some of the positive impacts were as follows:

- Consistent supply of vegetables including pumpkins and sweet cassava, root crops (like ginger, carrots dasheen and yams), banana and plantains
- A bumper crop of avocados, nutmegs, cocoa, golden apples and breadfruits.
- Adequate supply of water in our rivers and streams.

- d) An abundance of forage materials for both small and large ruminants (Livestock)

The notable negative effects are listed hereunder:

- a) A poor crop of Citrus and Mangoes since these crops need a marked dry spell for flowering.
- b) Flooding in some low lying areas which damaged crops and several irrigation systems.
- c) A very minimal yield of Sorrel and Pigeon Peas which are usually in very high demand for the Christmas Season.
- d) A significant number of landslides which resulted in soil loss and heavy siltation of rivers and streams.

Guyana

For the first six months of 2011, the average monthly rainfall was below the long term monthly average. The only months where this was not the case were February and March. The total rainfall that was experienced in March, at all the rainfall stations, was above the long term average and in more than 90 % of the stations, March 2011 will be known as the March with the highest total rainfall in the recorded climatological history of the country.

The synoptic system that was responsible for the extreme weather in February and March was the Inter Tropical Convergence Zone (ITCZ). The axis of the ITCZ was located over Southern Guyana, however due to Southern Hemispheric influence its presence was felt in all Regions across Guyana. Though the ITCZ was the major contributing factor to the significant amounts in rainfall values, the presence of the La Niña phenomenon also contributed with minimal effect.

Some of the notable total rainfall values for March 2011 are: 923.0 mm recorded at Leguan, Region 3; 595.9 mm at Grove Mahaicony, Region 4; 516.1 mm at Grass Hook and 494.9 mm at Foulis both in Region 6. Some of the accumulated rainfall figures for the month of February are; 777.6 mm at St. Deny Mission, Region 2 and Leguan Region 3 which recorded 624.3 mm. The highest one-day total rainfall for this period was 227.0 mm which was recorded at De Kinderen Back Region 3 on March 13.

Although for the first six months the accumulated rainfall was below the Climatological Average (1967-1997), the total average monthly rainfall and rain-days allowed for this period to be classified as Wet, with an average 304.5 mm rainfall and 10 rain-days. Climatologically, these six months receive 183.2 mm and 9 rain-days.

Temperatures for the first half of 2011 generally were higher than the Climatological Average for most of the stations located across Guyana. The highest temperature recorded for the period January to June was 36.7°C at Lethem, Region 9 towards the south of Guyana.

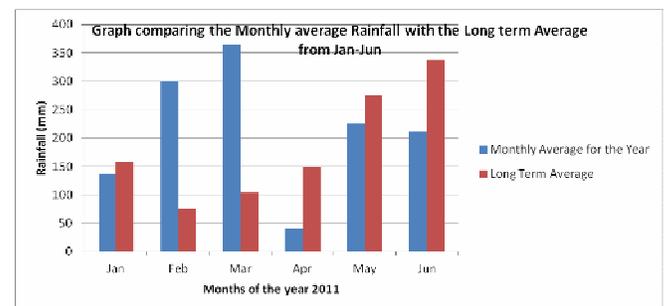


Figure 5. Monthly rainfall totals for 2011 compared with the average for the first six months in Guyana

The remaining six months saw the trend of below average continuing. Similar to the first half, two months received above average rainfall, July and December. Most of Guyana's weather for this period was influenced by ridging which was a direct result of the active Atlantic Hurricane season. This feature results in mostly fair weather across Guyana. During October, the rainfall amounts were above Climatological Average because of the passage of tropical waves towards the North of Guyana, producing significant rainfall amounts along Guyana's Coastline. December's rainfall was caused by low level and mid-level troughs and upper level support in the form of a ridge pattern aloft. Also in the second half of 2011, residents along the Coast had the opportunity to witness a very rare meteorological phenomenon in these parts of the continent, the Waterspout.

The second half of the year for Guyana could be classified as moderately wet with a six month average of 164.5 mm of rainfall per month, compared with 187.8 mm which is the Climatological Average. St.

Deny Mission in Region 2 recorded the highest rainfall for this period of 661.4 mm in October and Grove Mahaicony in Region 4 the second highest of 577.0mm in December.

The highest maximum temperature for the six month period was recorded at Timehri in August with 36.7°C. Temperatures throughout these six months were warmer than their Climatological Average.

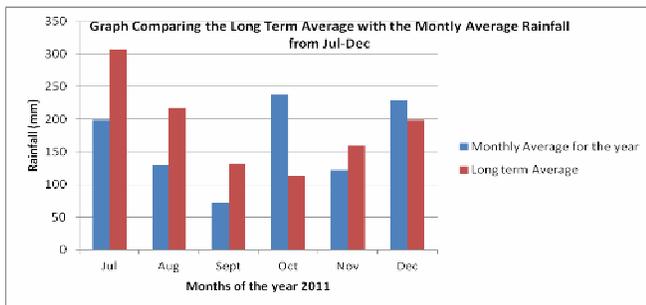


Figure 6. Monthly rainfall totals for 2011 compared with the average for the last six months in Guyana

Jamaica

A synopsis of Jamaica’s rainfall and temperature patterns for 2011, indicates that Jamaica experienced higher than average temperatures and below average rainfall in most areas. The Caribbean and the Atlantic basin experienced well above average named tropical storm activity, however most of these systems had very little impact on Jamaica’s weather. This was due mainly to semi-permanent high pressure systems which dominated weather across Jamaica as well as the northwestern Atlantic. This resulted in higher temperatures and reduced rainfall activities across most parishes.

Jamaica 2011 Rainfall

Jamaica’s rainfall pattern consists of two peak periods with higher values of rainfall and corresponding periods of lower rainfall amounts. The primary peak occurs in October and the secondary in May. The lowest amounts are at a minimum during the period February to March and the month of July. Deviations from this pattern do occur year to year.

Table 1, shows an average distribution of the mean rainfall reported for each month in 2011. This data is also compared with the 30 year mean. The maximum

rainfall recorded during the period was 291mm in June. This was due mainly to the late migration of the Upper Level Trough that generally brings increased rainfall across the island in May. October also recorded above normal rainfall and this was due to an increase in the number of troughs and tropical waves that affected the island during the month. The rainfall data showed most months recorded below the 30- year mean. Despite the below average rainfall there were some occurrences of torrential high precipitations particularly during the two peak periods of May-June and September-October.

Table 1 Monthly mean rainfall from stations across Jamaica for 2011 along with 30 year (1971-2000) mean

Months	2011 Island Mean (mm)	% mean 30 year mean 2011	30 Year Mean 1971-2000
Jan	78	76	103
Feb	82	88	93
Mar	65	74	88
Apr	85	66	128
May	203	101	201
Jun	291	201	145
Jul	198	169	117
Aug	174	102	170
Sep	173	86	202
Oct	246	105	235
Nov	65	37	176
Dec	77	67	115

Figure 7 shows the total amount of rainfall across the island for 2011. Based on preliminary reports the majority of the rainfall was recorded over the northeastern parish of Portland and the central mountain ridge which runs through the island while dry sectors emerged for coastal areas of north-central and south-central parishes.

Jamaica 2011 Temperature

Extreme temperatures recorded for selected automatic weather stations across the island are included in Table 2. The highest maximum air temperature recorded was 37.3°C, this was recorded at Barton Isles, St. Elizabeth in July, while an extreme minimum air temperature of 13.8°C was recorded at Bunkers Hills, Trelawny in February. Although, all data has not yet been collected, the island experienced an increase in daytime maximum temperatures as well as below normal rainfall in 2011.

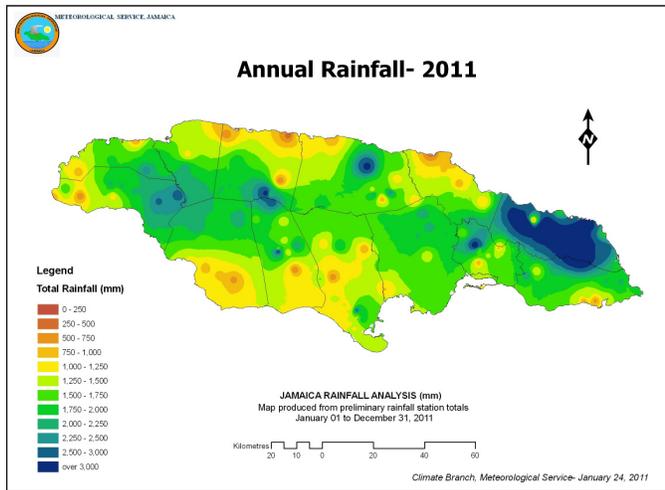


Figure 7. 2011 rainfall distribution across Jamaica.

Table 2 Extreme maximum and minimum temperatures for 2011

Climate Station	Extreme Max Temp. (°C)	Extreme Min Temp. (°C)
Barton Isles (St. Elizabeth)	37.3 (Jul)	15.6 (Feb)
Bunkers Hills (Trelawny)	34.9 (Apr)	13.8 (Feb)
John's Town (St. Thomas)	35.7 (May)	20.1 (Jan)
Mitchell Town (Clarendon)	35.2 (Aug)	18.1 (Nov)
Woodford (St. Andrew)	30.9 (Oct)	16.2 (Mar)
Manley Airport (Kingston)	34.6 (Jun)	21.2 (Mar)
Fair Prospect (Portland)	34.4 (Aug)	19.8 (Mar)
Orange River (St. Mary)	32.6 (Sep)	14.9 (Feb)
Sangster Airport (St. James)	35.0 (Sep)	19.1 (Feb)

St Lucia

The rainfall pattern for St. Lucia for 2011 differed from that of most of the previous years. For both Met. stations (at Hewanorra and George Charles airports), the monthly rainfall totals were above the long term means for most of the year.

For the Hewanorra, the mean cloud cover was 5 oktas and mean low cloud cover was 4 oktas. Winds were predominantly from the east (090) at 12 knots. The total annual rainfall was 2078.4 mm with the wettest month, surprisingly being April (in the heart of the traditional dry season) with 407.9 mm. This anomaly was caused by pressure troughs which affected the island during the second and last weeks of the month. This value (407.9 mm) is also the highest on record for April at Hewanorra since 1973. There were 191 rainfall days (≥ 1 mm) and the highest daily rainfall was 134.5 mm on the 11th of April. Mean monthly sunshine was 247.6 hours and mean daily 8.2 hours. The days of maximum sunshine (9.0 hours) occurred in February.

The mean maximum temperature was 30.4° C and the highest maximum (31.5° C) occurred in September. The mean minimum temperature was 24.8 ° C and the lowest min (23.5° C) occurred in April. The mean monthly soil temperature at a depth of 20 cm ranged from 27.0° C in January and February to 29.7° C in June and September.

For George Charles, the total annual rainfall was 2135.3 mm and the wettest month was April with 306.0 mm. There were 212 rainfall days and the highest daily rainfall (55.8 mm) occurred on the 28th of April. The monthly rainfall distribution was similar to that of Hewanorra and varied significantly from the mean monthly distribution.

Throughout the year, agricultural production, particularly bananas and plantains, was severely affected by the black sigatoka disease.

St Vincent and the Grenadines

Data collected at the E.T Joshua Airport indicates that the monthly rainfall totals for the dry season of 2010-2011 (1 December to 31 May) exceeded the monthly rainfall averages of 1979-2011. The lowest monthly rainfall totals usually occur during the months February to May, while October and November are usually the wettest months. See Figure 8. The average annual rainfall is 2,166.7mm with an average of 215 rain-days (>1 mm), but the actual rainfall for 2011 was 2879.7mm with 228 raindays - -above the averages. The highest barometric pressure was 1019.1 mb (27 Dec), and lowest was 1007.0 mb (28 Nov). The highest temperature was 32.9°C (9 Sep), and the lowest was 20.6 (12 Mar).

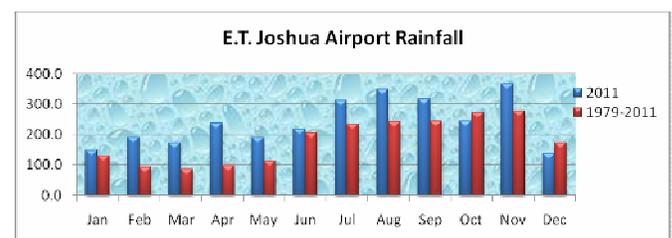


Figure 8. Monthly rainfall totals for 2011 compared with the monthly 1979-2011 averages for E.T. Joshua Airport, St. Vincent and the Grenadines

In the month of April, 236.7mm was recorded at the E.T Joshua Airport. This is more than twice the average of 92.8mm. In one rainfall event, the

northern portion of the mainland St. Vincent suffered major damage on the night of the 11th as heavy rains caused large logs and tree branches from interior mountain forest, (damaged during the passage of Hurricane Tomas in October 2010) to be transported downstream along with silt and boulders. Roads, bridges and river embankments crumbled as rivers and streams overflowed their banks. The area from Byrea Bridge to Sandy Bay was declared a disaster zone. The month of May had many thunderstorm activities throughout St. Vincent and the Grenadines (SVG). On the 29th a funnel cloud off the southeast coast of the mainland, came onshore (tornado) in the Biabou area raising debris into the atmosphere. In the Marriaqua Valley, a radio station and householders reported damages to equipment and appliances in similar conditions.

During the wet/Hurricane season, SVG was moderately wet due to a combination of troughs, Inter-tropical Convergence Zone (ITCZ) activity, tropical waves, storms, and hurricanes. On 31 July, a vigorous tropical wave with an associated low pressure dumped over 150mm of rainfall in the Arnos Vale area. There were various landslides and flooding across the islands. The low pressure system was named Emily as it passed to the north of SVG on the evening of August 1. Within a three day period (31 July 2pm to 3 August 2pm) more than 225mm of rainfall was recorded at the E.T. Joshua Airport. On 20 August, the leading edge of a disturbance pushed clouds over SVG. It was named Tropical Storm Irene as it edged near Dominica and Guadeloupe. For the following days feeder bands caused thunderstorm activity and funnel clouds across SVG. In September, Hurricane Katia and Tropical Storm Maria passed our vicinity generating large swells on the northeastern and east coast of St. Vincent. While October and December were below the monthly averages for rainfall records, November stayed well above average due to troughs and unstable conditions associated with Tropical Storm Sean.

Trinidad and Tobago

Climatologically, the Trinidad and Tobago Dry Season is during the period January to May and the Wet Season is during the period June to December.

Rainfall for Dry Season 2011 ranged between normal to above normal in Trinidad while in Tobago Dry Season 2011 was above normal. Wet Season in Trinidad and Tobago is bimodal in nature, that is, there are two peaks (July and November) observed during the season. Wet Season 2011 for Trinidad ranged from below normal to above normal, while in Tobago rainfall was mostly below normal. In both islands, primary and secondary peaks were below normal. This variation in rainfall led to an Annual rainfall for 2011 that was above normal for Trinidad and Tobago.

In Trinidad, during the month of January 2011, incidents of flooding and landslides were reported, however no impacts on agriculture were reported. There were fallen trees during June and July 2011 as a result of strong winds in parts of Trinidad and Tobago. The Wet Season was no stranger to reports of flooding and landslides which led to infrastructural damages. In August 2011 a farm was affected during the floods, however, the extent of damages to the farm was not reported. Although there were few reports received concerning the impacts of the weather on the agricultural community, seasonal rainfall for 2011 was comparatively better than 2010 within which the agricultural community felt the effects of drought.

Leaving you with scenes from the final National Farmers' Market of 2011, Grenada



Prepared by

Caribbean Institute for Meteorology and Hydrology (CIMH) and the National Meteorological Services of Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St Lucia, St Vincent and the Grenadines and Trinidad and Tobago

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