Annual Climatological Bulletin 2012

Water Resource Management Agency
Ministry of Sustainable Development, Energy, Science and Technology

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Annual Climatological Bulletin 2012

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FOREWORD

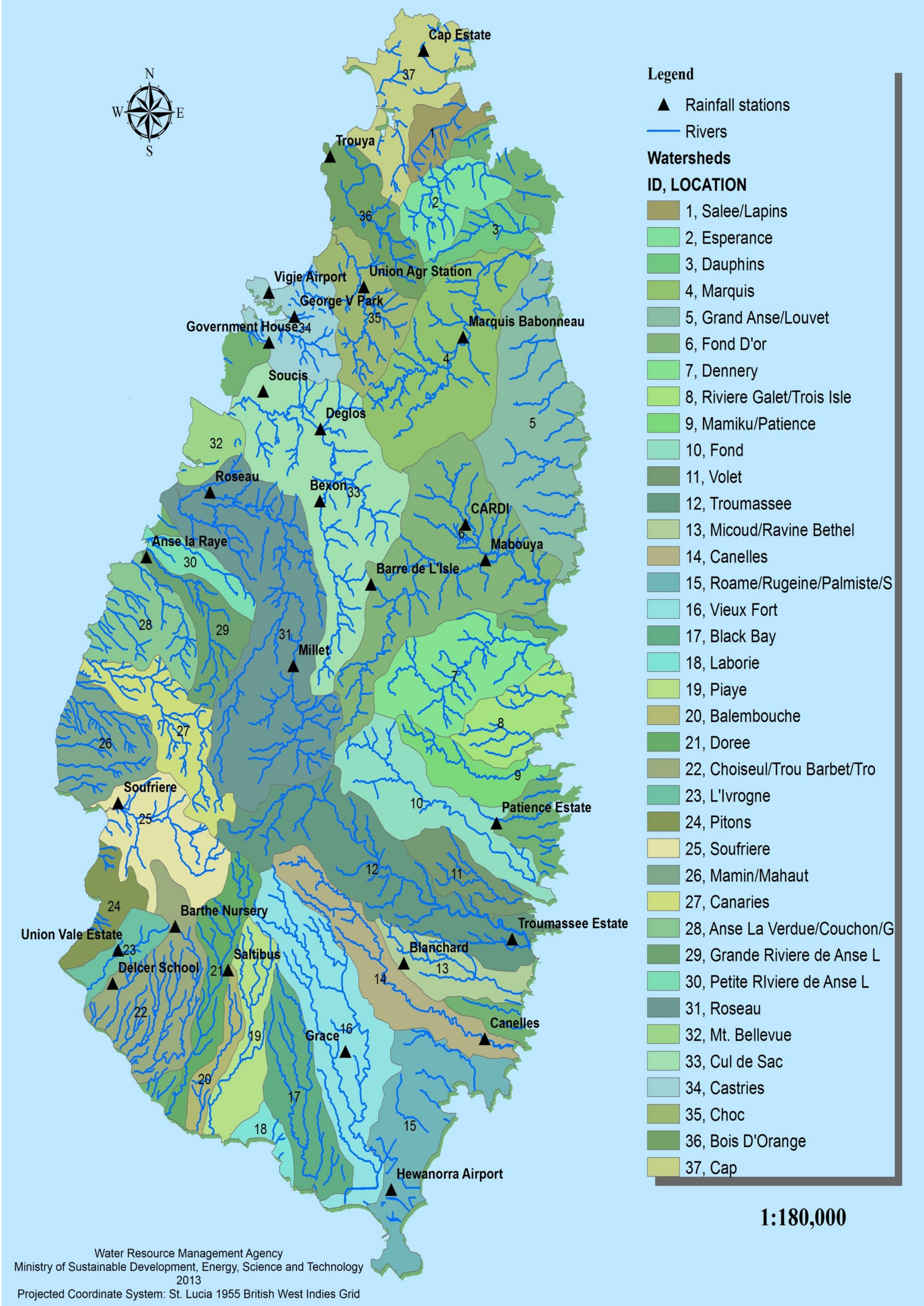
This Annual Agro-meteorological Bulletin is the first to be produced by the Water Resource Management Agency (WRMA) while under the new Ministry of Sustainable Development, Energy, Science and Technology (MSDEST). The WRMA is responsible for the management of the water resources of the country.

Data collection (agro-meteorological and hydrological) is one of the many functions of the Agency, complemented by the issuance of abstraction licensees and the monitoring of water quality and quantity in our fresh water systems. This agro-meteorological bulletin is one of the main outputs of the Agency, which will be produced on annual basis. This bulletin is aimed towards sensitizing the public on climatic data island wide.

This bulletin features Saint Lucia AGROMET Annual Summary for 2012 presented by the Water Resources Management Agency and the St Lucia Meteorological Services Department; Enhancing the Saint Lucia Hydro-Met Network with assistance from Carib-HYCOS, and Rainfall Statistics for 2011/2012 produced by the WRMA. The Ministry of Finance, Economic Affairs, Planning and Social Security also provides some very important information with respect to Global Warming and its impacts on rainfall and water distribution.

The staff of the WRMA deserves recognition for their relentless commitment, work ethics and high level of cooperation and team work demonstrated throughout the period January to December 2012. The collaboration between WRMA staff and the staff of the Saint Lucia Meteorological Services Department is the first step towards the integration and management required to sustainably manage the country's water resources and ultimately the promotion of sustainable national development.

MAP OF SAINT LUCIA SHOWING THE WATERSHEDS AND EXISTING HYDROLOGICAL MONITORING NETWORK



SAINT LUCIA AGROMET ANNUAL SUMMARY 2012

The weather statistics for 2012 for Hewanorra and George Charles Met Offices are shown in the tables below:

Average Annual Data for Hewanorra and George F.L. Charles

	Cloud Cover (oktas)	Wind Dir (°from N)	Wind Speed (kt)	Air Temp. (°C)	RH (%)	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Annual Sunshine (Hrs)	Annual Evap (mm)	Soil 20 (°C)
H	5	9	14	27.5	77	1622.7	30.3	23.8	3174	2684.2	28.6
GC	5	9	8	27.7	76	154.8	30.2	24.3			

Average Monthly Data for Hewanorra

	Cloud cover (oktas)	Wind Dir (°from N)	Wind Speed (kt)	Air Temp. (°C)	.RH (%)	Rainfall (mm)	Max Temp (°C)	Min Temp. (°C)	Annual Sunshine (Hrs)	Daily Evap (mm)	Soil20 (°C)
Jan	4	8	17	26.5	72	60.3	29.2	24	9.4	7.5	26.6
Feb	4	8	17	26.3	73	104.7	29	23.8	9.3	8.2	26.8
Ma	6	8	15	26.5	76	49.2	29.2	24.5	7.7	7.5	27.5
Apr	6	9	13	27.2	76	113.2	30.1	24.7	9.4	7.9	29
May	6	9	13	27.4	82	191.1	30.1	25.2	6.9	6.7	29.1
Jun	5	9	15	28.4	76	52.4	31	26.3	9.2	8.2	29.5
Jul	5	9	15	28.3	78	145.8	31	26	9.1	8	29.4
Aug	5	9	13	28.1	80	196	30.7	25.5	7.3	6.8	29.4
Sep	4	9	9	28.3	78	137.6	31.4	25.2	9.1	7.4	29.6
Oct	5	11	11	28.4	80	237.8	31.2	25.5	9.1	6.6	29.2

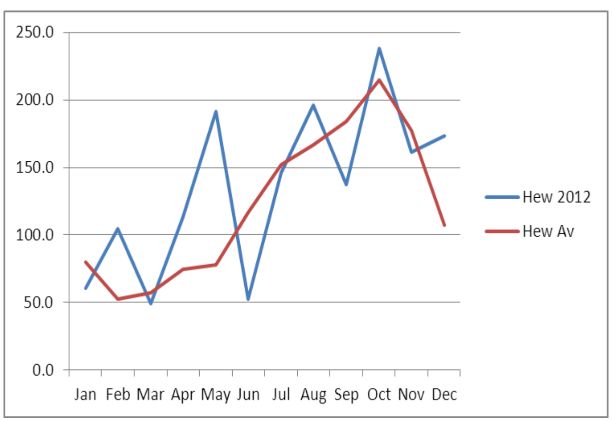
Average Monthly Data for Hewanorra											
Nov	4	8	12	28.1	77	161.4	31	25.4	9.5	7	29
Dec	4	8	12	26.8	78	173.2	29.8	23.8	8.3	6.2	27.6

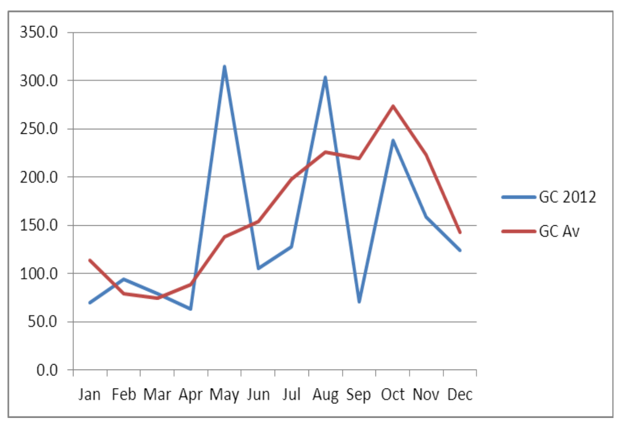
Average Monthly Data for George F. L. Charles

	Cloud Cover (oktas)	Wind Dir (º from N)	Wind Speed (kt)	Air Temp. (ºC)	RH (%)	Rainfall (mm)	Max Temp (ºC)	Min Temp (ºC)	Annual Sunshine (Hrs)	Daily Evap (mm)	Soil 20 (ºC)
Jan	4	90	10	26.4	73	69.8	28.7	23.2			
Feb	5	90	10	26.2	73	94.6	28.8	22.8			
Mar	6	90	9	26.6	75	79.3	29.1	23.6			
Apr	6	100	8	27.3	74	63	30.1	23.9			
May	6	100	8	27.5	81	315	30	24.7			
Jun	5	100	9	28.6	75	105.4	30.9	25.4			
Jul	5	100	8	28.5	77	127.5	30.8	25.3			
Aug	5	90	7	28.1	78	303.7	30.5	24.9			
Sep	5	90	5	28.9	77	70.9	31.7	24.9			
Oct	5	100	6	28.5	79	238.2	31.2	24.7			
Nov	4	90	7	28.1	76	158.4	30.8	24.7			
Dec	5	80	6	27.1	77	124.1	29.5	23.6			

Rainfall

Rainfall in Saint Lucia for 2012 was above the long term mean in the south of the island but below the mean in the north of the island. Hewanorra recorded a total of 1622.7 mm while George Charles recorded 1749.9 mm. The plotted values revealed significant variability





The rainfall at George Charles remained significantly lower than the mean after August. In fact George Charles recorded its second lowest rainfall for September since 1967.

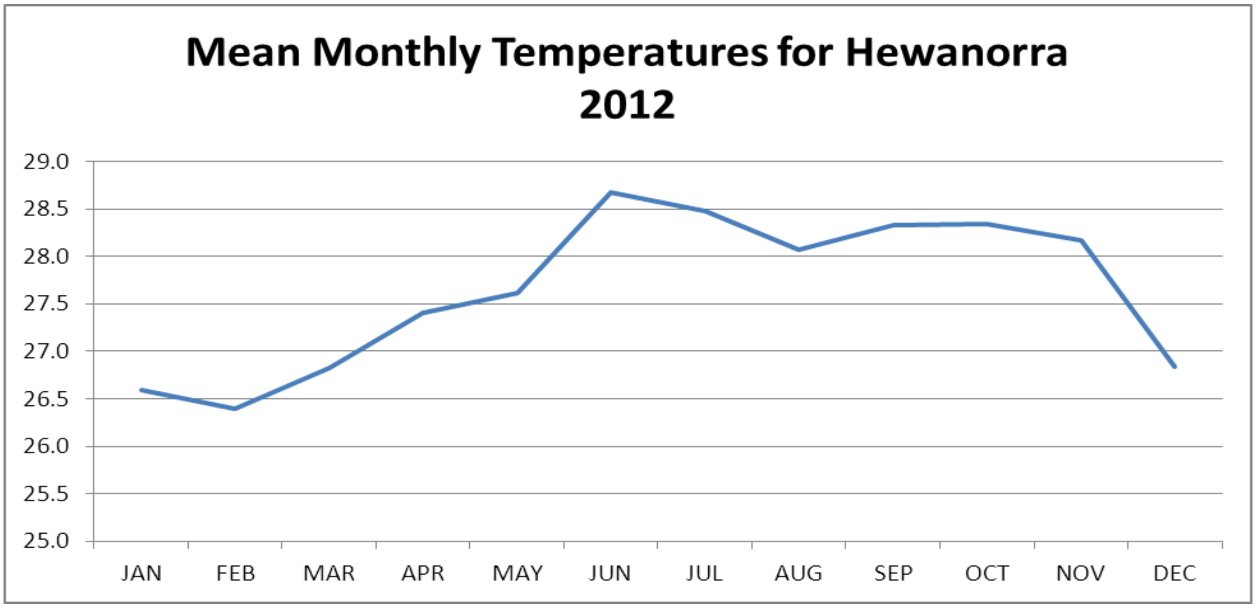
Vieux-Fort had 161 rainfall days and the highest daily rainfall was 78.4 mm on the 12th of November. The wettest month was October (237.8 mm) and the driest month was March (49.2 mm).

George Charles Met. Office had 160 rainy days and the highest daily rainfall was 71.8 mm on 24th May. The wettest month was May which produced 315.0 mm and the driest month was April which produced 63.0 mm.

Temperature

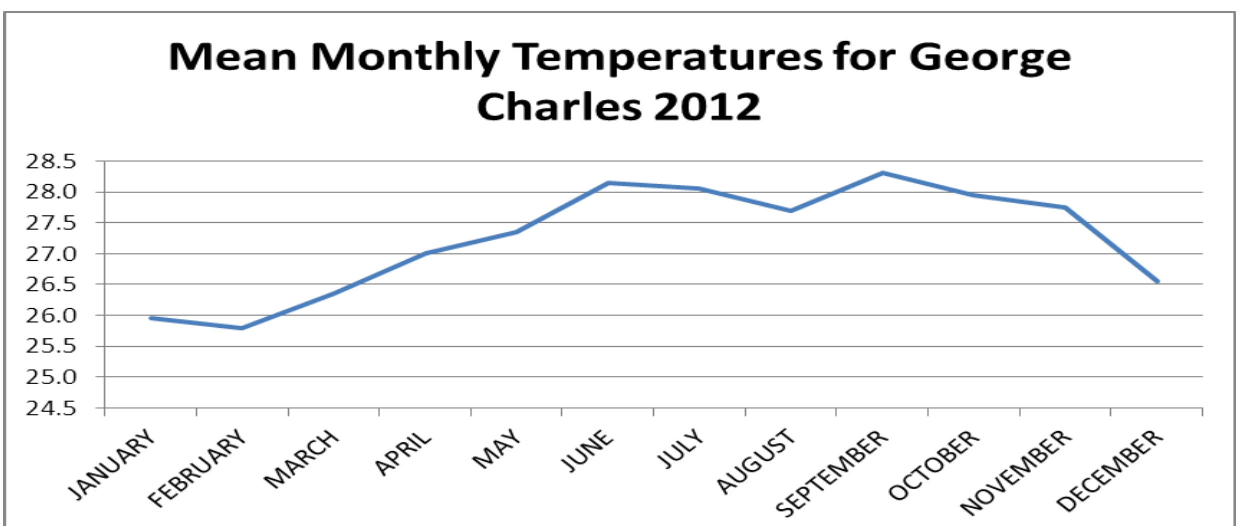
Hewanorra

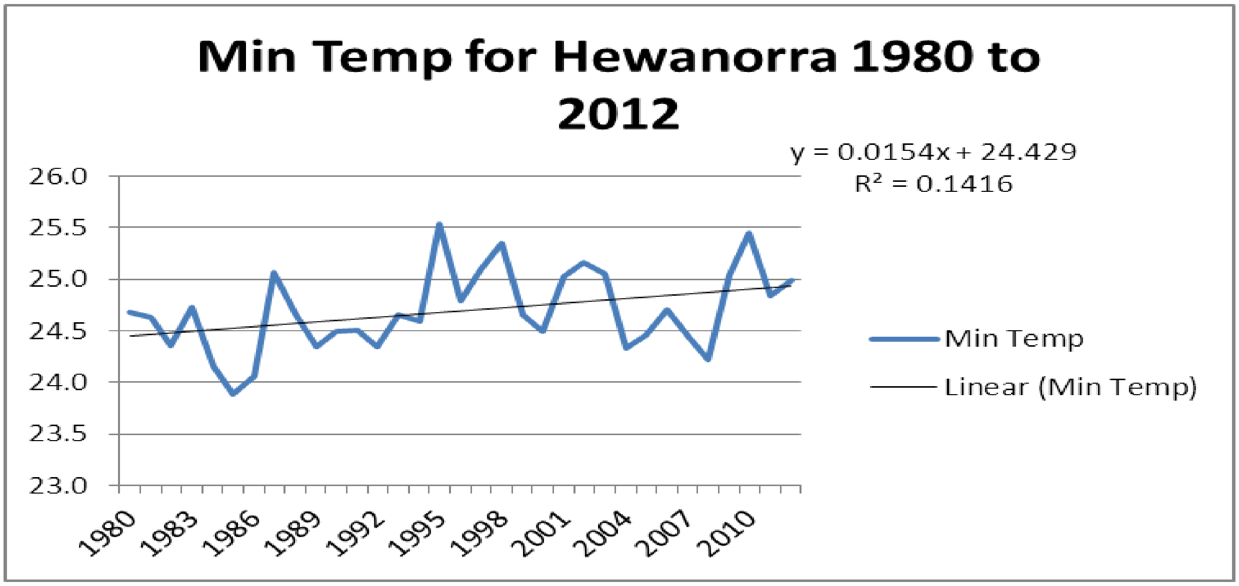
The highest maximum temperature was 32.5^{o} C in September and the lowest minimum was 20.0 ^{o}C. The warmest month was June and the coolest month was February. The annual temperature range (difference between the hottest and coldest month) was 2.3 ^{o}C.

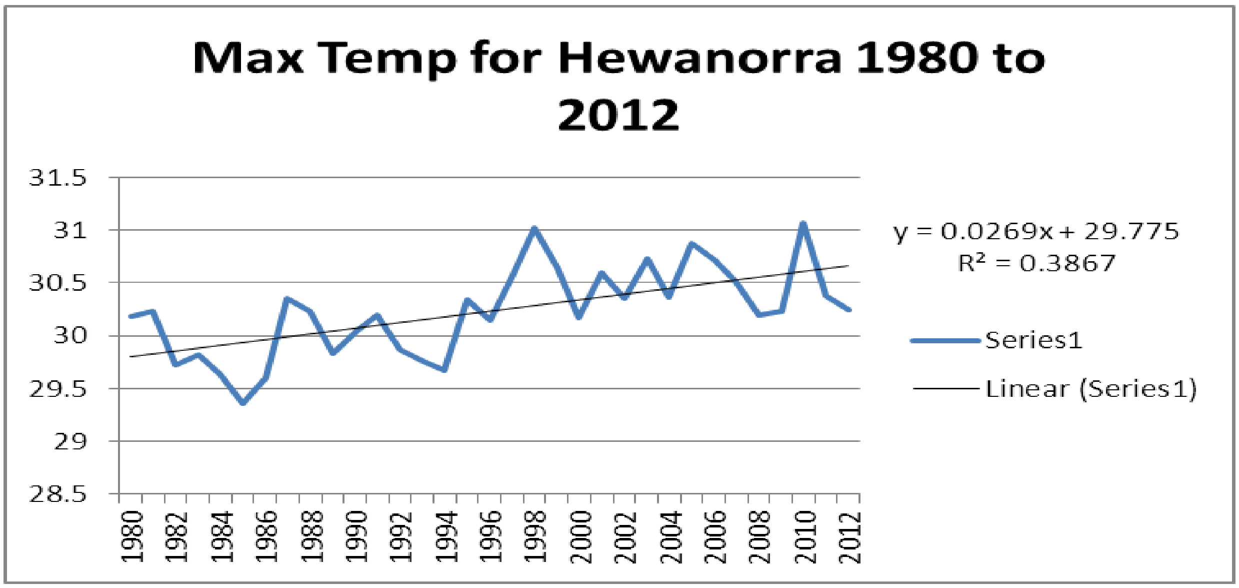


George Charles

The highest maximum temperature was 32.5 ^{o}C in September and the lowest minimum was 19.6 ^{o}C in November. The warmest month was September and the coolest month was February. The annual temperature range (difference between the hottest and coldest month) was 2.5 ^{o}C.







Relative Humidity

The annual mean relative humidity for Hewanorra was 77 per cent. January was the least humid month and May was the most humid month. At George Charles Met. Office the annual mean was 76 per cent. January and February were the least humid months and September was the most humid month.

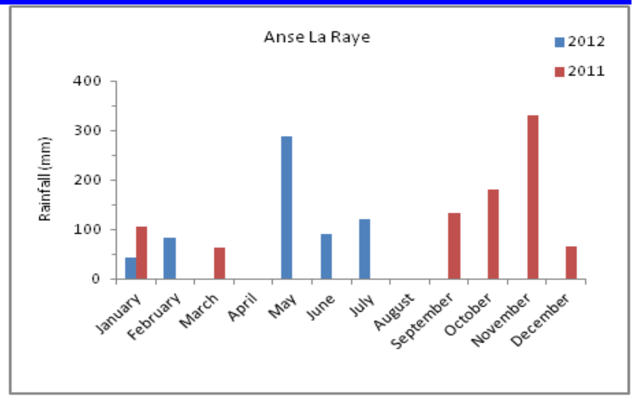
Weather and Climate Impacts

Saint Lucia was threatened by three systems and was place under a Tropical Storm Warning on the 2nd and 3rd of August during the passage of Tropical cyclone Ernesto. Later during the month, on August 10th and 11th, the island was placed under a Tropical Storm Watch when Tropical Cyclone Isaac passed in close proximity to the island. The island was for a third time placed under a Tropical Storm Warning for a brief period when Tropical Storm Rafael passed about150 miles northeast of the island on the night of October 12. Except for localized flooding on various parts of Saint Lucia, the impacts of the systems on the island were minimal.

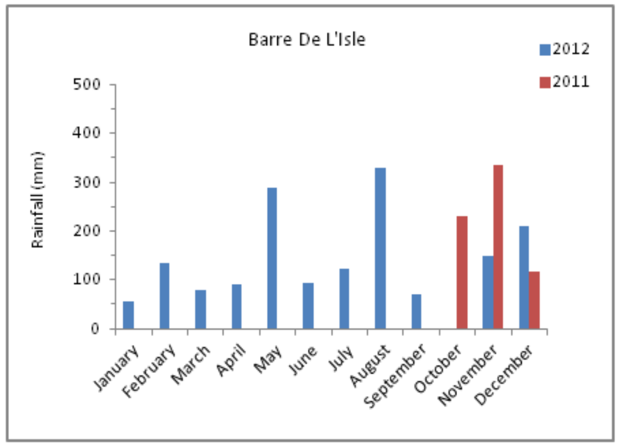
A general trend of below average rainfall in the north of the island which started in June continued through December. According to the drought monitor using the SPI, George Charles entered into a drought event on the time scale of 1 month in September and the event has continued through December. The monitor also revealed that drought events on time scales of 3 and 6 months started in November 2012.

Rainfall Station Statistics for 2012

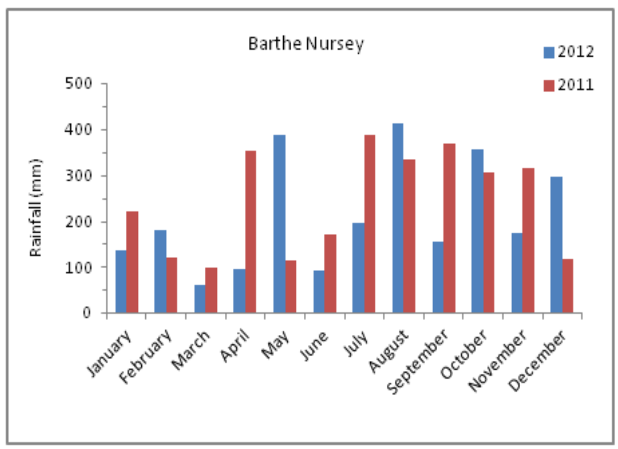
v *Anse La Raye*	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	43.8	106.0	41.3	11
February	82.6	N/A	N/A	15
March	N/A	63.8	N/A	N/A
April	N/A	N/A	N/A	N/A
May	288	N/A	N/A	21
June	92	N/A	N/A	11
July	121.4	N/A	N/A	21
August	N/A	N/A	N/A	N/A
September	N/A	132.8	N/A	N/A
October	N/A	181.4	N/A	N/A
November	N/A	331.2	N/A	N/A
December	N/A	66.6	N/A	N/A



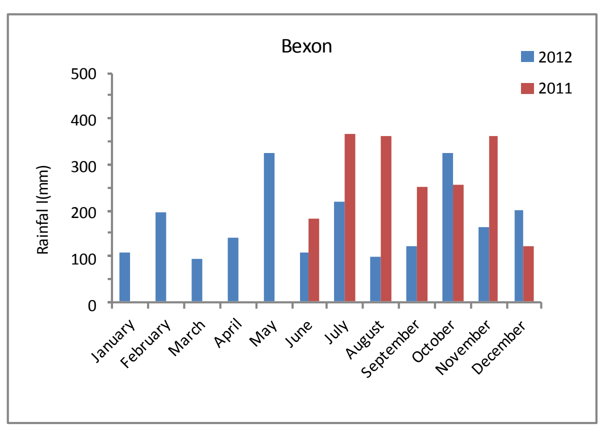
Barre De L'Isle	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	56.6	N/A	N/A	16
February	132.8	N/A	N/A	16
March	80.2	N/A	N/A	4
April	90.8	N/A	N/A	15
May	288	N/A	N/A	21
June	92	N/A	N/A	11
July	121.4	N/A	N/A	21
August	330	N/A	N/A	21
September	68.8	N/A	N/A	10
October	N/A	230.6	N/A	0
November	148	334.2	44.3	18
December	211	116.8	180.7	16



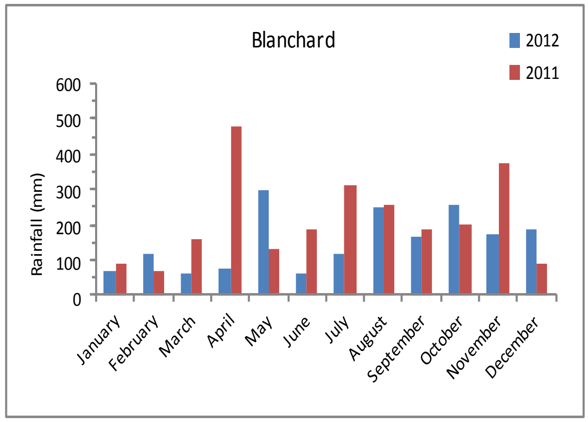
Barthe Nursey	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	136.2	221.8	61.4	17
February	180.1	120.4	149.6	23
March	63.0	98.0	64.3	10
April	97.1	354.0	27.4	15
May	387.3	114.0	339.7	22
June	94.5	171.0	55.3	15
July	196.5	388.2	50.6	23
August	412.8	336.4	122.7	23
September	157.2	369.9	42.5	12
October	356.3	307.5	45.3	18
November	174.5	315.8	55.3	17
December	296.3	118.3	250.5	19



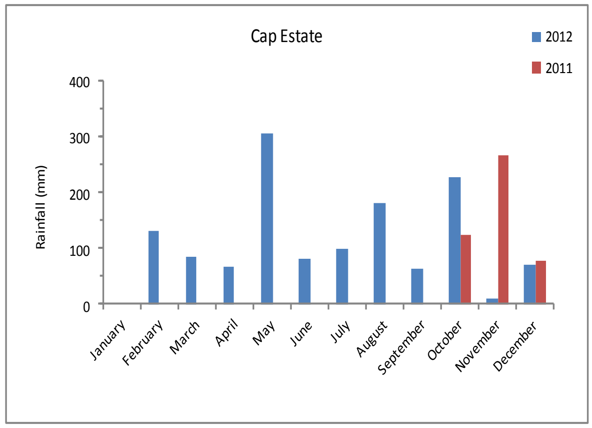
Bexon	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	108.4	N/A	N/A	18
February	194.4	N/A	N/A	22
March	94.2	N/A	N/A	10
April	140.8	N/A	N/A	18
May	327	N/A	N/A	19
June	108.4	183.8	59.0	17
July	220.4	366	60.2	21
August	98	362.8	N/A	7
September	123.2	253.4	48.6	9
October	322.8	256.4	125.9	18
November	163.8	360.2	45.5	18
December	202	120.2	168.1	17



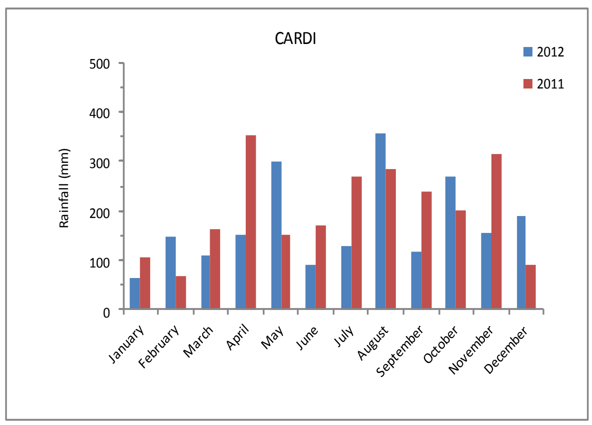
Blanchard	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	66	93	71.0	13
February	118	68	173.5	17
March	63.4	157	40.4	9
April	79.4	475.0	16.7	12
May	295.2	134.0	220.3	18
June	61	184.4	33.1	12
July	120.4	308.6	39.0	22
August	248.4	254.0	97.8	21
September	168	183.6	91.5	14
October	257.4	199.2	129.2	19
November	171.2	371.8	46.0	12
December	189.2	90.8	208.4	16



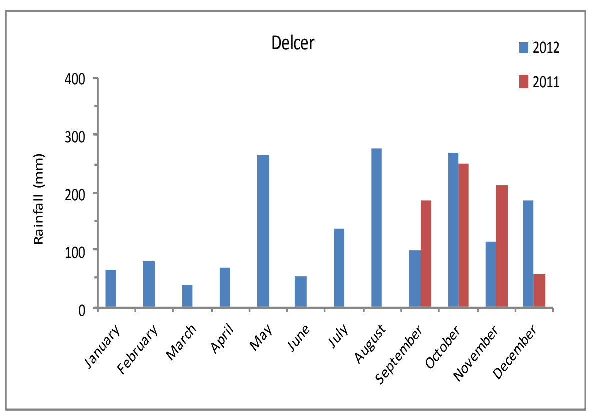
Cap Estate	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	N/A	N/A	N/A	N/A
February	130	N/A	N/A	14
March	83.6	N/A	N/A	3
April	67.4	N/A	N/A	6
May	304.4	N/A	N/A	14
June	79.6	N/A	N/A	6
July	98	N/A	N/A	16
August	180.8	N/A	N/A	19
September	62	N/A	N/A	10
October	228.8	124.8	183.3	18
November	8.4	268	3.1	2
December	70.2	78.4	89.5	13



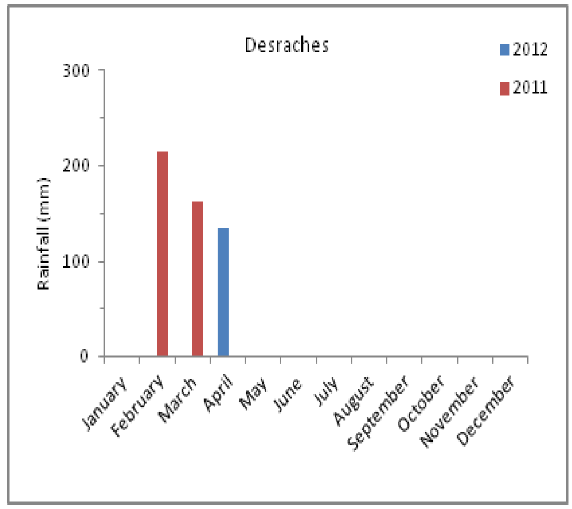
CARDI	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	66.2	105.4	62.8	14
February	146.8	69.2	212.1	13
March	108.6	164.6	66.0	8
April	153.4	354.0	43.3	18
May	298.2	152.9	195.0	17
June	92	171.2	53.7	12
July	128.6	271.0	47.5	18
August	355.7	284.2	125.2	16
September	115.8	237.8	48.7	11
October	269	201.4	133.6	19
November	155	316	49.1	16
December	189.4	90	210.4	14



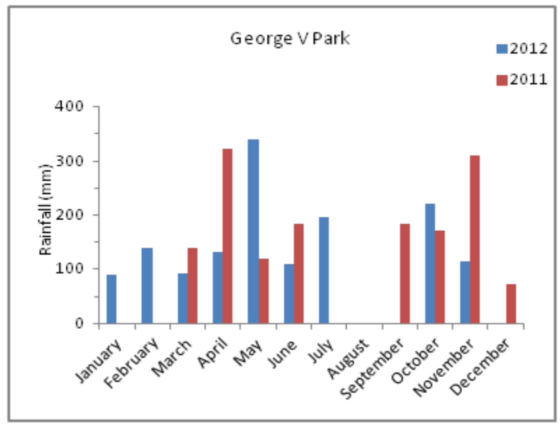
Delcer	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	66.2	N/A	N/A	15
February	80.4	N/A	N/A	13
March	38.6	N/A	N/A	5
April	66.6	N/A	N/A	9
May	264.2	N/A	N/A	17
June	54.2	N/A	N/A	11
July	135.8	N/A	N/A	18
August	278.4	N/A	N/A	22
September	97.6	186.4	52.4	9
October	269.6	251.6	107.2	18
November	112.6	213.2	52.8	12
December	185.4	55.4	334.7	16



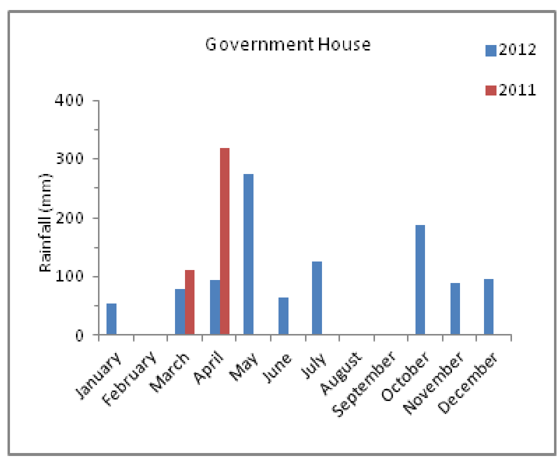
Desraches To be replaced	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January		N/A	N/A	
February		214	N/A	
March		162	N/A	
April	135.8	N/A	N/A	11
May		N/A	N/A	
June		N/A	N/A	
July		N/A	N/A	
August		N/A	N/A	
September		N/A	N/A	
October		N/A	N/A	
November		N/A	N/A	
December		N/A	N/A	



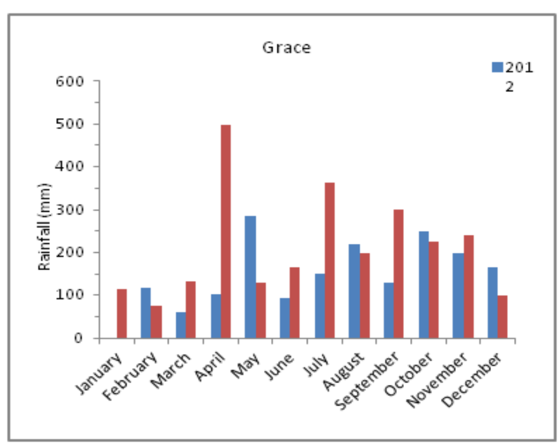
George V Park	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	89.9	N/A	N/A	12
February	138.9	N/A	N/A	16
March	92.5	139.4	66.4	5
April	131.0	322.8	40.6	12
May	339.9	120.0	283.3	17
June	110.2	184.7	59.7	9
July	195.5	N/A	N/A	15
August	N/A	N/A	N/A	N/A
September	N/A	182.8	N/A	N/A
October	221.5	171.3	129.3	18
November	115.1	311	N/A	11.0
December	N/A	73.3	N/A	N/A



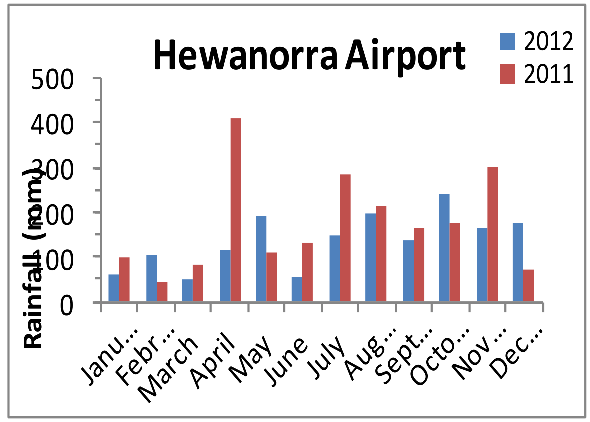
Government House	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	53.0	N/A	N/A	7
February	N/A	N/A	N/A	N/A
March	78.2	111.2	70.3	4
April	93.5	319.4	29.3	10
May	274.5	N/A	N/A	14
June	63	N/A	N/A	6
July	126.7	N/A	N/A	13
August	N/A	N/A	N/A	N/A
September	N/A	N/A	N/A	N/A
October	187.6	N/A	N/A	14
November	89	N/A	N/A	7
December	96.4	N/A	N/A	7



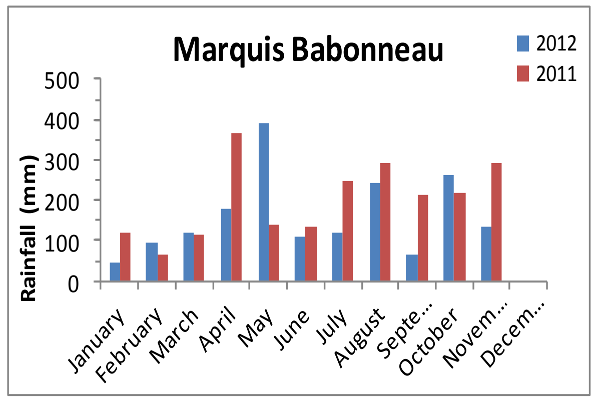
Grace	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	N/A	114	N/A	N/A
February	117.4	74	158.6	17
March	61.2	133	46.0	8
April	101.6	497.0	20.4	15
May	283.8	128.0	221.7	23
June	92.4	165.6	55.8	13
July	151.2	364.2	41.5	20
August	219.4	197.2	111.3	21
September	128.6	301.2	42.7	9
October	249.6	223.8	111.5	20
November	197.2	240.2	82.1	15
December	164.4	100	164.4	14



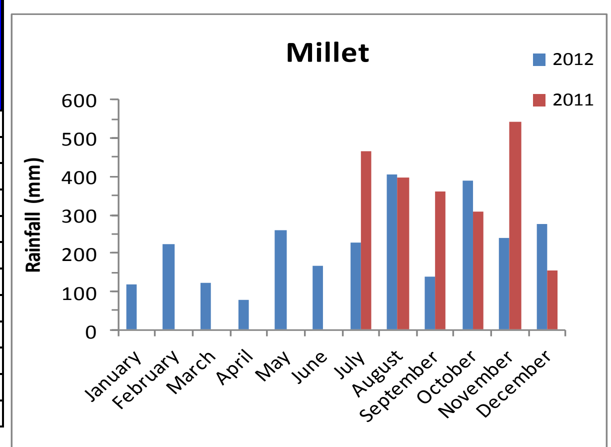
Hewanorra Airport	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	60.3	100.8	59.8	13
February	104.7	43.1	242.9	12
March	49.2	79.7	61.7	6
April	113.2	407.9	27.8	10
May	191.1	108.6	176.0	17
June	52.4	130.6	40.1	12
July	145.8	285.2	51.1	18
August	196.0	212.6	92.2	19
September	137.6	162.5	84.7	12
October	237.8	174.9	136.0	18
November	161.4	299.7	53.9	10
December	173.2	72.8	237.9	14



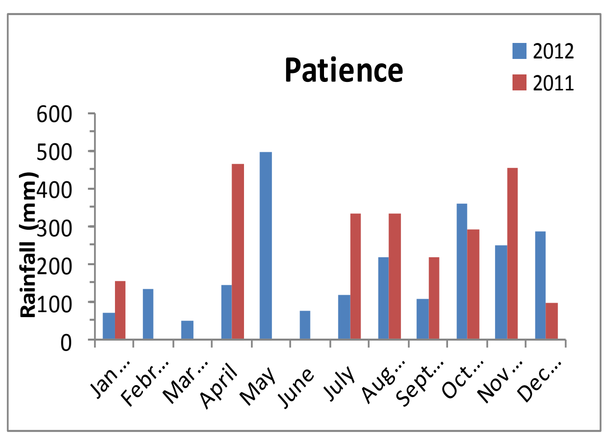
Marquis Babonneau	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	44.8	119.2	37.6	10
February	96.2	66.6	144.4	9
March	121	114.4	105.8	5
April	179.6	364.6	49.3	16
May	393.4	138.8	283.4	20
June	108.4	135.8	79.8	11
July	119	247.8	48.0	19
August	244.8	292.4	83.7	20
September	62.8	213.6	29.4	8
October	260.8	219.6	118.8	16
November	132.4	290.8	45.5	16
December	N/A	N/A	N/A	N/A



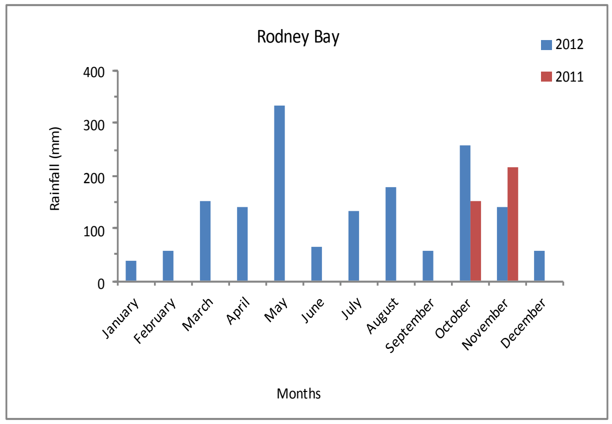
Millet	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	120.2	N/A	N/A	20
February	221.8	N/A	N/A	23
March	122.8	N/A	N/A	11
April	77	N/A	N/A	22
May	259.6	N/A	N/A	26
June	168.6	N/A	N/A	17
July	226.8	465.4	48.7	22
August	403.4	398.8	101.2	24
September	138.8	360.6	38.5	13
October	387	306.8	126.1	19
November	240	542.4	44.2	24
December	276.4	154.8	178.6	18



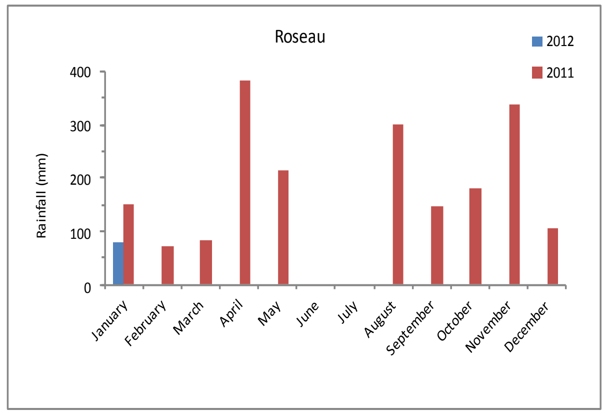
Patience	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	72	153.4	46.9	13
February	134.6	N/A	N/A	17
March	50.6	N/A	N/A	8
April	141.6	462.4	30.6	14
May	494	N/A	N/A	21
June	74.2	N/A	N/A	12
July	114.6	333.2	34.4	17
August	218	333.1	65.4	16
September	106	214.2	49.5	10
October	360.2	287.8	125.2	17
November	248	455	54.5	16
December	286.4	93.6	306.0	16



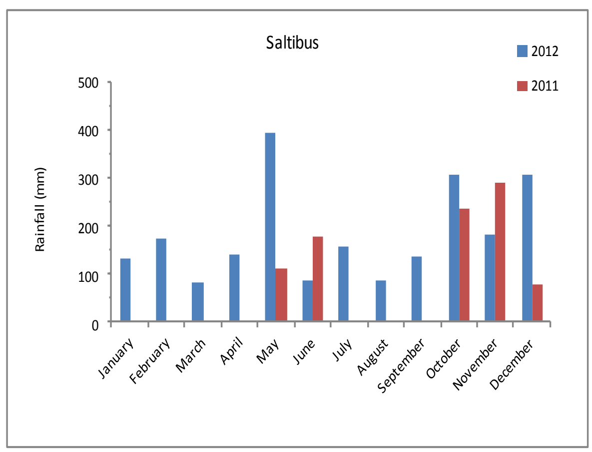
Rodney Bay	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	36.8	N/A	N/A	5
February	56.1	N/A	N/A	8
March	153.9	N/A	N/A	3
April	141.7	N/A	N/A	6
May	334.4	N/A	N/A	15
June	67	N/A	N/A	9
July	133.1	N/A	N/A	9
August	178.1	N/A	N/A	15
September	57.9	N/A	N/A	9
October	257.4	151.7	169.7	14
November	139.1	216.5	64.2	4
December	58.7	N/A	N/A	7



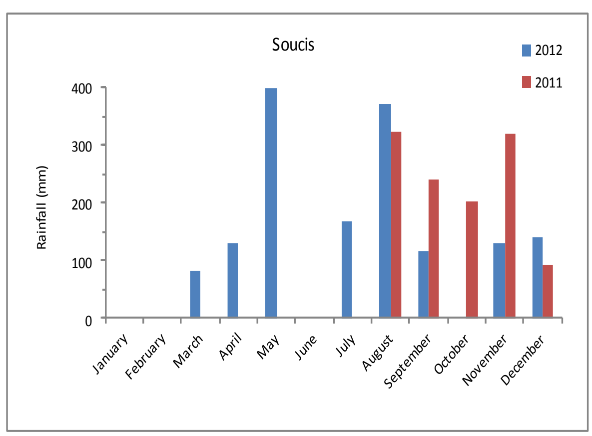
Roseau To be replaced	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	79.4	151.4	52.4	
February		72.8	N/A	
March		81.2	N/A	
April		383.6	N/A	
May		214.8	N/A	
June		N/A	N/A	
July		N/A	N/A	
August		299.2	N/A	
September		148.2	N/A	
October		179	N/A	
November		336.4	N/A	
December		106.6	N/A	



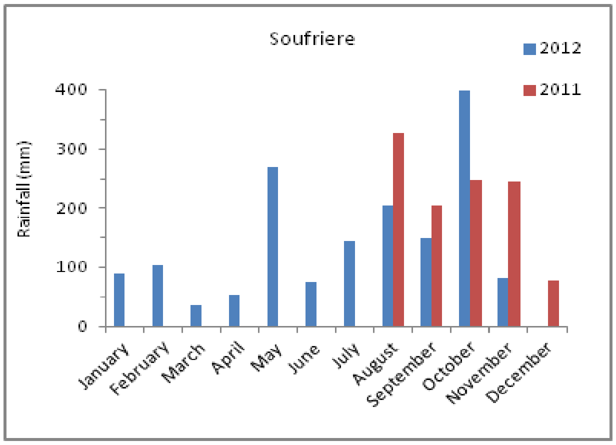
Saltibus	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	131.6	N/A	N/A	16
February	174.4	N/A	N/A	20
March	81.6	N/A	N/A	10
April	141.6	N/A	N/A	14
May	391.6	109.8	356.6	21
June	86.4	176.2	49.0	15
July	158.4	N/A	N/A	21
August	87.2	N/A	N/A	7
September	136.6	N/A	N/A	10
October	307	234.6	130.9	19
November	183.6	289	63.5	17
December	306.8	76.6	400.5	18



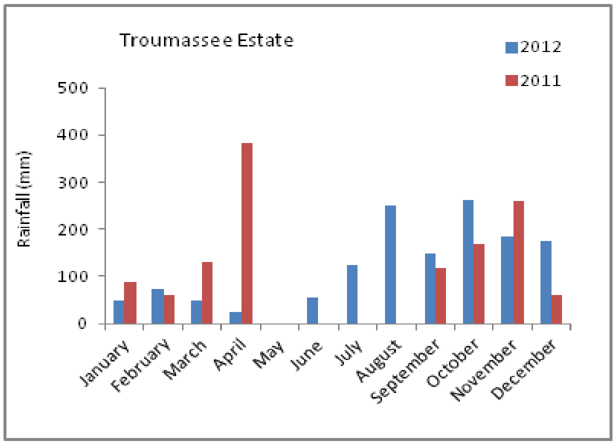
Soucis	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	N/A	N/A	N/A	N/A
February	N/A	N/A	N/A	N/A
March	80	N/A	N/A	8
April	130.4	N/A	N/A	20
May	399.6	N/A	N/A	25
June	N/A	N/A	N/A	N/A
July	168.6	N/A	N/A	18
August	369.4	321.6	114.9	26
September	117.2	240.4	48.8	10
October	N/A	200.6	N/A	N/A
November	128.4	319	40.3	16
December	140.4	92.4	151.9	20



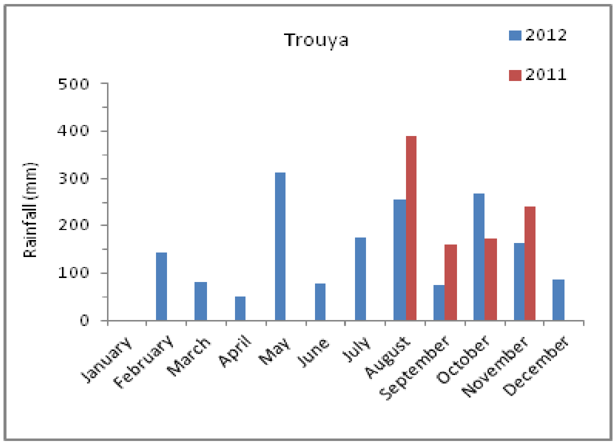
Soufriere	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	89.2	N/A	N/A	14
February	102.8	N/A	N/A	17
March	36.6	N/A	N/A	6
April	53.8	N/A	N/A	10
May	269.6	N/A	N/A	17
June	75.4	N/A	N/A	13
July	145.2	N/A	N/A	18
August	204.2	327.8	62.3	14
September	149.2	204.6	72.9	10
October		246.8	875.0	10
November	81.8	245.2	N/A	N/A
December	N/A	76.2	N/A	N/A



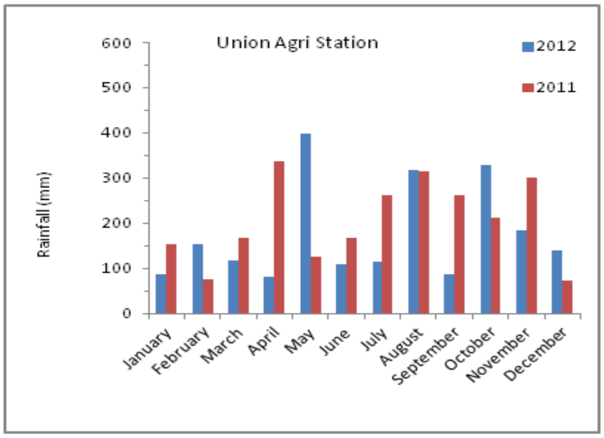
Troumassee Estate	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	47.6	87.8	54.2	12
February	73.4	60.8	120.7	10
March	48.2	130.4	37.0	6
April	22.8	383.0	6.0	8
May	N/A	N/A	N/A	0
June	54.2	N/A	N/A	12
July	123.6	N/A	N/A	19
August	250.8	N/A	N/A	20
September	148.6	116.8	127.2	13
October	261.8	169.6	154.4	17
November	184.8	259.2	71.3	12
December	176.8	62	285.2	17



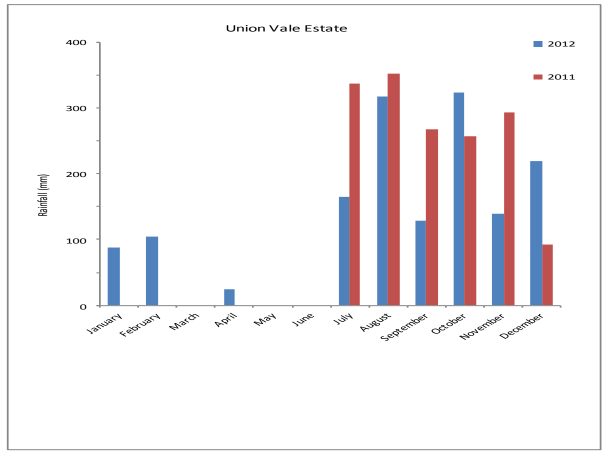
Trouya	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	N/A	N/A	N/A	
February	141.4	N/A	N/A	16
March	79.4	N/A	N/A	4
April	49.2	N/A	N/A	8
May	313.2	N/A	N/A	16
June	78.4	N/A	N/A	14
July	174.2	N/A	N/A	17
August	255.4	390.2	65.5	22
September	74.4	161	46.2	9
October	267.2	172.4	155.0	15
November	163.4	241.2	67.7	11
December	87.2	*N/A*	*N/A*	12



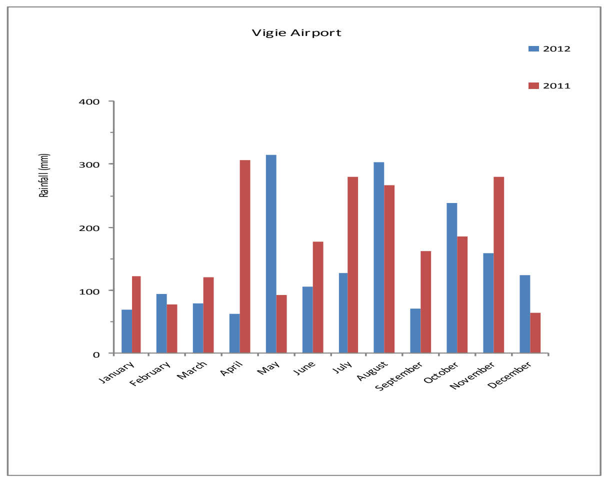
Union Agr Station	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	86.2	152.8	56.41	13
February	154.6	76.7	201.56	15
March	116.5	169.3	68.81	6
April	82.6	336.5	24.55	15
May	400.3	127.2	314.70	18
June	108.3	168.2	64.39	8
July	114	262.6	43.41	16
August	317.2	316.4	100.25	20
September	87.7	261.5	33.54	11
October	330.1	212.6	155.27	18
November	184.7	301.4	61.28	16
December	139.3	73.8	188.75	16



Union Vale Estate	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	88.4	N/A	N/A	16
February	104.6	N/A	N/A	20
March	N/A	N/A	N/A	N/A
April	25	N/A	N/A	5
May	N/A	N/A	N/A	N/A
June	N/A	N/A	N/A	N/A
July	165.4	337.4	49.0	20
August	316.8	352.0	90.0	19
September	129.2	267.8	48.2	11
October	323.8	256.8	126.1	17
November	139.8	292.6	47.8	13
December	219.8	91.8	239.4	17



Vigie Airport	2012 Rainfall (mm)	2011 Previous Year's Total (mm)	% in relation to previous Year	No of Days ≥1.0 (mm)
January	69.8	121.6	57.4	10
February	94.6	78.3	120.8	16
March	79.3	120	66.1	6
April	63	306	20.6	10
May	315	92.9	339.1	17
June	105.4	176.9	59.6	7
July	127.5	280.4	45.5	18
August	303.7	266.2	114.1	23
September	70.9	161.9	43.8	8
October	238.2	185.5	128.4	15
November	158.4	280.6	56.5	12
December	124.1	65	190.9	18



TOTAL RAINFALL FOR 2012 (mm)

Station	January	February	March	April	May	June	July	August	September	October	November	December
East												
Barre De L'Isle	56.6	132.8	80.2	90.8	288	92	121.4	330	68.8	N/A	148	211
Bexon	108.4	194.4	94.2	140.8	327	108.4	220.4	98	123.2	322.8	163.8	202
Blanchard	66	118	63.4	79.4	295.2	61	120.4	248.4	168	257.4	171.2	189.2
CARDI	66.2	146.8	108.6	153.4	298.2	92	128.6	355.7	115.8	269	155	189.4
Grace	N/A	117.4	61.2	101.6	283.8	92.4	151.2	219.4	128.6	249.6	197.2	164.4
Hewanorra	60.3	104.7	49.2	113.2	191.1	52.4	145.8	196	137.6	237.8	161.4	173.2
Troumasse Estate	47.6	73.4	48.2	22.8	N/A	54.2	123.6	250.8	148.6	261.8	184.8	176.8
Patience	72	134.6	50.6	141.6	494	74.2	114.6	218	106	360.2	248	286.4
West												
Anse La Raye	43.8	82.6	N/A	N/A	288.0	92.0	121.4	N/A	N/A	N/A	N/A	N/A
Barthe Nursery	136.2	180.1	63.0	97.1	387.3	94.5	196.5	412.8	157.2	356.3	174.5	296.3
Delcer	66.2	80.4	38.6	66.6	264.2	54.2	135.8	278.4	97.6	269.6	112.6	185.4
Desraches	-	-	-	-	-	-	-	-	-	-	-	-
Roseau	79.4	-	-	-	-	-	-	-	-	-	-	-
Saltibus	131.6	174.4	81.6	141.6	391.6	86.4	158.4	87.2	136.6	307	183.6	306.8
Soufriere	89.2	102.8	36.6	53.8	269.6	75.4	145.2	204.2	149.2	159.6	81.8	N/A
Union Vale Estate	88.4	104.6	N/A	25	N/A	N/A	165.4	316.8	129.2	323.8	139.8	219.8
North												
Cap Estate	N/A	130	83.6	67.4	304.4	79.6	98	180.8	62	228.8	8.4	70.2
George V Park	89.9	138.9	92.5	131	339.9	110.2	195.5	N/A	N/A	221.5	115.1	N/A
Government House	53	N/A	78.2	93.5	274.5	63	126.7	N/A	N/A	187.6	89	96.4
Marquis Babonneau	44.8	96.2	121	179.6	393.4	108.4	119	244.8	62.8	260.8	132.4	-
Millet/Dam	120.2	221.8	122.8	77	259.6	168.6	226.8	403.4	138.8	387	240	276.4
Rodney Bay	36.8	56.1	153.9	141.7	334.4	67	133.1	178.1	57.9	257.4	139.1	58.7
Soucis	N/A	N/A	80	130.4	399.6	N/A	168.6	369.4	117.2	NA	128.4	140.4
Trouya	N/A	141.4	79.4	49.2	313.2	78.4	174.2	255.4	74.4	267.2	163.4	87.2
Union	86.2	154.6	116.5	82.6	400.3	108.3	114	317.2	87.7	330.1	184.7	139.3

Effective Rainfall (Peff)

This refers to the portion of rainfall which remains in the soil and contributes to the growth of crops. It is defined as: *Effective rainfall = Rainfall-Direct Runoff*

This relation is established for St Lucia as equation:

$$Peff = (-0.00086*Pmonth) + 0.95)* Pmonth$$

This water is either taken up by plants or percolates to deeper zones out of reach of plant roots. When taken up by the plant the water will eventually transpire into the air through the leaves. Deeper percolation contributes to base flow in rivers

EFFECTIVE RAINFALL FOR 2013 (mm)

Station	January	February	March	April	May	June	July	August	September	October	November	December
East												
Barre De L'Isle	51.0	111.0	70.7	79.2	202.3	80.1	102.7	219.8	61.3	N/A	121.8	162.2
Bexon	92.9	152.2	81.9	116.7	218.7	92.9	167.6	84.8	104.0	217.0	132.5	156.8
Blanchard	59.0	100.1	56.8	70.0	205.5	54.7	101.9	182.9	135.3	187.6	137.4	149.0
CARDI	59.1	120.9	93.0	125.5	206.8	80.1	107.9	229.1	98.5	193.3	126.6	149.1
Grace	N/A	99.7	54.9	87.6	200.3	80.4	124.0	167.0	107.9	183.5	153.9	132.9
Hewanorra	54.2	90.0	44.7	96.5	150.1	47.4	120.2	153.2	114.4	177.3	130.9	138.7
Troumasse Estate	43.3	65.1	43.8	21.2	N/A	49.0	104.3	184.2	122.2	189.8	146.2	141.1
Patience	63.9	112.3	45.9	117.3	259.4	65.8	97.6	166.2	91.0	230.6	182.7	201.5
West												
Anse La Raye	40.0	72.6	N/A	N/A	202.3	80.1	102.7	N/A	N/A	N/A	N/A	N/A
Barthe Nursery	113.4	143.2	56.4	84.1	238.9	82.1	153.5	245.6	128.1	229.3	139.6	206.0
Delcer	59.1	70.8	35.4	59.5	191.0	49.0	113.2	197.8	84.5	193.6	96.1	146.6
Desraches												
Roseau												
Saltibus	110.1	139.5	71.8	117.3	240.1	75.7	128.9	76.3	113.7	210.6	145.4	210.5
Soufriere	77.9	88.6	33.6	48.6	193.6	66.7	119.8	158.1	122.6	129.7	72.0	N/A
Union Vale Estate	77.3	90.0	NA	23.2	NA	NA	133.6	214.6	108.4	217.4	116.0	167.3
North												
Cap Estate	N/A	109.0	73.4	60.1	209.5	70.2	84.8	143.6	55.6	172.3	7.9	62.5
George V Park	78.5	115.4	80.5	109.7	223.5	94.2	152.9	N/A	N/A	168.2	98.0	N/A
Government House	47.9	N/A	69.0	81.3	196.0	56.4	106.6	N/A	N/A	148.0	77.7	83.6
Marquis Babonneau	40.8	83.4	102.4	142.9	240.6	92.9	100.9	181.0	56.3	189.3	110.7	N/A
Millet/Dam	101.8	168.4	103.7	68.1	188.7	135.7	171.2	243.3	115.3	238.8	178.5	196.9
Rodney Bay	33.8	50.6	125.8	117.3	221.5	59.8	111.2	141.9	52.1	187.6	115.5	52.8
Soucis	N/A	N/A	70.5	109.3	242.3	N/A	135.7	233.6	99.5	N/A	107.8	116.4
Trouya	N/A	117.1	70.0	44.7	213.2	69.2	139.4	186.5	65.9	192.4	132.3	76.3
Union	75.5	126.3	99.0	72.6	242.5	92.8	97.1	214.8	76.7	219.9	146.1	115.6
Vigie	62.1	82.2	69.9	56.4	213.9	90.6	107.1	209.2	63.0	177.5	128.9	104.7

ANNUAL MAXIMUM TEMPERATURE

Months year	Jan Max Temp °C	Feb Max Temp °C	Mar Max Temp °C	Apr Max Temp °C	May Max Temp °C	Jun Max Temp °C	Jul Max Temp °C	Aug Max Temp °C	Sep Max Temp °C	Oct Max Temp °C	Nov Max Temp °C	Dec Max Temp °C	MEAN
1988	29.3	30.0	29.5	30.1	30.8	30.9	31.0	30.4	30.7	30.4	30.1	29.2	**30.2**
1989	28.9	28.6	28.7	0.0	0.0	0.0	30.6	31.0	31.0	31.1	30.1	29.3	**22.4**
1990	28.7	28.4	28.9	29.7	30.1	30.2	30.3	30.9	31.5	31.3	29.9	28.6	**29.8**
1991	27.8	27.8	28.1	28.3	29.5	29.7	29.5	30.3	30.2	29.9	29.4	27.9	**29.0**
1992	28.9	28.9	28.8	29.5	30.0	29.3	30.6	30.7	30.2	31.2	29.8	29.1	**29.7**
1993	28.3	28.6	28.5	30.1	30.5	30.4	30.2	30.1	30.5	30.0	29.4	28.9	**29.6**
1994	28.7	28.0	28.5	29.0	29.8	29.6	29.7	29.7	29.7	30.0	29.9	29.0	**29.3**
1995	28.7	29.6	29.1	29.5	30.0	30.1	31.0	30.9	31.1	31.1	30.5	29.0	**30.0**
1996	29.5	29.3	28.6	29.1	29.4	29.9	29.7	30.3	32.5	32.6	30.7	29.2	**30.0**
1997	28.5	28.9	28.5	29.4	30.2	30.1	29.8	30.9	31.0	31.3	30.7	29.9	**29.9**
1998	29.4	29.9	29.8	30.8	31.1	30.7	30.9	31.5	31.4	30.8	30.5	29.7	**30.5**
1999	29.1	28.4	28.9	29.6	31.0	31.5	31.1	31.2	31.7	31.3	31.5	30.0	**30.4**
2000	29.2	29.8	29.0	29.5	30.2	30.3	30.6	31.1	31.5	31.4	30.6	29.6	**30.2**
2001	29.3	29.0	29.4	29.9	0.0	31.2	31.1	31.5	31.9	31.0	31.2	30.4	**27.9**
2002	29.5	0.0	30.3	30.8	30.9	31.1	31.2	31.8	31.5	31.1	31.1	30.7	**28.3**
2003	29.7	29.4	29.9	30.8	31.0	30.5	30.9	31.5	32.4	31.1	30.9	29.3	**30.6**
2004	29.7	29.5	29.6	30.5	30.2	30.4	30.8	30.4	31.8	32.5	31.0	30.4	**30.5**
2005	29.4	30.3	30.8	31.8	31.9	31.2	31.5	32.1	32.7	31.8	30.0	30.0	**31.1**
2006	29.2	29.1	30.5	31.3	31.9	31.3	31.4	31.8	32.3	29.8	31.0	30.6	**30.8**
2007	30.4	29.5	29.5	30.4	30.3	30.8	30.9	30.1	31.6	30.8	30.3	29.3	**30.3**
2008	29.0	28.6	28.3	29.2	30.6	30.6	30.8	31.5	31.6	31.6	30.5	29.3	**30.1**
2009	29.5	28.9	28.8	30.1	30.0	30.9	31.2	31.6	32.7	32.0	31.2	30.6	**30.6**
2010	29.9	31.0	31.7	31.3	31.8	31.5	31.9	32.3	32.0	31.6	30.9	29.4	**31.2**
2011	29.3	29.6	29.3	30.1	31.1	31.5	31.2	31.5	32.1	31.4	30.8	30.4	**30.6**
2012	29.2	29.3	29.1	30.4	30.4	31.3	31.3	31.3	32.3	32.2	30.3	29.9	**30.5**
Mean	29.1	29.2	29.3	30.0	30.6	30.6	30.7	31.0	31.4	31.1	30.5	29.5	
MAX	30.4	31.0	31.7	31.8	31.9	31.5	31.9	32.3	32.7	32.6	31.5	30.7	
MIN	27.8	27.8	28.1	28.3	29.4	29.3	29.5	29.7	29.7	29.	29.4	27.9	

Average Monthly Minimum and Maximum Temperature, Relative Humidty and Evaporation for the Union Agricultural Station

2012				
Month	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Relative Humidity (%)	Mean Evaporation (mm)
JANUARY	29.2	20.6	69.6	4.4
FEBRUARY	28.8	21.3	69.2	4.5
MARCH	29.1	21.6	74.7	4.8
APRIL	30.4	22.1	68.1	4.7
MAY	30.4	22.5	80.1	4
JUNE	31.3	23.9	74	5.5
JULY	31.3	23.5	77	5.6
AUGUST	30.9	23.1	80.2	4
SEPTEMBER	32.3	21.7	76.3	7.09
OCTOBER	31.6	18.4	77	4.05
NOVEMBER	30.4	20.5	79.7	5.13
DECEMBER	29.9	20.8	81.1	3.3

	Temperature (°C)			Relative Humidity (%)	Evaporation (mm)
Year 2012	Max	Min	Mean	Mean	Mean
1st quarter	29	21.2	25.1	71.2	4.6
2nd quarter	30.7	22.8	26.8	74.1	4.7
3rd quarter	31.5	22.8	27.1	77.8	5.6
4th quarter	30.6	19.9	25.4	79.3	4.2
AVERAGE	**30.4**	**21.7**	**26.1**	**75.6**	**4.8**

Union Agro-Meteorological Station

Union Vale Rainfall Station

Enhancing the Saint Lucia Hydro-Met Network with Assistance from Carib-HYCOS

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Water Resource Management Agency
Ministry of Sustainable Development, Energy, Science and Technology

The water resources of Saint Lucia are highly vulnerable to climate change effects, over-abstraction and pollution. As such it is necessary that this vital resource be monitored in order to engender well-informed planning and management strategies for environmental sustainability and disaster management. It has long been thought necessary that the existing system of meteorological and hydrological instruments and stations be expanded and modernized. This shortcoming is being assisted by the provision of water level recorders, additional rainfall loggers and a data management system.

The Caribbean Hydrological Cycle Observing System (Carib-HYCOS) is a regional project funded by the European Union's INTERREG Program as well as the General and Regional Councils of Martinique. It is developed under the framework of the World Meteorological Organization's (WMO) World Hydrological Cycle Observing System (WHYCOS) Program, to provide a scientific basis for water resources assessment and the integrated development and management of these resources between sectors and countries. The Carib-HYCOS project helps develop the technical skills of the National Hydrological Services of 11 Caribbean islands-states, including St. Lucia, with respect to the collection, maintenance, analysis and application of reliable and high-quality water resources data, in order to promote a more sustainable development and management of freshwater resources.

Through the Carib-HYCOS project, Saint Lucia, along with 11 other member countries, received hydrological monitoring equipment and Hydromet software for the management of hydrological data. Saint Lucia was the proud host of the regional workshop for English-speaking project member countries for the installation and maintenance of the hydrological equipment in March 2012. Participants from Antigua, Barbados, Dominica, Jamaica and Trinidad joined St. Lucian hydro-meteorological officers from the Water Resource Management Agency (WRMA) and the Saint Lucia Meteorological Services, with guidance from Carib-HYCOS representatives Jean-Pierre Briquet, Maurice Guilliod and Georges Adele, for hands-on sessions in the installation and maintenance of the equipment. By the end of the week-long workshop, a water level recorder and rainfall logger were installed on the Deglos bridge. The system utilizes a solar panel and the data is uploaded to an internet site that allows the staff of WRMA to remotely retrieve real-time data. To date, hydrological monitoring equipment has been installed at three stations across Saint Lucia: Deglos, Mabouya and Canelles.

In many Caribbean countries, data acquisition is a problem due to lack of equipment or technical capacity to maintain these equipment. Carib-HYCOS, through provision of equipment and conduct of the workshop, is assisting Saint Lucia in paving the path for more accurate data collection and a greater quantity of data for more in-depth analysis throughout the region. This will contribute to more informed decision making for planning and management of our precious water resources.

Carib-HYCOS

Enclosure for Data Logger in Canelles

Data Logger

Pressure Sensor Probe (Canelles River)

Regional participants during training and installation

Deglo Site

Regional participants on site

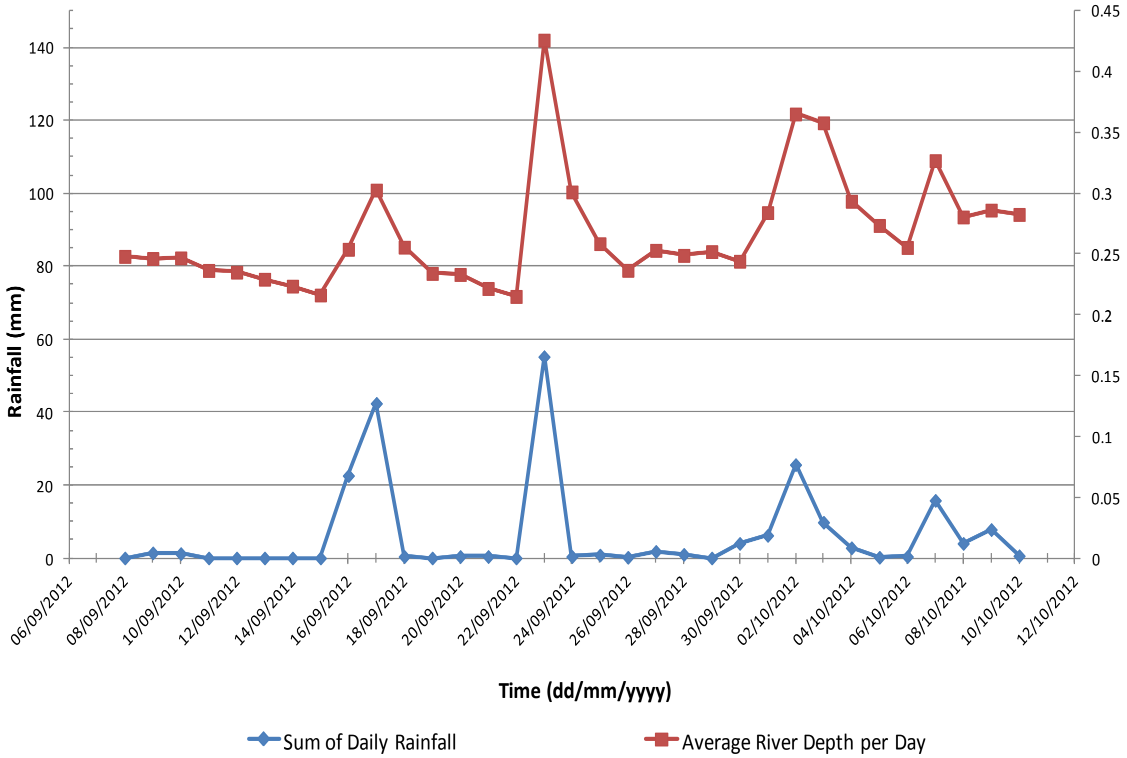

Figure showing strong correlation between rainfall and river depth at Deglos Carib-HYCOS station (each rainfall event has a corresponding river depth increase). This shows that as rainfall events occour; the amount of water in our rivers increase and then begin to decrease after

Global Warming: Why Regional Water Technicians and Decision-Makers should be Aware of its Effects on Rainfall Depth and Intensity, Irrigation Requirements and Water Distribution

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INTRODUCTION

Global warming can be defined as an increase in the average temperature on the earth, due to the greenhouse gas effect which causes changes in climate (www.askoxford.com). Recent warming of the earth is a cause for concern since temperature changes are accelerating (London, 2004). Based on NASA GISS surface temperature readings, the eighteen warmest years on record from the time when consistent recording began in 1880, have occurred since 1980, with eleven of those years occurring from 1990 (See Figure 1.1). In light of this, Small Island Developing States (SIDS), the smallest emitters of greenhouse gases are among the areas most significantly impacted by accelerated global warming (London, 2004). Additionally, according to NASA (www.nasa.gov), the year 2011 was the ninth warmest year on record, with an average global temperature of 0.92 degrees F (0.51 C), warmer than the mid -20th century baseline. In essence, these facts illustrate a long term trend of increases in global temperature (See Figure 1.1).

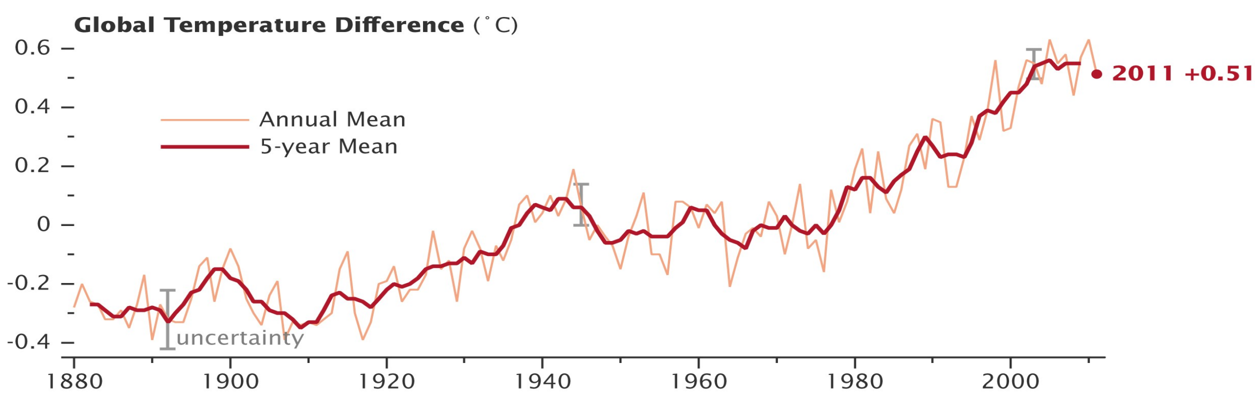

Figure 1.1
Source: http://www.nasa.gov/topics/earth/features/2011-temps.html

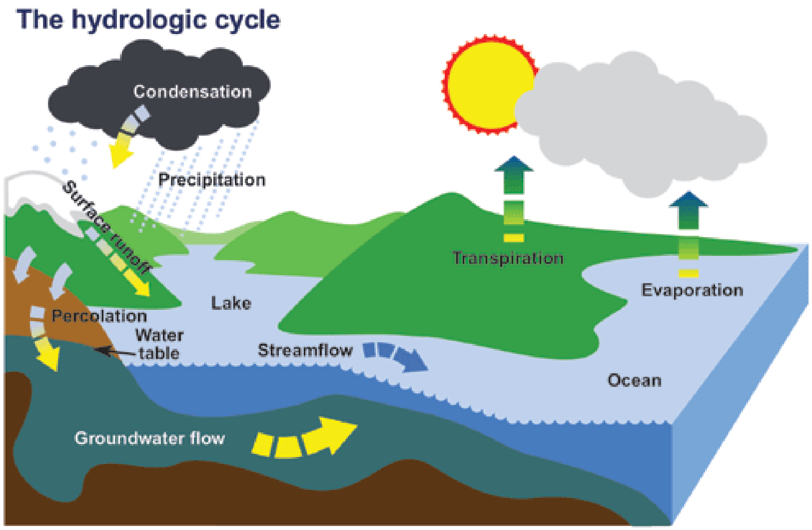

Figure 1.2
Source: http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=23CEC266-1
According to the WWAP (2009), most climate scientists agree with observational evidence that global warming will cause intensification, acceleration or enhancement of the global hydrological cycle (See Figure 1.2). Consequently, given that precipitation is a major part of the cycle, when planning for adaptation to climate factors, the question must be asked: how will precipitation change? (Neelin, 2009). This article examines the potential future effects of global warming on rainfall depth, intensity, irrigation requirements and water distribution and highlights reasons why hydrologists, engineers and water decision-makers in the region should be aware of these developments.

POTENTIAL GLOBAL WARMING EFFECTS

Rainfall Depth and Intensity
Projections from downscaled modelled outputs from the Hadley Centre's PRECIS model show a drying propensity with more dry days and fewer consecutive wet days for the Caribbean region (Farrell et al., 2007). Leslie (2008), states that the Caribbean region is already experiencing the effects of climate change through changing weather patterns that cause intense extremes such as droughts, intense rainfall that leads to flooding and hurricanes. Also, rainfall variability has increased in the region where the mean average rainfall has decreased by 250mm (IPCC, 2001b in London, 2004). Moderate shifts in rainfall patterns could significantly impact water availability and agricultural productivity (London 2004). The negative impact on agriculture can be seen in the case of Guyana with extensive flooding that occurred in 2005 and 2006 due to extremely high rainfall. This caused major crop losses and as a result, financial losses of USD 55million in 2005 and USD 22.5 million in 2006, reduced Guyana's gross domestic product (GDP) since agriculture accounted for thirty five point four percent (35.4%) (Farrell et al., 2007). Farrell et al. (2007) note that more intense rainfall and urbanisation are expected to cause increased surface runoff, thereby reducing infiltration and potential aquifer charge. Therefore, countries in the region that depend largely on groundwater will be severely affected. This will not only affect the quantity of water entering aquifers, but also the quality of water within aquifers. Overall, the consequences of global warming and increased climate variability can reduce groundwater quality. Conversely, decreased precipitation can cause the intensification of water scarcity with increasing demand for water, reduced base flow, increased rates of evapotranspiration and shift in biodiversity (Frederick, 1997).
Regional hydrologists must be concerned with these changes since they assist in solving water quantity, quality and availability problems. Engineers who conduct infrastructural planning for example, placing of culverts in drains would have to adjust their planning and designs of structures to accommodate larger flows of water produced by more intense precipitation. Water decision-makers however, need to be aware of these events since they engage in planning for the water sector within their countries. They will have to effectively manage water during periods of drought, put measures in place for flood occurrences, and invest in monitoring and data collection. Data collection, monitoring and management are critical, given that decision-making will be based on the data collected. Therefore,

data management systems that are regularly updated would be crucial in monitoring and tracking the effects of global warming. In addition, water decision-makers will have to be integrally involved as water quality is usually affected by sedimentation and siltation after periods of heavy rainfall.

Irrigation Requirements

In the face of climate change, changing rainfall patterns and the expectation of longer dry periods, will cause irrigation requirements to change due to drought and scarcity of water. Important factors that have contributed to more regions experiencing droughts are decreased precipitation on land, coupled with increased temperatures that enhance evapotranspiration and reduce soil moisture (IPCC Technical Paper IV, 2008). With fewer consecutive wet days and more dry days, irrigation will be required for longer periods and new methods will have to be practiced. Essentially, the irrigation requirements of crops will be affected by changes in weather related variables such as the amount and timing of precipitation and evapotranspiration (Andales, 2009). Agriculture which is the single biggest user of water will be the most affected sector and decision-makers will have to put appropriate plans in place as this can have major implications for food security in the future (Cashman et al., 2010).

Regional hydrologists who deal with water quantity issues will have to develop action plans for changes in irrigation requirements. Options that should be explored include the use of water efficient irrigation systems such as drip irrigation that deliver water via drip or trickle directly to the base of plants (Lamont Jr. et al., 2002). As well, crop engineers should engage in crop modification to produce crops that adapt to the expected drier weather. Water decision makers in their planning and forecasting for global warming effects, should embark on programmes that provide incentives for individuals to engage in activities such as rainwater harvesting and recycling of grey water (water used in kitchen sinks and showers) that can be used for irrigation purposes. According to Cashman et al. (2010), rainwater harvesting is an obvious adaptation strategy and policy makers should encourage its collection, while also making much needed investments in storage. Additionally, planning of mitigative and adaptive measures to address changing irrigation requirements must commence in order to meet the demands of the future regardless of increasing global warming.

Water Distribution

As global warming occurs, the impacts of climate change on the hydrological cycle will affect water supply in the future. Increasing temperatures and changing rainfall patterns are expected to cause an increase in the demand for water by households, farmers, tourism, manufacturers and recreation (Farrell et al., 2007). With increasing demand and increasing urbanisation, efficient water distribution will become critical and will require investments of large sums of money in meeting the increased demand. According to Cashman et al. (2010), water deficits are likely to occur since the rate of demand for water exceeds the rate of supply. This, coupled with growing populations in Caribbean islands, exerts more pressure on water scarcity and can lead to increases in supply being expensive and environmentally sensitive. Similarly, Farrell et al. (2007) state that as population growth is expected to increase, competition for land and water will exert additional stress on the region's water resources with respect to quality and quantity. In addition, this is exacerbated by the view that in the Caribbean region, the government is solely responsible for the provision of adequate water services. As a result, individuals do not adapt to water scarcity by implementing measures in their households or businesses where it requires investments in equipment such as pumps or purification systems (Cashman et al., 2010).

Water decision-makers must be aware that with the expected increased demand for water, investments must be made in storage such as dams and water treatment facilities and that hydrologists and engineers will be required to engage in the planning and design of those facilities, given new and changing trends. The implementation of methods to address inefficiencies such as water losses and measures such as training of personnel specifically for the improved monitoring and maintenance of distribution systems will also be critical. Therefore, water decision-makers ought to understand that the implementation of new technologies must be commenced in order to deal with issues of scarcity and inefficient water distribution.

CONCLUSION

The vulnerabilities of Caribbean countries will worsen by accelerated global warming and as a result, water technicians and decision-makers should be proactive in engaging in adaptive and mitigative measures that address its long term effects. (London, 2004). Changes in rainfall patterns – depth and intensity, can have substantial impacts on water availability and water quality. It can also impact the agricultural sector where it makes a significant contribution to GDP, as was evident in the case of Guyana due to the floods of 2005 and 2006. The implications for irrigation requirements and water distribution are that they will require large investments in infrastructure such as storage treatment facilities and distribution, monitoring and data collection. In light of this, London (2004) states that as of now, targeted investments to address vulnerabilities of countries in the region will likely lead to no-regrets outcomes that are highly environmentally and economically beneficial. Additionally, in support of this, Cashman et al. (2010) state that better water management practices are critical in adapting to the impacts of climate change on the region's water resources and the demand for water services. Therefore, hydrologists, engineers and

Drought Monitoring and Mitigation Pilot Site at Monchy and Union

Water Level Sensor

Data Logger

Rainfall logger and solar panel

Soil Moisture Probe

DID YOU KNOW?

That the right to water is vested in the Crown and maybe exercised on its behalf by the Minister in accordance with the Water and Sewerage Act No. 14, 2005

That all companies abstracting water from our natural water resources must now seek an abstraction licence from the Water Resource Management Agency failure to do so is a direct contravention of the Act

That based on the output for February 2013 from leading forecast agencies and local analysis we expect normal to below rainfall over St Lucia during the next 3-6 months, therefore we need to put all water conservation practices in place and to monitor the weather.