Monthly Bulletin
Ministry of Agriculture
Hydrometeorological Service

September 2017

"To observe, archive and understand Guyana's weather and climate and provide meteorological, hydrological and oceanographic services in support of the Guyana needs and national and international obligations."

Bulletin September 2017

HYDROMETEOROLOGICAL BULLETIN

Hydrometeorological Service, 18 Brickdam, Stabroek, Georgetown
www.http://hydromet.gov.gy | Tel #: 592-225-9303 | Fax #: 592-226-1460

Highlights

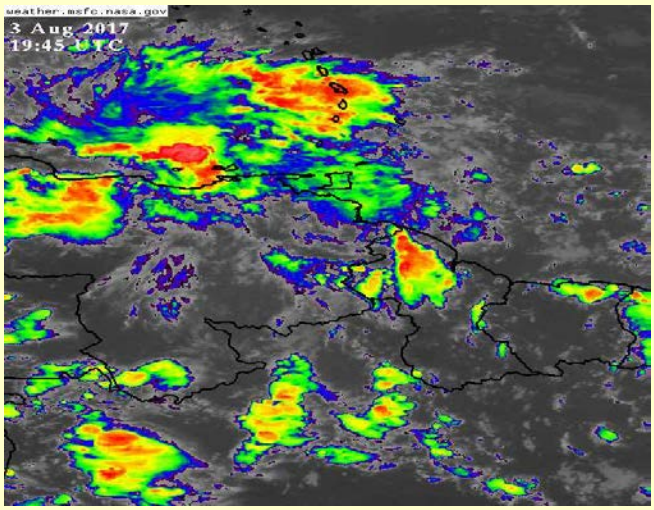
- Guyana classified as Moderately Dry August 2017
- Observed rainfall consistent with Historical Average – *Nearly equal number of stations recorded below and above normal rainfall.*
- Warmer than average conditions dominated across much of the Earth's surface: Third highest August temperature recorded in 138 years.
- Chance for extremely dry weather condition for September – November 2017 is low, but still a bit higher than usual.

INSIDE THIS ISSUE

Below: Career Day exhibition being hosted by the Hydrometeorological Service staff

Review of Synoptic Systems that influenced the Weather Conditions for September 2017

Guyana experienced *Moderately Dry* conditions during August 2017 The prevailing weather conditions throughout the month was influenced by a number of meteorological systems. These includes the movement of the Inter–Tropical Convergence Zone (ITCZ), ridging in the troposphere, Saharan Air Layer along with the passage of Tropical Waves over Northern Guyana. In addition, there were occasional Tropical Cyclones, which contributed to the reduction (drying) of moisture in the atmosphere over Guyana. The later resulted in very little convection, and hence contributed to significant reduction of rainfall amounts Country wide



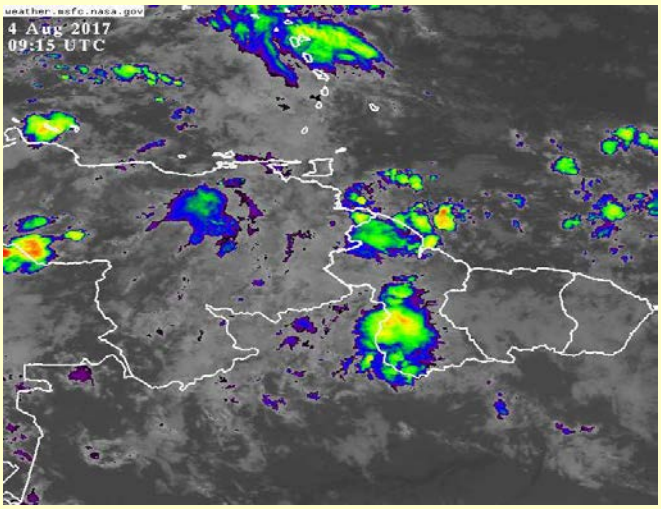


Figure 1 Satellite image showing deep convection.

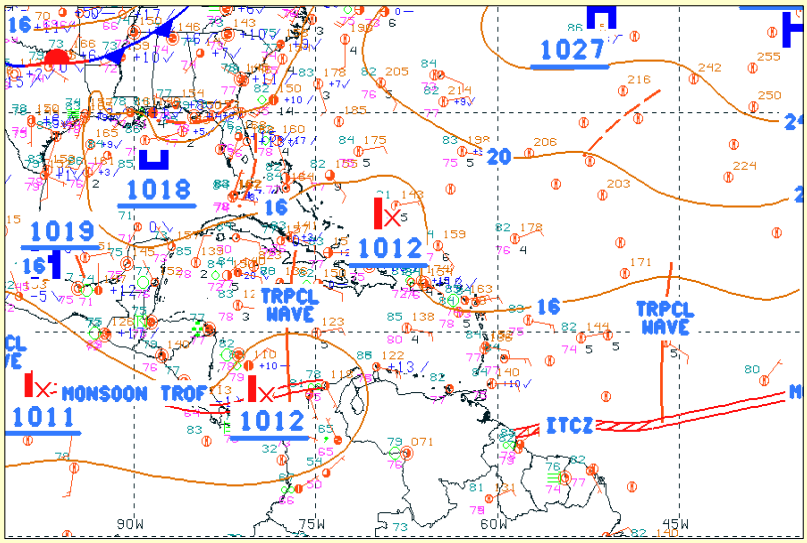


Figure 2 Surface Chart (Valid August 12, 2017) showing the position of the ITCZ along the North Western coast of Guyana.

The start of the month was mainly influenced by ridging and sinking motions within the troposphere. As a result, most of the observed rainfall was due primarily to local convection Additionally, The Inter Tropical Convergence Zone and low level trough were active from time to time. This produced significant one – day (24 hours accumulated) rainfall amounts over various location across Guyana as shown in Figure 18 below. Figure 1 above and Figure 2 to the left shows influence of deep convection and the ITCZ respectively.

Review of Seasonal Outlook provided in July.

Below is a brief review of the Seasonal Outlook for Guyana which was provided by the Hydrometeorological Service earlier in July 2017.

Precipitation: All Regions across Guyana should have expect *near-normal* rainfall for the period August to October 2017.

Usually, Guyana would experience 18 to 31 wet days during this season, however, 15 to 29 were expected for August – October 2017, with the maximum in Region 6. The regional projected rainfall accumulation for this season can be seen in the figure to the right.

Temperature: Region 4 expected warmer temperatures than normal (27.7 °C) while all other locations expected near-normal temperatures.

Drought: Drought is not a concern at this moment. The rainfall during May – July would have recharged reservoirs, conservancies and aquifers to satisfactory levels.

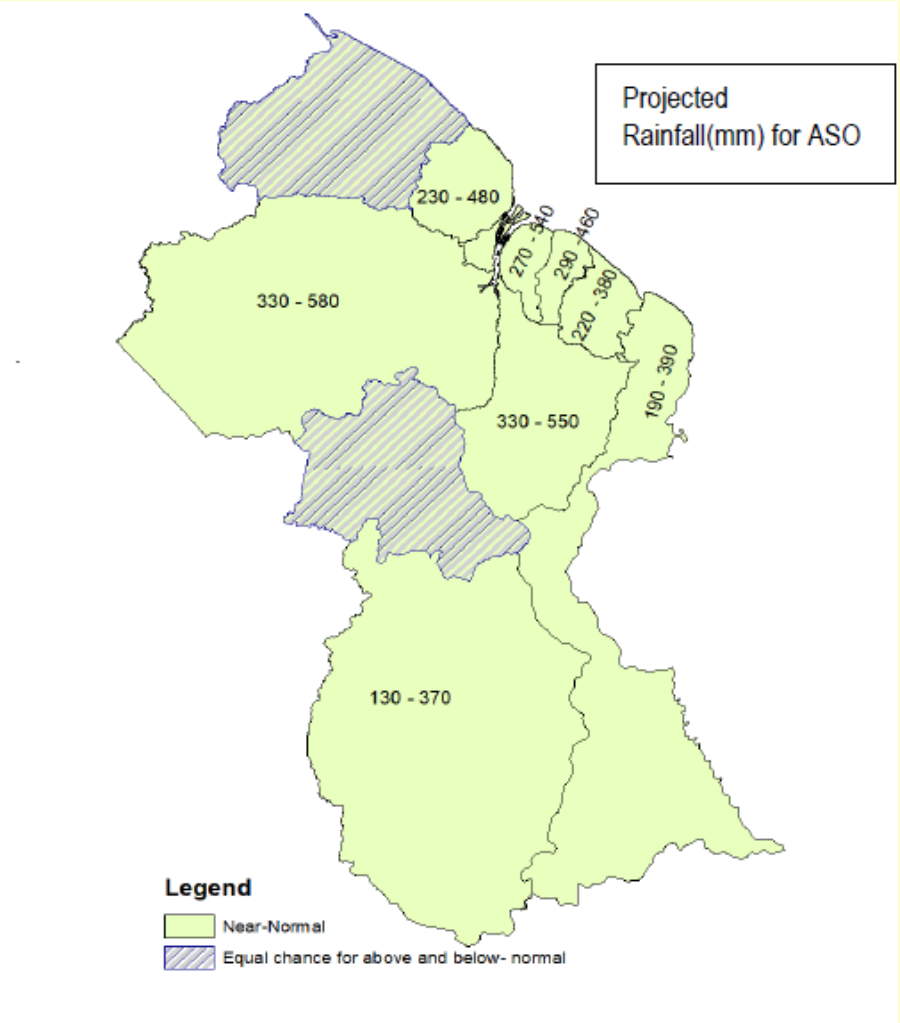


Figure 3 Map of Guyana showing rainfall Seasonal Normal and probabilistic forecast[1] across Guyana for period August – October 2017.

[1]The forecast and projection above was prepared taking into account the usual Climatological trends along with current dynamical models and Climate Prediction Tools (CPT)

Review of Climatological Trends and Comparison with Year to Date Rainfall

What Usually occurs: August – September – October compared to observed rainfall

The month of August is usually associated with the heightening of the primary dry season for most of Guyana. During this period, the ITCZ would have already migrated northwards. As a result of its position at this time, the influence on observed precipitation over Guyana tends to be less significant. However, the ITCZ is not the only system that affects the weather condition in our Region.

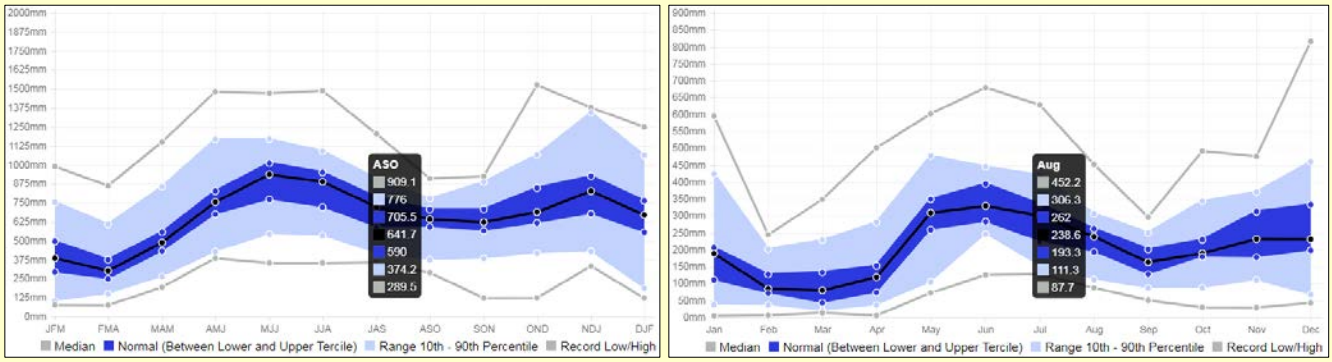
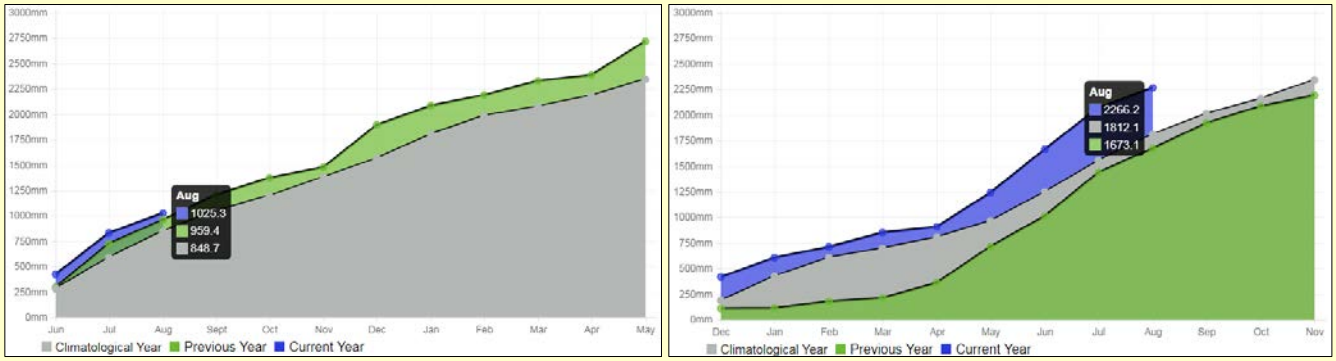


Figure 4 Seasonal and monthly rainfall variation for Region 1 at Mabaruma with emphasis for ASO and August.



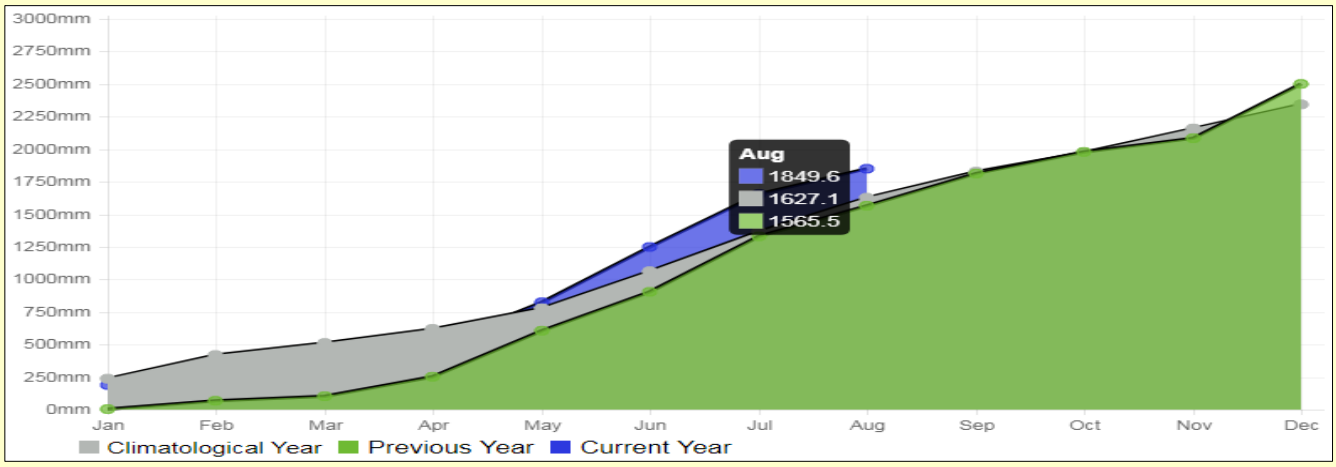


Figure 5 Graph showing Accumulated Rainfall (up until August 2017) for (a) Water Year - June to May (b) December to November Year (c) Calendar Year, and comparison with Climatological and Previous year for Region 1 at Mabaruma

Apart from the ITCZ, the weather during this period can also be influenced by other less significant contributors such as Tropical Waves, Surface Troughs and localized convections.

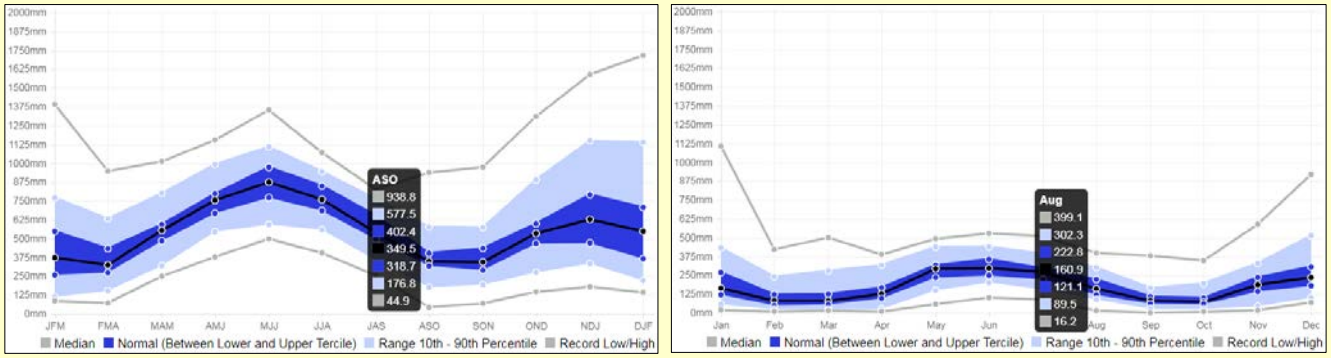


Figure 6 Seasonal and monthly rainfall variation for Region 4 at Georgetown with emphasis for ASO and August.

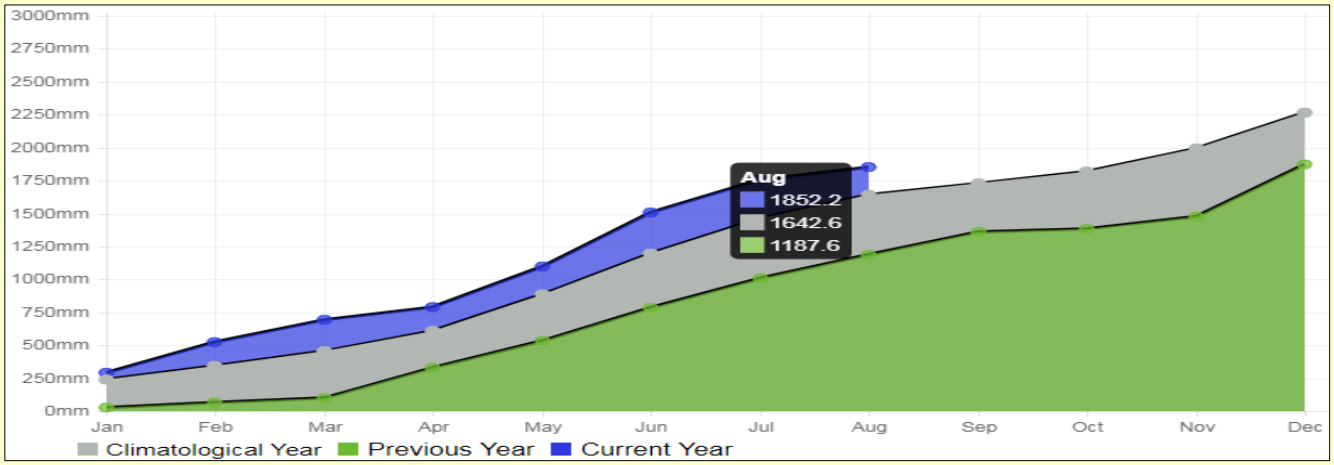


Figure 7 Graph showing Accumulated Rainfall (up until August 2017) for (a) Water Year - June to May (b) December to November Year (c) Calendar Year, and comparison with Climatological and Previous year for Region 4 at Georgetown

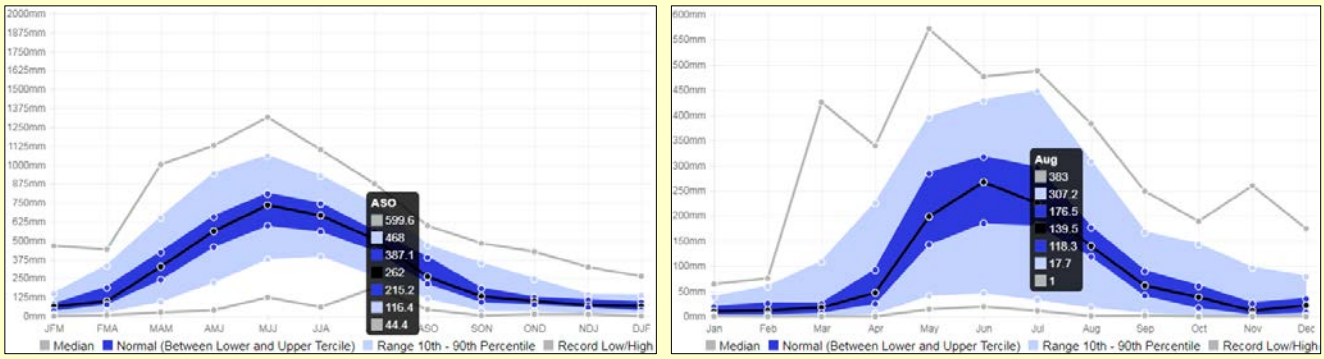
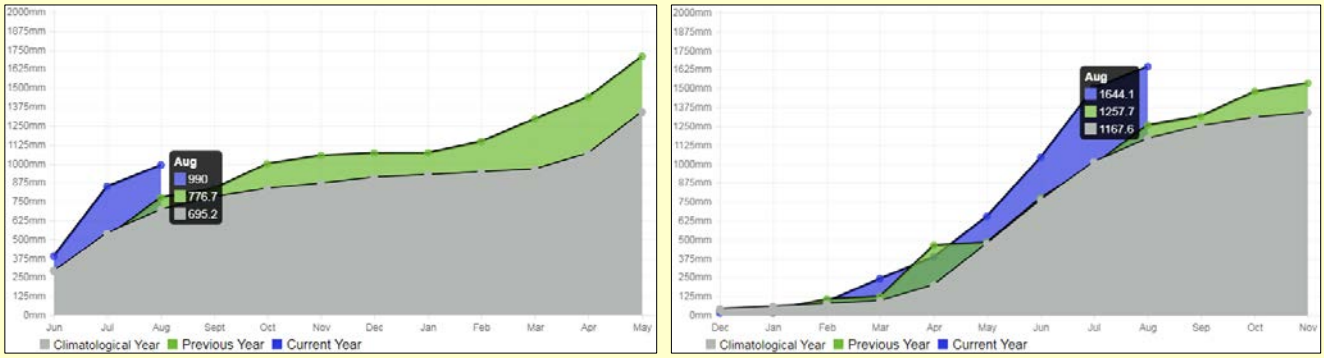


Figure 8 Seasonal and monthly rainfall variation for Region 9 at Lethem with emphasis for ASO and August.



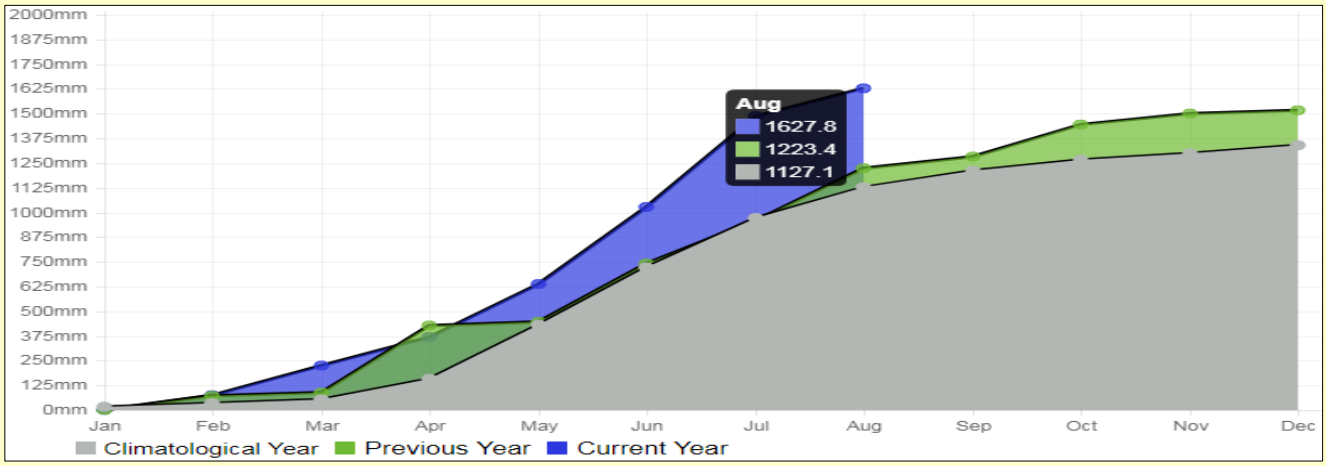


Figure 9 Graph showing Accumulated Rainfall (up until August 2017) for (a) Water Year - June to May (b) December to November Year (c) Calendar Year, and comparison with Climatological and Previous year for Region 9 at Lethem

August 2017 Rainfall Analysis

Guyana was classified as Moderately Dry for the month of August 2017, with a nationwide average rainfall of 113.4 mm distributed over an average of 9 rain days. A detailed comparison of the August 2017 rainfall with the historical average for selected stations can be seen in Figure 10 below.

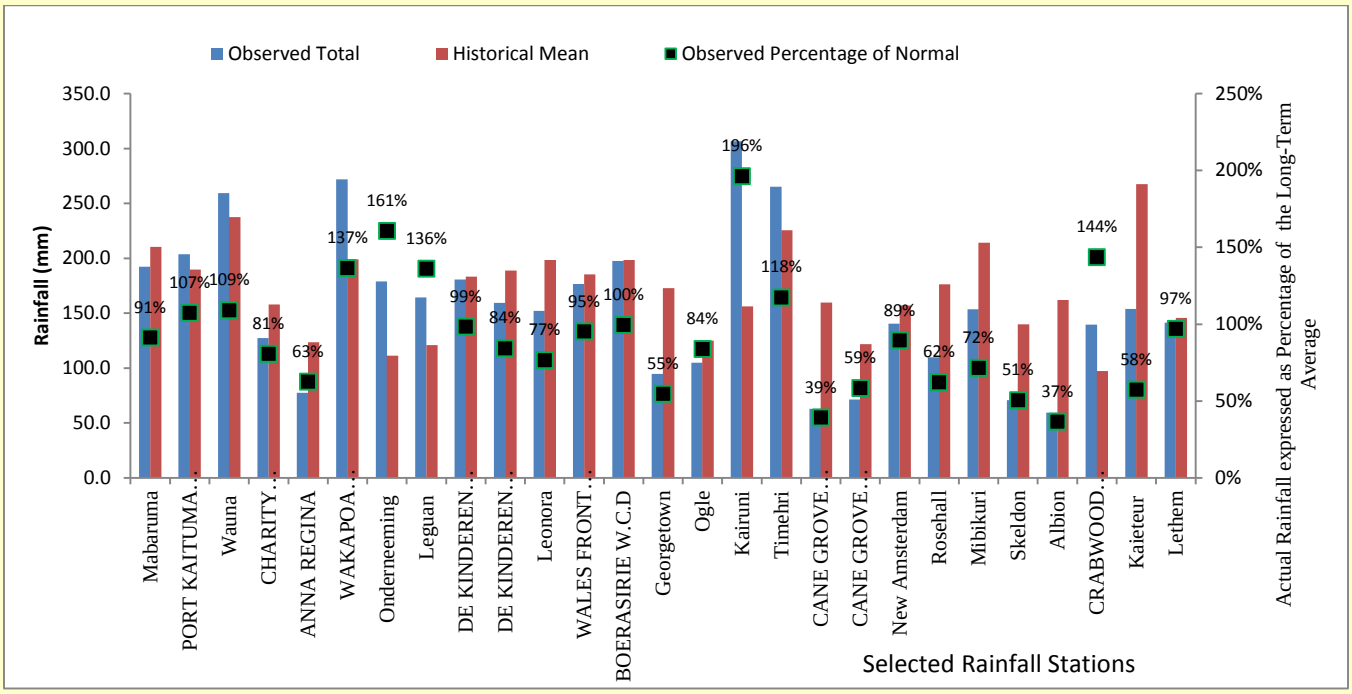


Figure 10 Comparison of the accumulated observed Rainfall for August 2017 expressed as a percentage of the Historical mean

According to the records collected and processed by the Hydromet a significant number of locations recorded rainfall amounts consistent with their historical averages. Region 4 at Kairuni recorded the highest deviation of 96% above its historical average at an observed total rainfall of 306.7 mm for the month.

Figure 11 to the left shows the temporal distribution of daily rainfall for selected locations across Guyana. It can be seen from the figure, the rainfall was distributed randomly throughout the month (as expected during a dry season) rather than being continuous The graph also shows the maximum one – day rainfall which was recorded in Region 3 at Leonora at 114.5 mm on August 3, 2017. While not quite comparable, several other locations recorded significant one – day rainfall amounts.

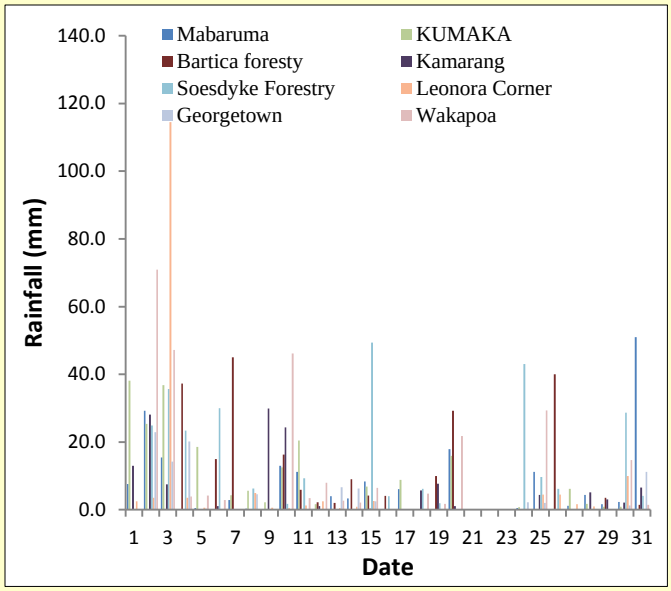


Figure 11 Temporal distribution of daily rainfall for August 2017 for selected stations throughout Guyana

Further analysis of the rainfall amount in Figure 10 above was done and the results presented in Figure 12 below as a histogram. The horizontal axis shows August 2017 accumulated rainfall expressed as a Percentage difference of the long-term average, with –ve values indicating rainfall amounts below the historical averages, while +ve values represent rainfall amounts greater than the historical average. From the figure below, it can be observed that the amount of stations recording below average and those recording above average rainfall are almost equal..

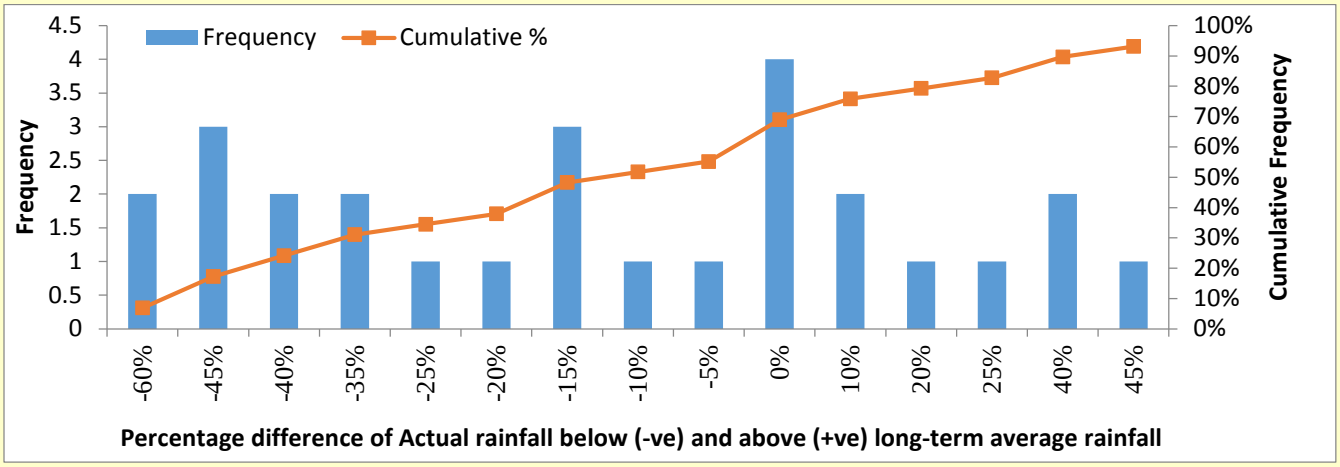
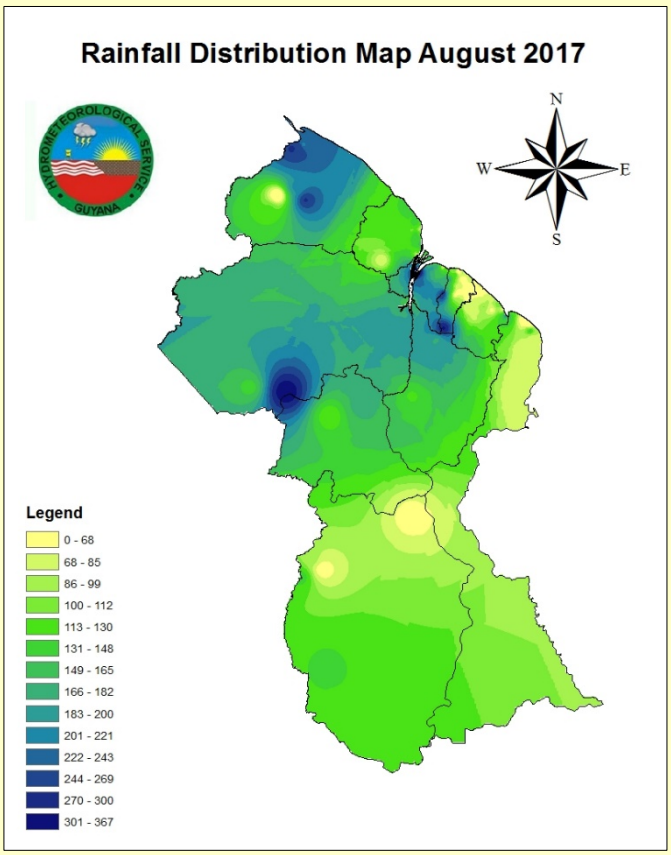


Figure 12 Histogram of August 2017 rainfall as percentage difference of Long term average rainfall



It is also worthwhile to mention that a third (1/3) of the locations received rainfall amounts less than 25% of their historical average while only about a fifth (1/5) of the locations received rainfall exceeding their historical average by more than 25%Figure 20 shows a spatial representation of the rainfall distribution across Guyana. Region 3 at Fort Island recorded the highest accummulated rainfall for August 2017 at 371.7 mm in 23 rain days. Several other locations also recorded significant rainfall amounts as can been seen on the map to the left or the graph below.

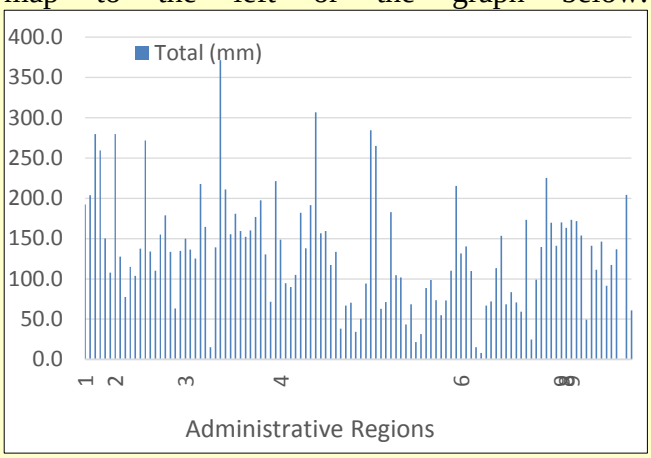


Figure 13 (a)Map and (b) Graph showing Spatial Interpolation (IDW) and distribution of rainfall amounts acrosss Guyana.

Table 1 Summary of Regional rainfall classification throughout Guyana for August 2017.

Region	Average Rainfall (mm)	Average Rain days	Classification	Station with the highest total
1	185.0	15 days	Moderately Wet (MW)	Wauna recorded 259.4 mm of rainfall with 21 rain days.
2	141.1	11 days	Moderately Dry (MD)	Wakapoa Pomeroon River recorded 271.8 mm of rainfall with 17 rain days.
3	172.4	10 days	Moderately Dry (MD)	Boerasirie (W.C.D) recorded 197.6 mm of rainfall with 9 rain days.
4	118.9	9 days	Dry (D)	Kairuni recorded 306.7 mm of rainfall with 23 rain days.
5	67.1	9 days	Dry (D)	Canegrove Front (E.D.C) recorded 159.7 mm of rainfall with 10 rain days.
6	73.9	5 days	Dry (D)	New Amsterdam recorded 140.5 mm of rainfall with 7 rain days.
7	155.4	14 days	Moderately Wet (MW	Bartica Agri recorded 169.6 mm of rainfall with 12 rain days.
8	267.6	13 days	Wet (W)	Kaieteur recorded 267.6 mm of rainfall with 13 rain days.
9	141.3	10 days	Moderately Dry (MD)	Lethem recorded 141.3 mm rainfall with 10 rain days.
10	164.8	17 days	Moderately Wet (MW	Wismar recorded 164.8 mm of rainfall with 17 rain days.

Climatological Summary for August 2017

Table 2 Summary of Observed data and Historical averages for Synoptic stations across Guyan during August 2017

STATION	RAINFALL (mm)		MAX. TEMP (˚C)		MIN. TEMP (˚C)		SUNSHINE HOURS	
	TOTAL	LONG TERM AVERAGE	MEAN	LONG TERM AVERAGE	MEAN	LONG TERM AVERAGE	MEAN	LONG TERM AVERAGE
MABARUMA	192.3	210.4	30.4	*	22.4	*	5.7	*
GEORGETOWN	94.8	172.9	30.2	30.8	23.8	24	7.8	6.8
TIMEHRI	265.2	225.7	31.4	*	22.2	*	6.5	*
OGLE	104.8	125	30.5	*	23.7	*	7	*
N/AMSTERDAM	140.5	157.1	31.2	32	23.9	23.3	7	5.07
KAIETEUR	112.5	267.6	28.7	*	*	*	5.1	*
LETHEM	137.8	145.7	31.5	32.1	23.8	23.9	7.8	5.7
KAMARANG	141.1	*	29.3	*	21.1	*	6.1	*
EBINI	*	203.1	32.1	*	22.3	*	6	*

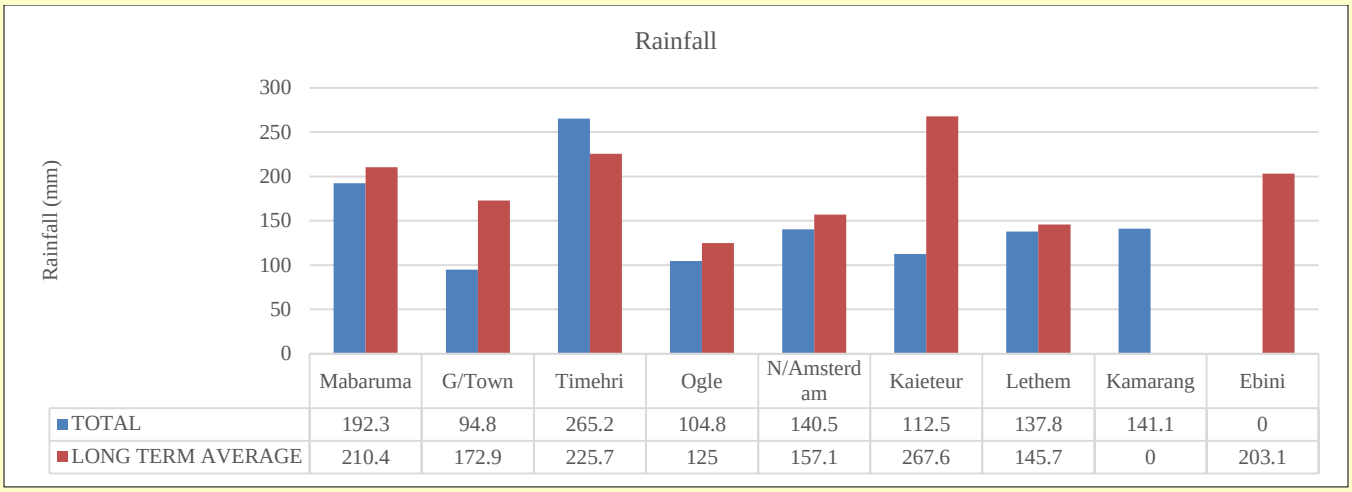


Figure 14 Comparison of August 2017 observed rainfall with its historical average for Synoptic Weather Stations across Guyana.

Figure 17 shows a comparison of August 2017 actual accumulated rainfall with the historical average for the Synoptic weather stations across Guyana. As already pointed out above, with the exception of Region 4 at Georgetown and Timehri along with Region 8 at Kaieteur, all other synoptic stations across Guyana recorded rainfall totals consistent with their long-term averages...

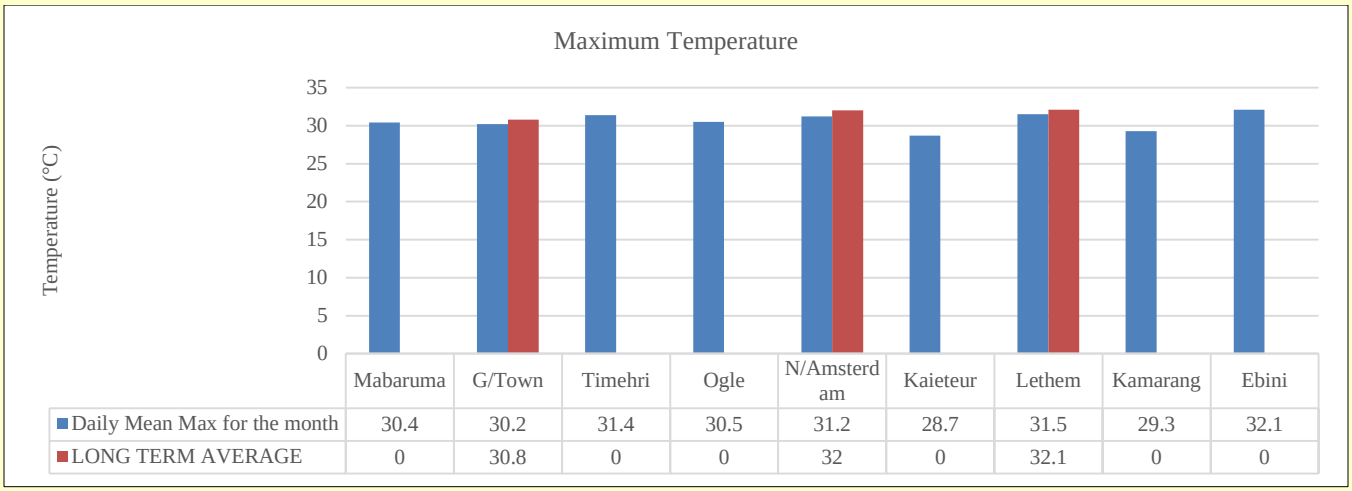


Figure 15 Comparison of August 2017 actual mean monthly Maximum Temperature with mean monthly historical average for August for Synoptic Weather Stations across Guyana

As with the previous month, during August 2017 all Synoptic stations recorded maximum and minimum temperatures with only a slight variation from their long-term averages. According to the data available, all stations having historical temperature data recorded mean maximum temperature slightly below their historical averages. Region 10 at Ebini recorded the highest mean maximum temperature of 31.5 °C with Region 9 at Lethem trailing by only 0.6 °C. On the other hand, Region 7 at Kamarang recorded the lowest minimum temperature for the month.

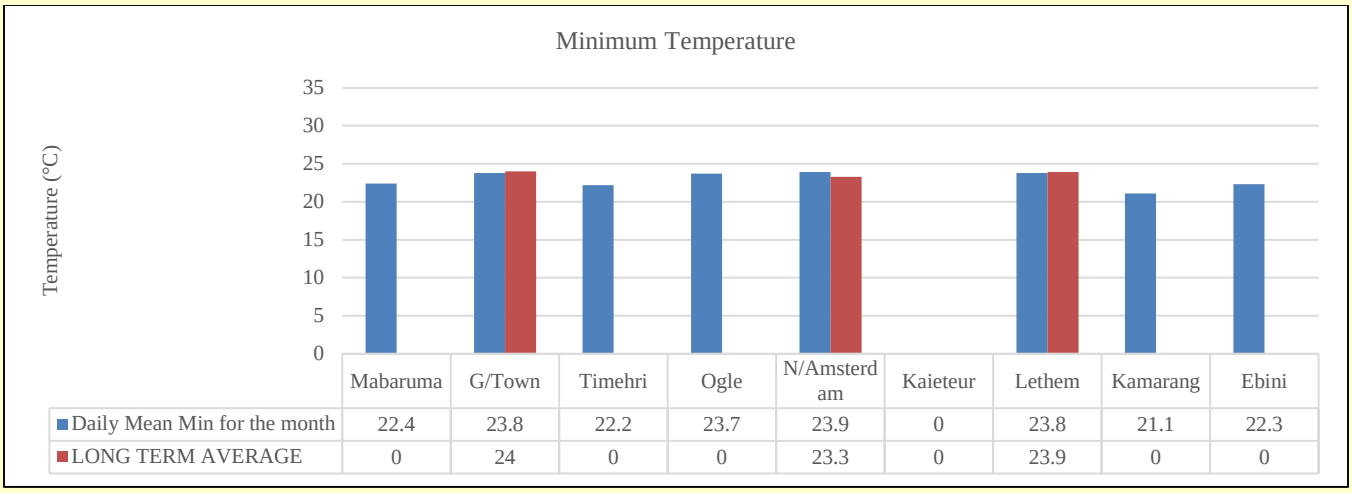


Figure 16 Comparison of August 2017 actual mean monthly Minimum Temperature with mean monthly historical average for August for Synoptic Weather Stations across Guyana

For stations with available historical records, all stations observed monthly average daily mean bright sunhine hours significantly greater than their historical averages. for August month. Regions 4 and 10 at Georgetown and Lethem repectively tied for the highest daily mean values at 7.8 hours/day

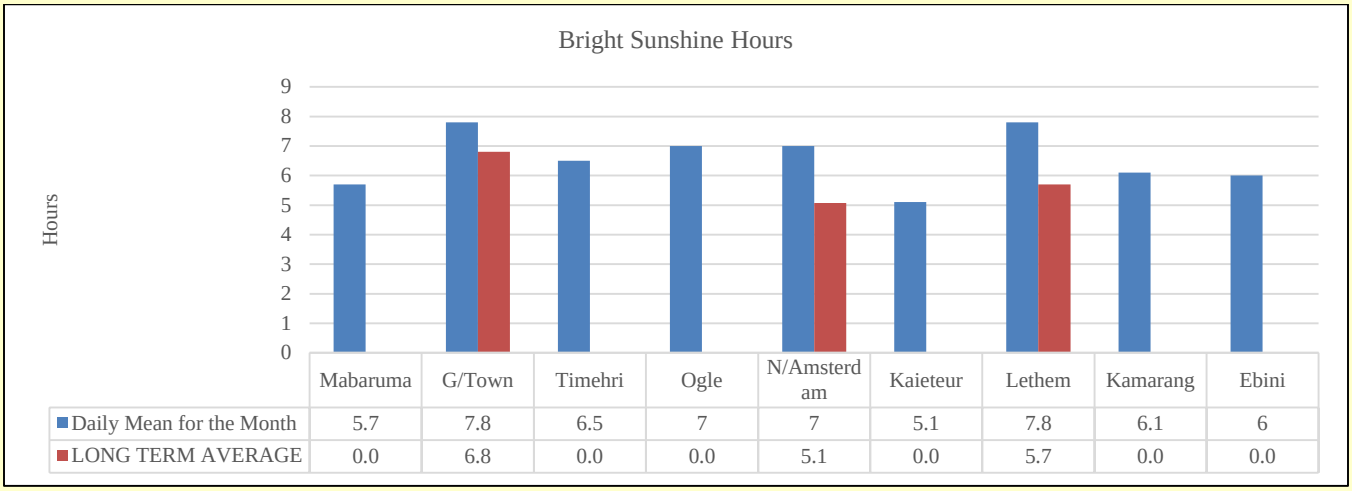


Figure 17 Comparison of August 2017 actual daily mean Bright Sunshine Hours with historical average for August for Synoptic Weather Stations across Guyana

Global Analysis

The combined global average temperature over the land and ocean surfaces August 2017 was 0.83°C (1.49°F) above the 20th century average of 15.6°C (60.1°F) —the third highest August temperature since global records began in 1880, trailing 2016 (+0.90°C / +1.62°F) and 2015 (+0.88°C / +1.58°F) – see Figure 25 (b) below. August 2017 also marks the 41st consecutive August and the 392nd consecutive month with a global temperature at least nominally above the 20th century average.

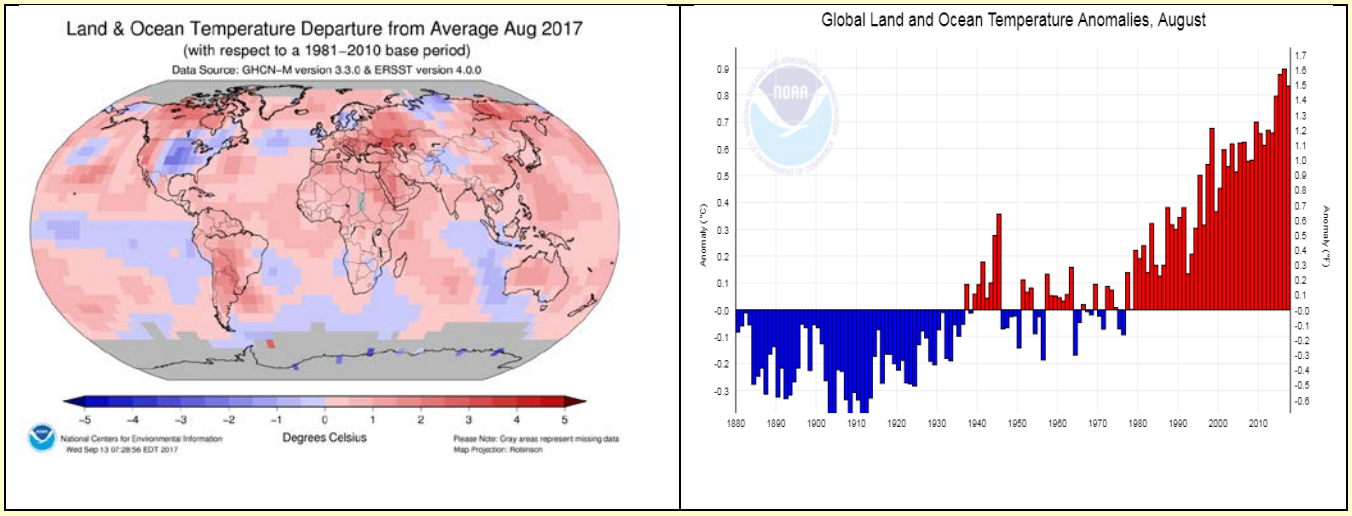


Figure 18(a) Global departure of August 2017 Land and Ocean Temperatures from the Historical averages taken for period 1981 - 2010. Compliments of NOAA[2]. (b) Global Land and Ocean Temperature Anomalies for the month of August from 1880 to 2017[3]

Warmer-than-average temperatures during the month were observed across much of the world's land surfaces. Averaged as a whole, the global land surface temperature for August 2017 was 1.17°C (2.11°F) above the 20th century average of 13.8°C (56.9°F)—the second highest August global land surface temperature since records began in 1880, behind 2016 by 0.08°C (0.14°F). Regionally, five of six continents had a top five warm August temperature, Additionally, much of the world's oceans also had warmer- to much-warmer-than-average conditions during August 2017, with several areas scattered across all major oceans experiencing record warmth. Overall, the global sea surface temperature for August 2017 was 0.71°C (1.28°F) above average and the fourth highest August temperature since 1880. The last five years (2013–2017) are among the top five years with the highest global ocean temperatures on record.

[2] http://www.ncdc.noaa.gov/sotc/service/global/map-blended-mntp/201708.gif
[3] http://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/1/12/1880-2017

Climatological Outlook for the next few Weeks

CariCOF Precipitation and Temperature Outlook for September to November2017

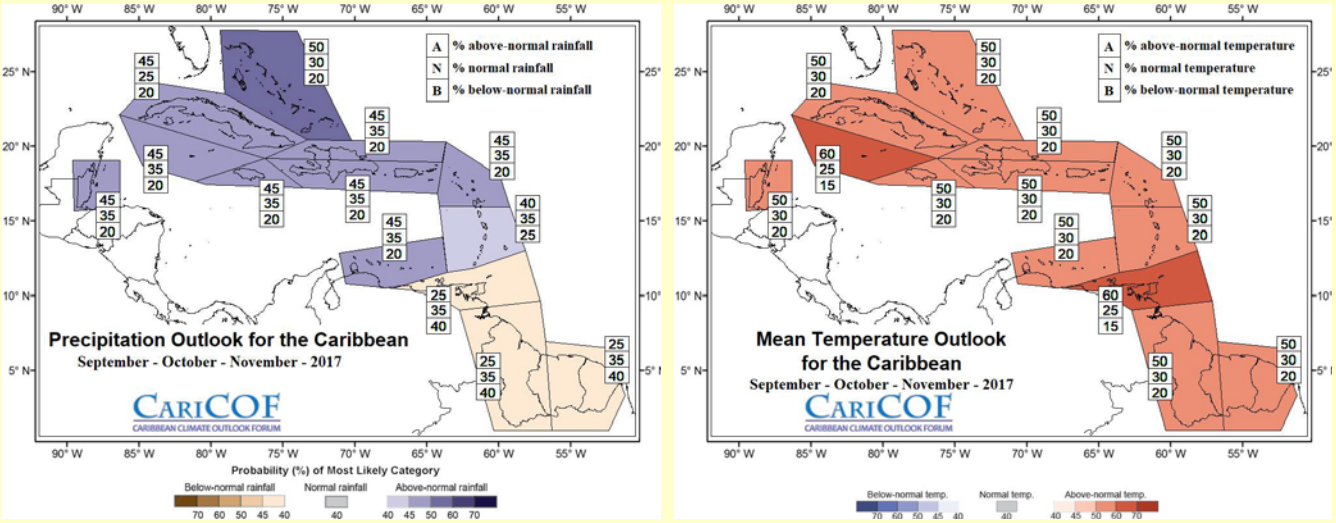


Figure 19 CariCOF (a) Precipitation and (b) Temperature outlook for the Caribbean for the period valid September – November, 2017 showing 75% confidence for *Above Normal to Normal* rainfall and 80% confidence for *Above Normal to Normal* Temperature for Guyana

According to the Outlook provided by CariCOF for the period Septmber – November 2017 in Figure **19**(a) above, Expect drier to pretty much like usual for this period with a confidence of 75%. The chance for extremely dry weather conditions are low, notwithstanding this is the period of the Primary dry season, as a result, chances of extreme dry are still a bit higher than usual. Additionally, according to the Temperature Outlook in

Figure **19**(b) above, warmer than to pretty much like usual can be expected for this period with a confidence level of 80 %. There is a resonable chance of extreme warm conditions which can cause minor discomfort at times.

CariCOF Wet Days and Wet Spells Outlook for September – November, 2017.

Table 3 Climatological Normals and Forecasted Number of ***Wet Days*** and various categories of ***Wet Spells*** for selected locations across Guyana for the period September to November, 2017

Rainfall Stations	No. of wet days		No. of 7-day wet spells (20% wettest)		No. of 7-day very wet spells (10% wettest)		No. of 3-day extremely wet spells (1% wettest)	
	Climatology	Forecast	Climatology	Forecast	Climatology	Forecast	Climatology	Forecast
Guyana_73	11-21	8-20	0.9-3	0.5-2.6	0-2.1	0.1-1.5	0-1	0-0.2
Guyana (Albion)	14-28	10-29	0.9-3.5	0.4-2.8	0.4-1.7	0.2-1.3	0-1	0-0.4
Guyana (Blairmont)	19-32	12-29	0.9-3	0.4-2.5	0-1.3	0.2-1.3	0-0	0-0.2
Guyana (Enmore)								
Guyana (Georgetown)	16-31	12-31	0.9-3	0.4-2.5	0.4-1.3	0.2-1.1	0-0	0-0.2
Guyana (New Amsterdam)	22-38	17-34	0.4-2.6	0.5-2.5	0-1.3	0.1-1.1	0-0	0-0.6
Guyana (Skeldon)	25-40	22-39	0.9-3	0.8-2.9	0.4-1.8	0.2-1.6	0-0.1	0-0.9
Guyana (Timehri)	20-28	14-31	0.4-3	0.5-2.8	0-1.3	0-1.4	0-0.1	0-0.5

Wet Days: Ususally, during September – October – November , 20 to 35 of the 91 days are Wet Days along Coastal Guyana as shown in Table 3 above. For September – November 2017, rainfall is likely to be below to normal for Guyana, as a result, slightly less or the usual amount of Wet Days is expected across the Country. This may result in disruption of outdoor activities

7 – Days Wet Spells: Usually, Coastal Guyana experiences between 1 to 3 '*Seven – Days' Wet Spell*, with up to 2 of them being Very Wet for the period September – November. For September to November 2017, according to the CariCOF Outlook shown in Table 3 above, either slightly less or the usual Wet and Very Wet spells are expected.

IRI-ENSO Forecast

***Synopsis*: There is an increasing chance (~55-60%) of La Niña during the Northern Hemisphere fall and winter 2017-18.**

Over the last month, equatorial sea surface temperatures (SSTs) were near-to-below average across the central and eastern Pacific Ocean. ENSO-neutral conditions were apparent in the weekly fluctuation of Niño-3.4 SST index values between -0.1°C and -0.6°C. While temperature anomalies were variable at the surface, they became increasingly negative in the sub-surface ocean, due to the shoaling of the thermocline across the east-central and eastern Pacific. Though remaining mostly north of the equator, convection was suppressed over the western and central Pacific Ocean and slightly enhanced near Indonesia. The low-level trade winds were stronger than average over a small region of the far western tropical Pacific Ocean, and upper-level winds were anomalously easterly over a small area of the east-central Pacific. Overall, the ocean and atmosphere system remains consistent with ENSO-neutral.

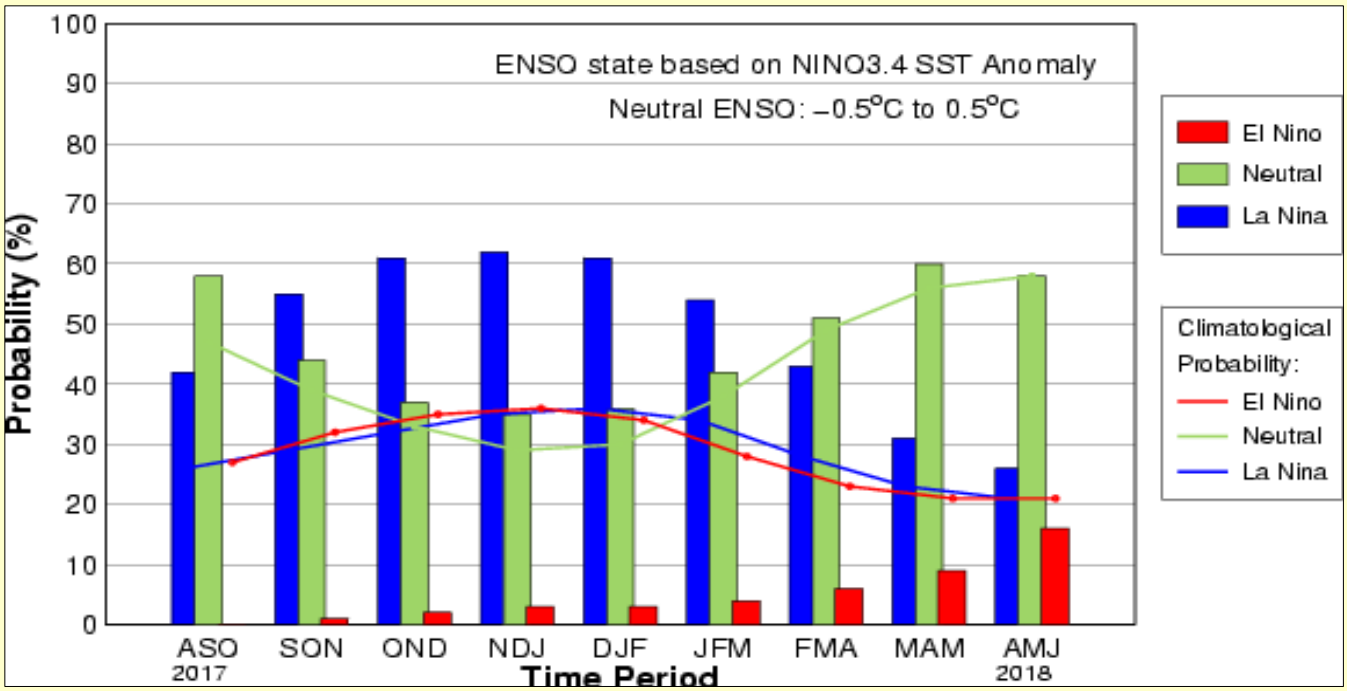


Figure 20 September 2017 CPC/IRI Official Probabilistic ENSO Forecast

Recent and Current Conditions

In mid-September 2017, the NINO3.4 SST anomaly was near the borderline of the weak La Niña category. For August the SST anomaly was -0.15 C, in the ENSO-neutral range, and for June-August it was 0.26 C, also in the ENSO-neutral range. The IRI's definition of El Niño, like NOAA/Climate Prediction Center's, requires that the SST anomaly in the Nino3.4 region (5S-5N; 170W-120W) exceed 0.5 C. Similarly, for La Niña, the anomaly must be -0.5 C or less. The climatological probabilities for La Niña, neutral, and El Niño conditions vary seasonally, and are shown in a table at the bottom of this page for each 3-month season. The most recent weekly anomaly in the Nino3.4 region had cooled to -0.6, in the weak La Niña range. The pertinent atmospheric variables, including the upper and lower level zonal wind anomalies, have been showing mainly neutral patterns, although the convection pattern has become somewhat suggestive of a borderline La Niña condition. The Southern Oscillation Index (SOI) has been somewhat above average, although the equatorial SOI has been near average. Subsurface temperature anomalies across the eastern equatorial Pacific have become somewhat below average. Despite recent SST anomalies some signs of La Niña patterns in some atmospheric variables, the combination of the SST and the atmospheric conditions continues to warrant an ENSO-neutral diagnosis for the recent 1-month period..

Expected Conditions

The official diagnosis and outlook produced jointly by CPC and IRI issued by the NOAA/Climate Prediction Center ENSO Diagnostic Discussion suggested that that La Niña has the greatest chance of prevailing through fall and into winter, with slightly lower chances for ENSO-neutral. The model ENSO predictions from mid-September is shown below (Figure 21) in the IRI/CPC ENSO prediction plume. Those predictions suggest that the SST has the greatest chance for being in the weak La Niña range for September-November through the rest of 2017, and show a slightly lower but significant probability for ENSO-neutral, and

possibly a minimal La Niña condition that endures for only 2 to 4 running 3-month seasons

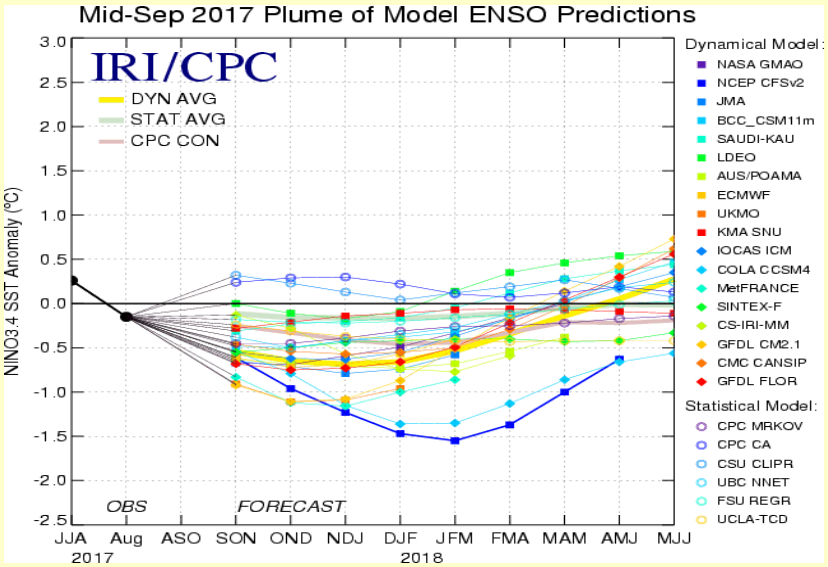


Figure 21 September 2017 Plume of Model ENSO Predictions

Table 4 Showing variation in seasonal climatological probabilities for La Niña, neutral, and El Niño conditions for each 3-month season.

Season	La Niña	Neutral	El Niño
DJF	36%	30%	34%
JFM	34%	38%	28%
FMA	28%	49%	23%
MAM	23%	56%	21%
AMJ	21%	58%	21%
MJJ	21%	56%	23%
JJA	23%	54%	23%
JAS	25%	51%	24%
ASO	26%	47%	27%
SON	29%	39%	32%
OND	32%	33%	35%
NDJ	35%	29%	36%

In summary, as of mid-September, according to the models on the IRI/CPC plume, about 50 to 60% of the dynamical or statistical models predicts, on average, a slight preference for weak La Niña conditions from Oct-Dec 2017 to Dec 2017-Feb 2018, with highest probabilities for ENSO-neutral during Sep-Nov 2017 and again from Jan-Mar 2018 and later. Additionally, while, about 40 to 50% of models predict neutral conditions, none of the models predicts El Niño conditions. Chances for El Niño are very small through Mar-May 2018

Annex I
Glossary of Terms

- **CariCOF** - Caribbean Climate Outlook Forum

- **CPC** – Climate Prediction Center

- **ENSO** - *El Niño–Southern Oscillation* is an irregularly periodical variation in winds and sea surface temperatures over the tropical eastern Pacific Ocean, affecting much of the tropics and subtropics.

- **Historical Mean** - Arithmetical mean computed using all the available Historical data from time of commencement of data collection.

- **IRI** – International Research Institute

- **ITCZ** - *The Inter Tropical Convergence Zone* is a belt of low pressure which circles the Earth generally near the equator where the trade winds of the Northern and Southern Hemispheres come together.

- **Long Term Average** - Same as Historical Mean

- **NOAA** - National Oceanic and Atmospheric Administration

- **Normal** - An Arithmetical mean taken over a Thirty (30) years period defined by WMO - currently 1981-2010.

- **Primary Dry Season** - The Major Dry Season in Guyana Occurring during the period August to mid-November

- **Primary Wet Season** - A period of heavy rainfall in Guyana occurring during the period Mid-April to Mid-July as a result of the northward movement of the ITCZ

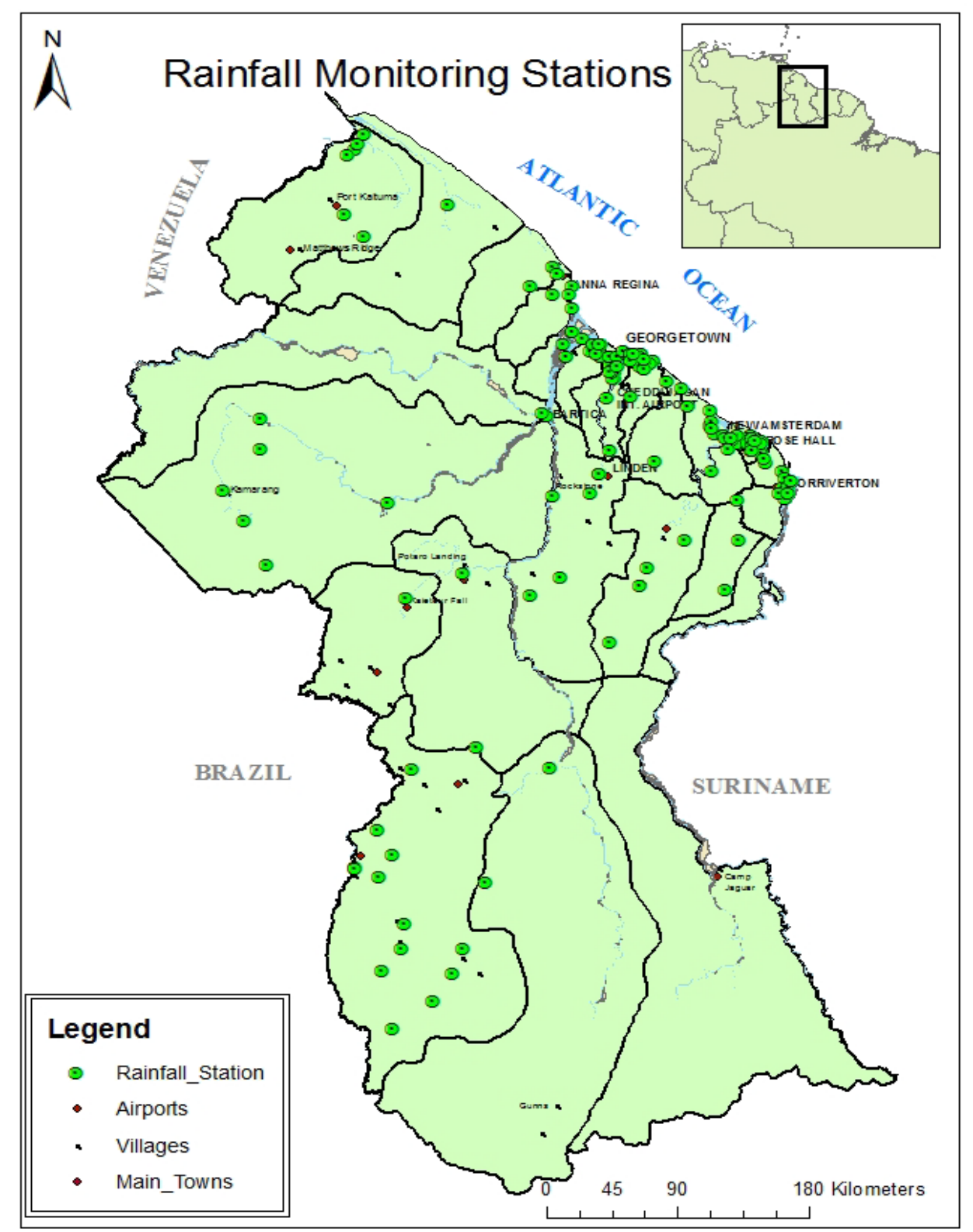
- **Secondary Dry Season**

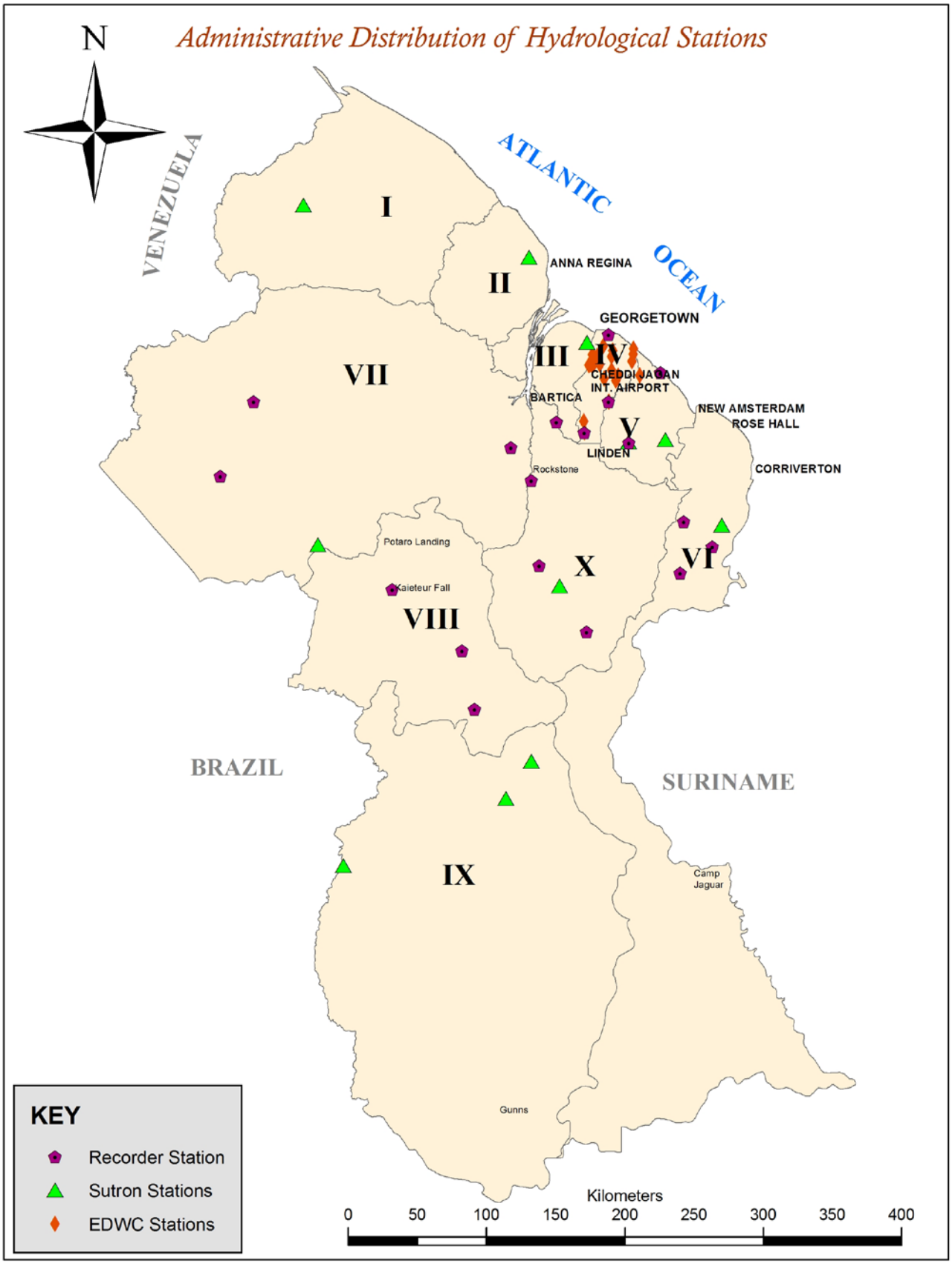
- S**econdary Wet Season -** A rainfall season in Guyana occurring during the period mid-November to January as a result of the Southward movement of the ITCZ

- **SST** - Sea Surface Temperature

- **WMO** - World Meteorological Organization

Annex II


Rainfall Monitoring Stations
N
VENEZUELA
ATLANTIC
OCEAN
BRAZIL
SURINAME
Port Kaituma
ANNA REGINA
GEORGETOWN
NEW AMSTERDAM
ROSE HALL
LINDEN
CORRIVERTON
Kamarang
Polaro Landing
Camp Jaguar
Legend
Rainfall_Station
Airports
Villages
Main_Towns
0 45 90 180 Kilometers


Administrative Distribution of Hydrological Stations
N
VENEZUELA
ATLANTIC
OCEAN
I
II
III
IV
V
VI
VII
VIII
IX
X
ANNA REGINA
GEORGETOWN
CHEDDI JAGAN
INT. AIRPORT
BARTICA
NEW AMSTERDAM
ROSE HALL
LINDEN
CORRIVERTON
Rockstone
Potaro Landing
Kaieteur Fall
BRAZIL
SURINAME
Camp
Jaguar
Gunns
KEY
Recorder Station
Sutron Stations
EDWC Stations
Kilometers
0
50
100
150
200
250
300
350
400

Annex III

Classification of Precipitation Values

DESCRIPTION	ABBREVIATION	RAINDAYS	RAINFALL (mm)
Very Dry	VD	0-10 11-20	0-59.9 11-29.9
Dry	D	1-10 11-20 21-31	60-119.9 30-89.9 21-59.9
Moderately Dry	MD	1-10 11-20 21-31	120-179.9 90-149.9 60-119.9
Moderately Wet	MW	1-10 11-20 21-31	180-239.9 150-209.9 120-179.9
Wet	W	1-10 11-20 21-31	240-329.9 210-269.9 180-239.9
Very Wet	VW	1-10 11-20 21-31	330-449.9 270-389.9 240-329.9
Exceedingly Wet	EeW	1-10 11-20 21-31	450-569.9 390-509.9 330-449.9
Excessively Wet	EsW	1-10 11-20 21-31	›570 510-629.9 450-569.9
Extremely Wet	EtW	11-20 21-31	›630 ›570

Sources

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or

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Hyde Park Timehri

Phone:
592-225-9303 | 592-261-4489 | 592-225-4247

Fax:
592-225-1460

E-Mail:
hydromet.nwwc@gmail.com

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