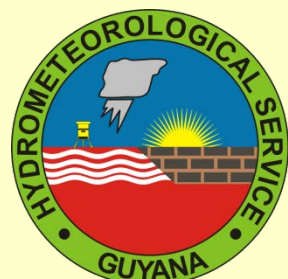


Monthly Bulletin

Ministry of Agriculture

Hydrometeorological Service

July 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."

HYDROMETEOROLOGICAL BULLETIN

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Highlights

- ❖ Guyana classified as Exceedingly Wet for June 2017
- ❖ Observed rainfall significantly above Historical Average for June 2017 – *Several stations recorded rainfall almost tripling long term average.*
- ❖ Warmer than average conditions dominated across much of the Earth's surface: Third highest June temperature recorded in 138 years.
- ❖ Wetter to pretty much like usual condition expected for July to September 2017.
- ❖ ENSO-neutral conditions favored. For July to August

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Below: Probable path of Tropical Storm Bret



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

June continues the primary rainy for northern Guyana and the only wet season for southern Guyana; June also marks the beginning of the Atlantic Hurricane Season. The rainy season is caused primarily by the northern migration of the

Inter Tropical Convergence Zone (ITCZ), along with low and mid-level troughs and propagation of tropical waves. These systems were all responsible for providing significant amounts of rainfall throughout Guyana..

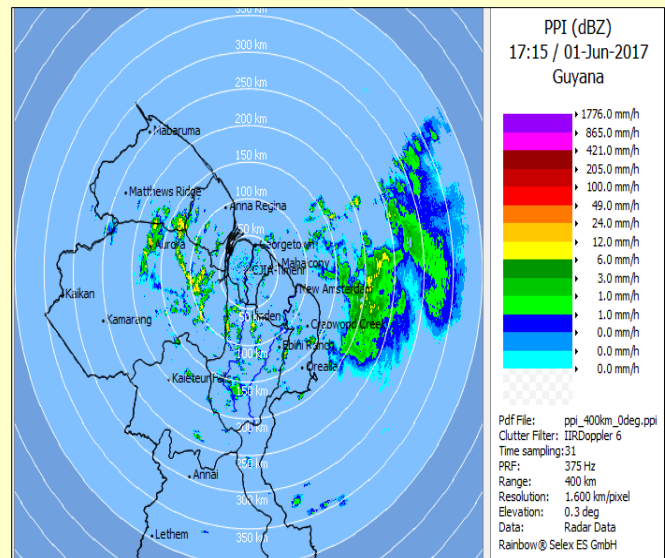
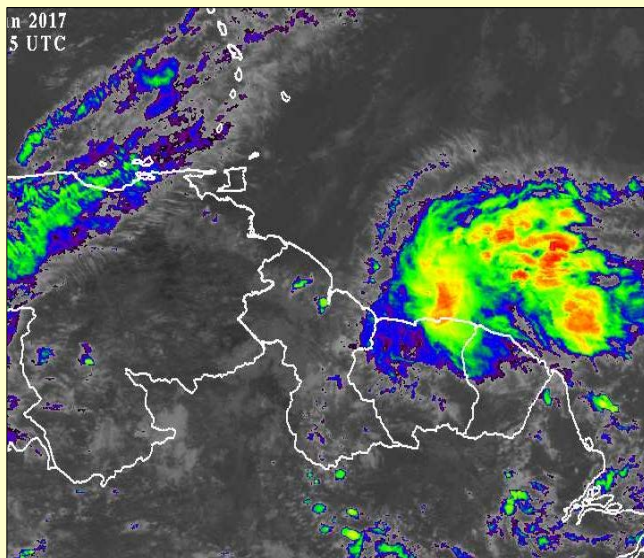


Figure 1(a)Satellite image (valid June 01 2017) showing deep convective clouds associated with the tropical wave embedded in the ITCZ approaching Guyana, (b)Radar Image (valid June 01, 2017) showing moderate echoes associated with the approaching tropical wave.

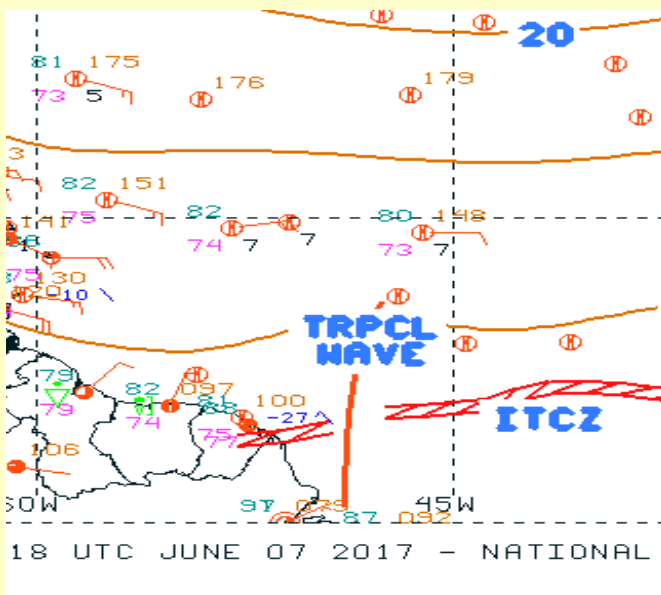


Figure 2 Surface chart (valid June 08, 2017) showing the position of the tropical wave and the Inter Tropical Convergence Zone along Guyana.

During the period June 01 – 10 2017, the propagation of tropical waves was the dominant feature affecting Weather conditions throughout Guyana. In addition, the Inter Tropical Convergence Zone (ITCZ) also had some influences but mainly over inland and interior locations. The influence of these systems produced large amount of precipitation at various locations across Guyana.

During the period June 11 -22, 2017 The Inter Tropical Convergence Zone was observed mainly over the northern Guyana, as it interacted with tropical waves, low and mid-level troughs producing large amount of precipitation throughout Guyana. In addition, a Tropical Storm (Bret) was observed to the north of Guyana. This system brought about rainfall amounts in excess of 7 inches within 24 – hour period.

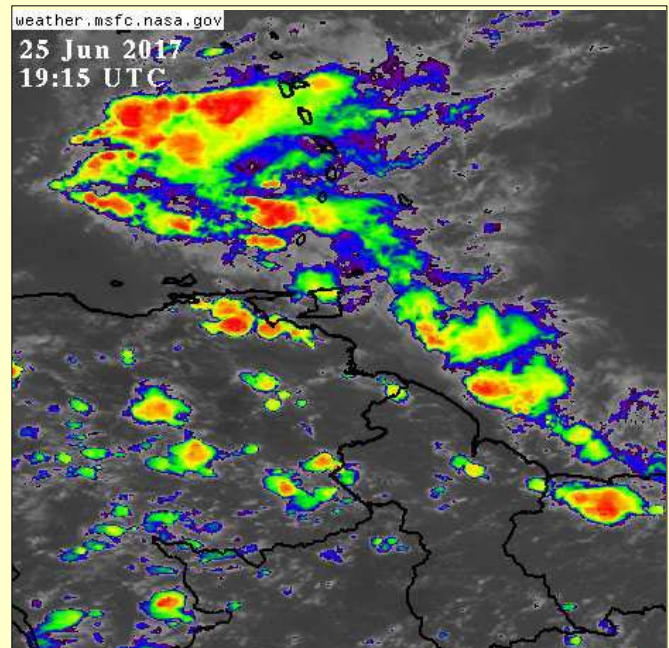
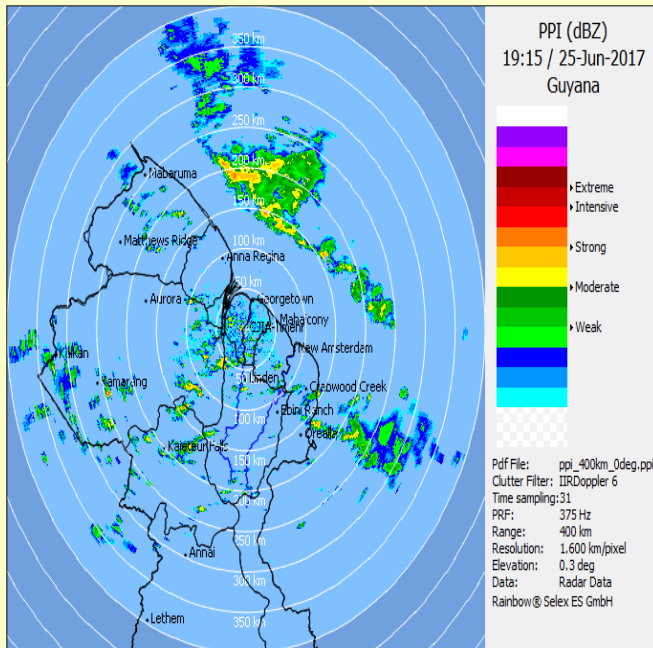


Figure 3 (a) Radar Image (valid June 25,2017) showing strong reflectivity associated with the ITCZ (b) Satellite image (valid June.25, 2017) showing deep convective clouds associated with the ITCZ

During the period June 25 – 30, the Inter Tropical Convergence Zone was located to the north of Guyana as shown in Figure 3 above. Despite the position to the ITCZ, the instabilities associated with this synoptic feature was suppressed by dust from the Saharan Air Layer (SAL) over coastal

areas, however, inland and interior locations observed significant precipitation as a result of day time heating. During this period, the highest 24 – hour rainfall total of 97.3 mm (3.9 inches) was recorded in the North Rupununi at Parishara on June 29, 2017.

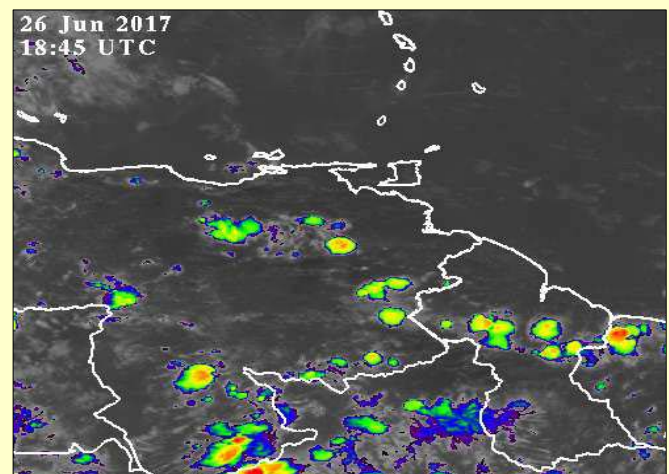
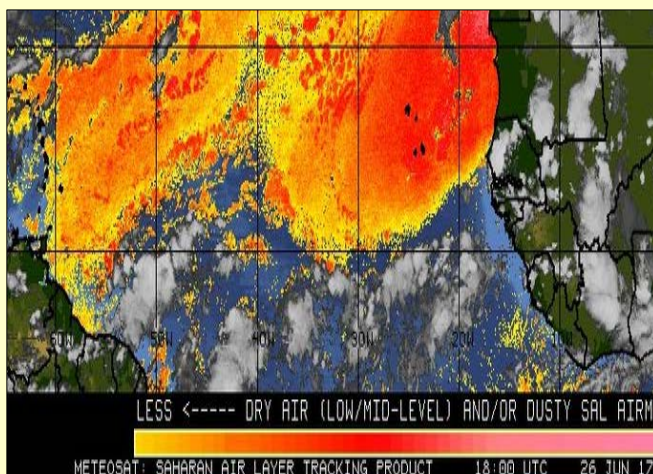


Figure 4 Image of Saharan Air Layer Image (valid June 26, 2017) showing dust in the atmosphere along Guyana's Coast: (b). Satellite image (valid June 26, 2017) showing deep convective clouds associated with day time heating.

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 below.

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.

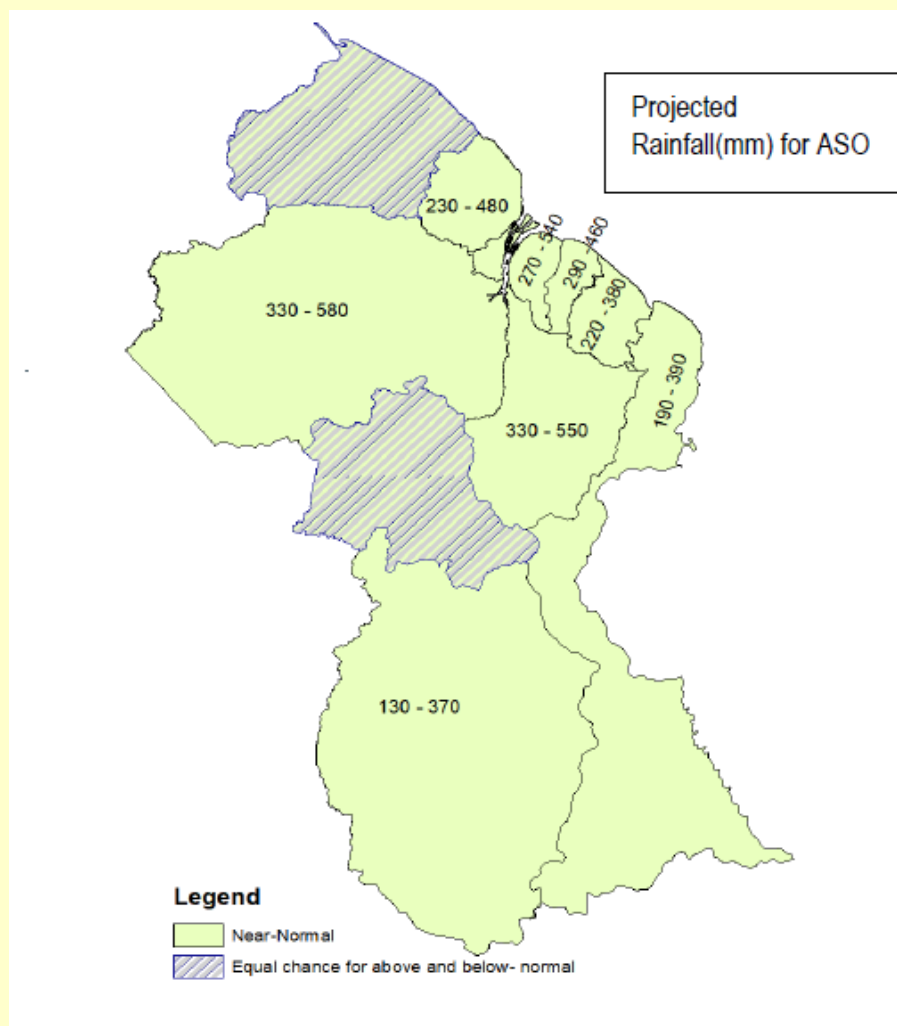


Figure 5 Map of Guyana showing rainfall Seasonal Normal and probabilistic forecast¹ across Guyana for period August – October 2017.

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

June 2017 Rainfall Analysis

Guyana was classified as *Exceedingly Wet* for the month of June 2017, with a nationwide average rainfall of 442.6 mm distributed over an average of 22 rain days. A detailed comparison of the June 2017 rainfall with the historical average for selected stations can be seen in Figure 6 below.

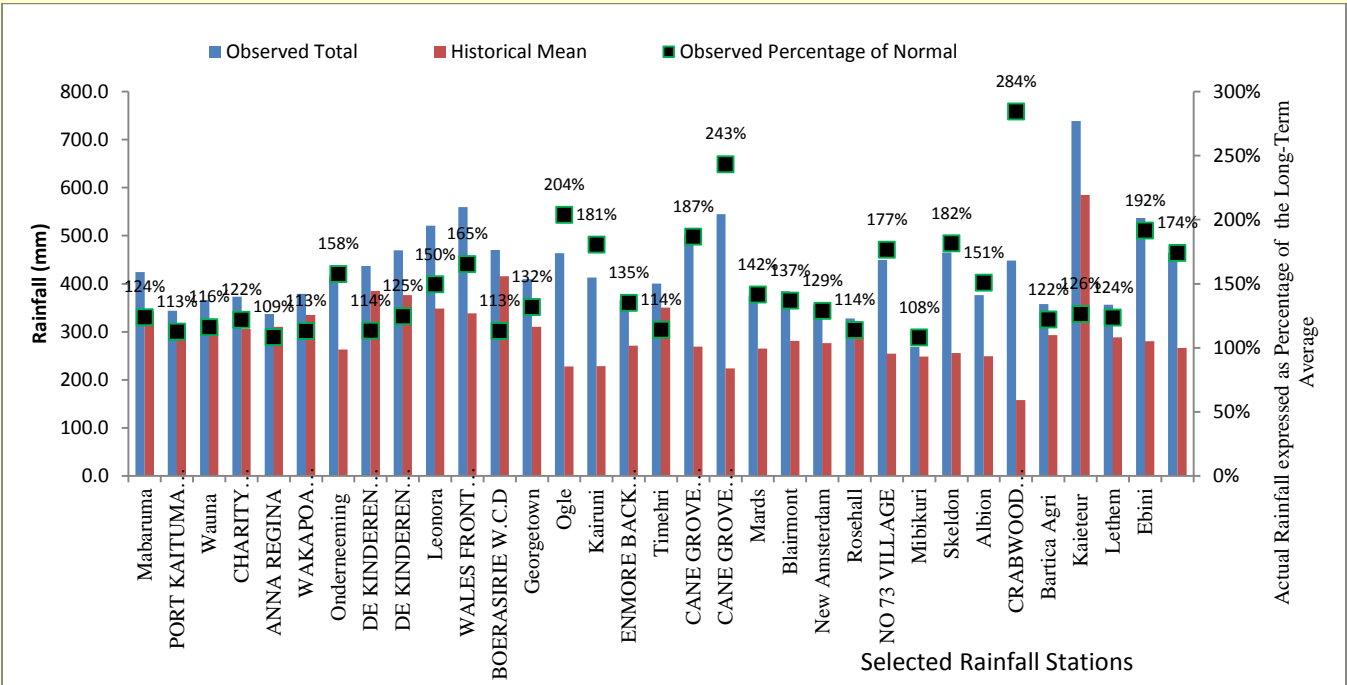


Figure 6 Comparison of the accumulated observed Rainfall for June 2017 expressed as a percentage of the Historical mean

According to the records collected and processed by the Hydromet, rainfall stations at all locations across Guyana recorded rainfall amounts significantly above their historical averages, several exceeding by more than twice. Region 6 at Crabwood Creek recorded the highest deviation, that is, 184% above its historical average at an observed total rainfall of 448.6 mm for the month. Notwithstanding, several other locations recorded rainfall accumulation significantly more than this value.

Figure 7 to the left shows the temporal distribution of daily rainfall for selected locations across Guyana. The graph also shows the maximum one – day rainfall which was recorded in Region 6 at John’s Village with 188.7 mm on June 22, 2017. Several other locations recorded significant one – day rainfall amounts including Region at Mahadia with 181.7 mm on June 8, 2017.

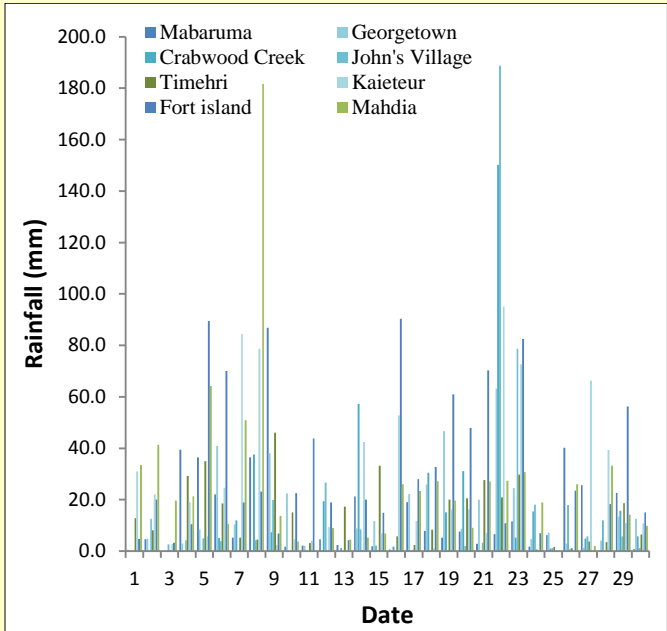


Figure 7 Temporal distribution of daily rainfall for June 2017 for selected stations throughout Guyana

Further analysis of the rainfall amount in Figure 6 above was done and the results presented in Figure 8 below as a histogram. The horizontal axis shows June 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 all stations recorded rainfall amounts above their historical averages.

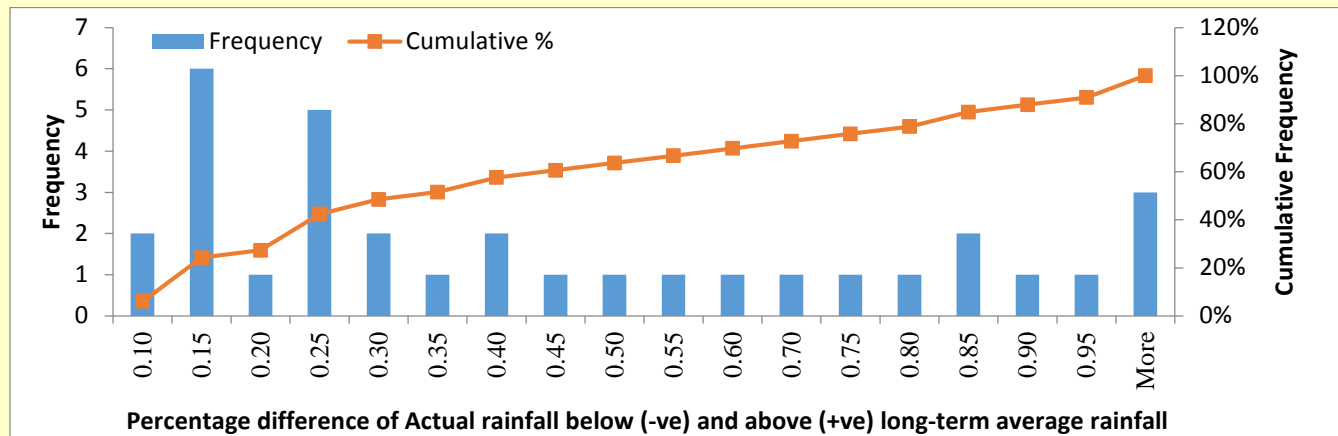
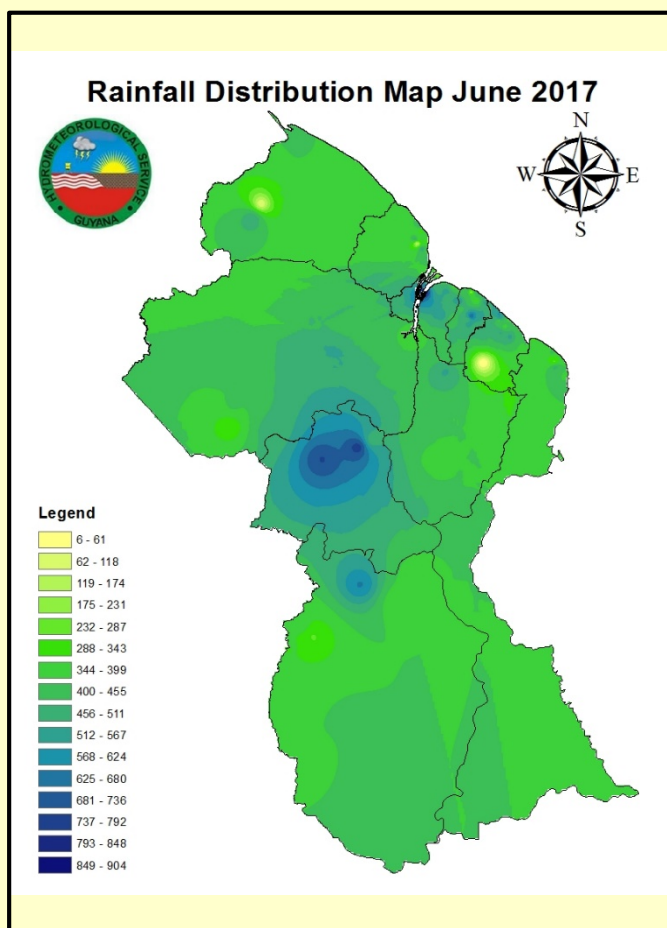


Figure 8 Histogram of June 2017 rainfall as percentage difference of Long term average rainfall



It is also worthwhile to mention that three fifths (3/5) of the locations received rainfall amounts greater than their historical average by over 25%, while about a tenth (1/10) of the locations received rainfall exceeding their historical average by more than double. Figure 9 shows a spatial representation of the rainfall distribution across Guyana. Region 3 at Fort Island recorded the highest accumulated rainfall for June 2017 at 915.0 mm in 28 rain days. Several other locations also recorded significant rainfall amounts, including Region 8 at Mahadia and Kaietuer at 738.7 mm and 761.1 mm as can be seen on the map to the left or the graph below.

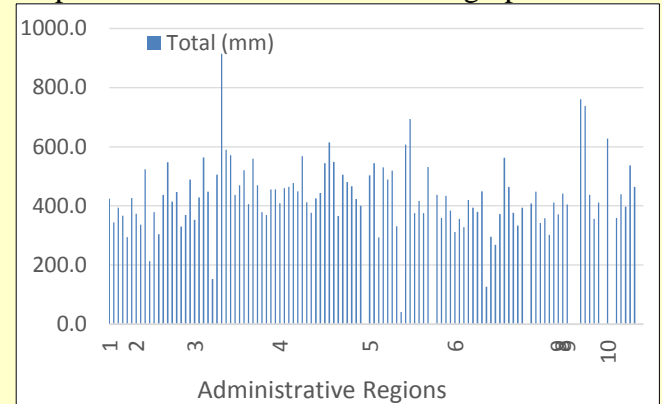


Figure 9 (a)Map and (b) Graph showing Spatial Interpolation (IDW) and distribution of rainfall amounts acrosss Guyana.

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

<i>Region</i>	Average Rainfall (mm)	Average Rain days	Classification	Station with the highest total
1	374.6	24	Exceedingly Wet (EeW)	Kumaka recorded 426.7 mm in 28 rain days
2	416.4	23	Exceedingly Wet (EeW)	Capoey Lake recorded 547.8 mm in 28 rain days
3	473.1	23	Excessively Wet (EsW)	Fort Island recorded 915.0 mm in 28 rain days
4	462.8	24	Excessively Wet (EsW)	Strathavon recorded 615.3 mm in 26 rain days
5	455.8	20	Exceedingly Wet (EeW)	Novar Mahaicony recorded 694.1 mm in 25 rain days
6	387.7	18	Very Wet (VW)	North Yakusari recorded 563.1 mm in 21 rain days
7	371.1	24	Exceedingly Wet (EeW)	Dagg Point recorded 441.8 mm in 28 rain days
8	749.9	27	Extremely Wet (EtW)	Mahdia recorded 761.1 mm in 28 rain days
9	436.3	20	Exceedingly Wet (EeW)	Annai Rupununi recorded 627.8 mm in 19 rain days
10	465.2	25	Excessively Wet (EsW)	Wisburg recorded 465.5 mm in 17 rain days

Climatological Summary for June 2017

Table 2 Summary of Observed data and Historical averages for Synoptic stations across Guyan during June 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
<i>MABARUMA</i>	407.1	342.7	30.1	28.9	23.4	22.6	*	3.4
<i>GEORGETOWN</i>	409.5	310.5	30.4	29.2	23.9	23.8	5.0	5.5
<i>TIMEHRI</i>	386.5	350.4	31.2	30.2	22.1	22.5	4.5	4.3
<i>OGLE</i>	464.0	227.6	30.4	30.7	23.7	*	6.0	*
<i>N/AMSTERDAM</i>	356.2	276.4	31.3	*	24.0	23.3	5.0	5.6
<i>KAIETEUR</i>	748.7	584.9	28.9	31.0	21.6	22.8	4.7	*
<i>LETHEM</i>	356.4	288.5	31.8	28.0	22.7	20.0	5.1	6.3
<i>KAMARANG</i>	327.8	*	30.1	31.2	21.2	22.6	5.0	3.9
<i>EBINI</i>	537.2	280.4	31.5	31.8	23.5	22.8	5.4	5.7

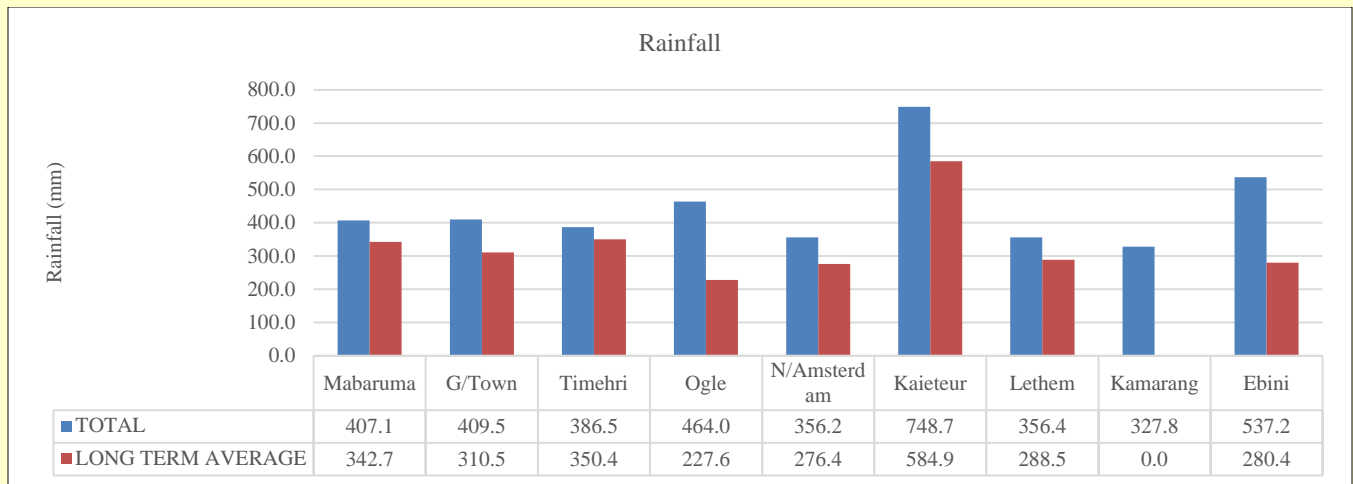


Figure 10 Comparison of June 2017 observed rainfall with its historical average for Synoptic Weather Stations across Guyana.

Figure 10 shows a comparison of June 2017 actual accumulated rainfall with the historical average for the Synoptic weather stations across Guyana. As already pointed out above, all synoptic stations

across Guyana recorded rainfall totals significantly greater than their long-term averages. Region 8 at Kaieteur recorded the highest amounts for Synoptic Stations.

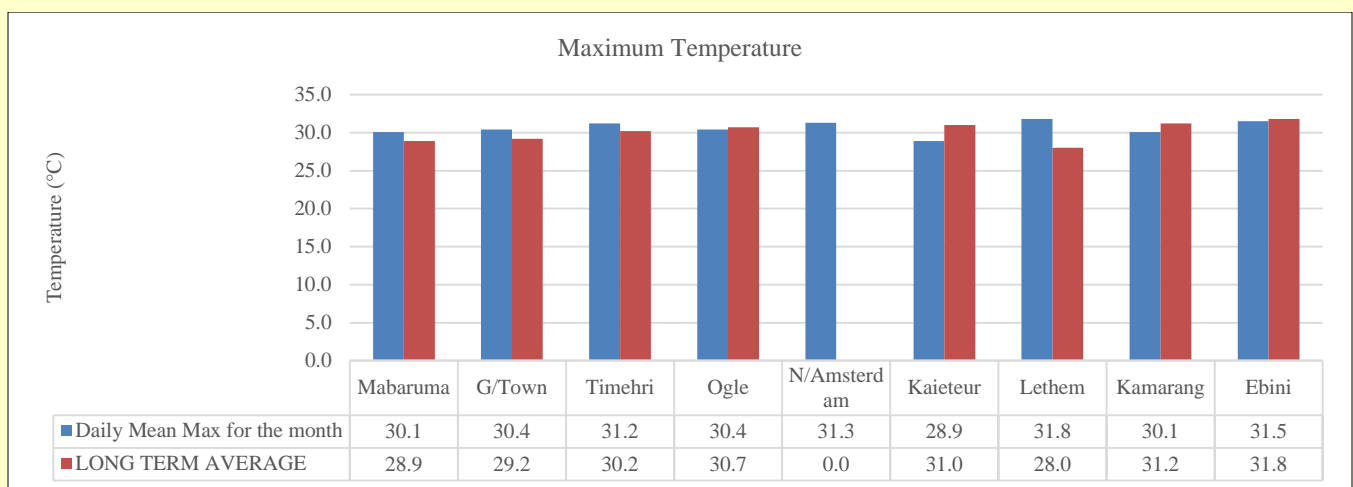


Figure 11 Comparison of June 2017 actual mean monthly Maximum Temperature with mean monthly historical average for June for Synoptic Weather Stations across Guyana

During June 2017, all Synoptic stations recorded maximum and minimum temperatures with only a slight variation from their long-term averages. Notwithstanding few stations recorded above average while others recorded below average Region 9 at Lethem recorded the highest mean

maximum temperature of 31.8 °C with Region 10 at Ebini trailing by only 0.3 °C. Lethem also recorded the highest daily maximum temperature of 34.5° on June 04, 2017 On the other hand, Region 7 at Kamarang recorded the lowest minimum temperature for the month.

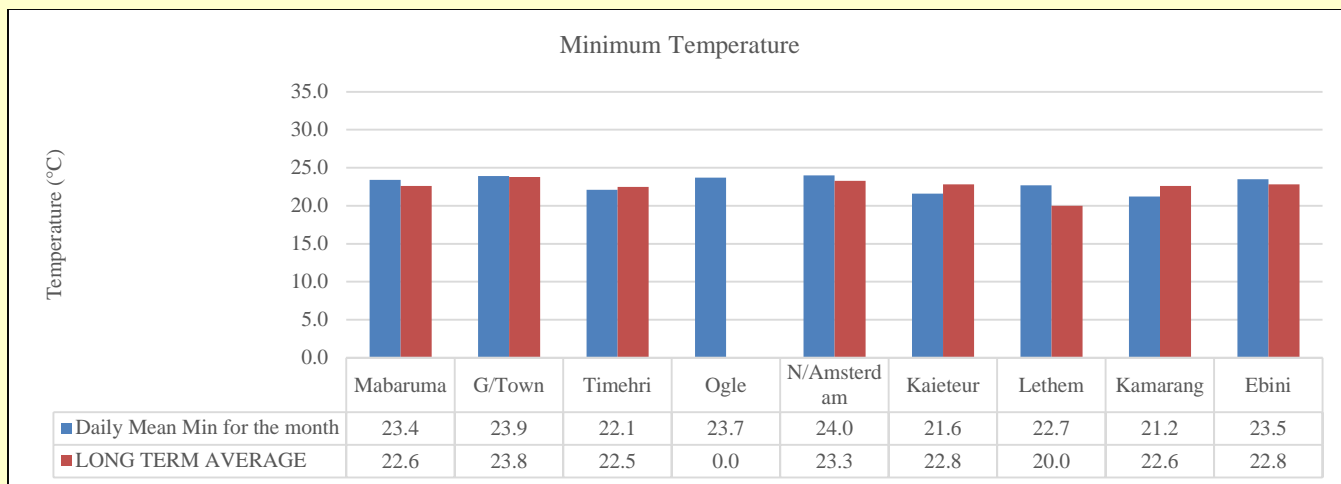


Figure 12 Comparison of June 2017 actual mean monthly Minimum Temperature with mean monthly historical average for June for Synoptic Weather Stations across Guyana

For stations with available historical records, few stations observed monthly average daily mean bright sunshine hours greater than their historical averages while others recorded values less than

their historical averages for June 2017. Regions 4 at Ogle recorded the highest daily mean value at 6.0 hours/day while Timehri recorded the lowest amount at 4.5 hours/day

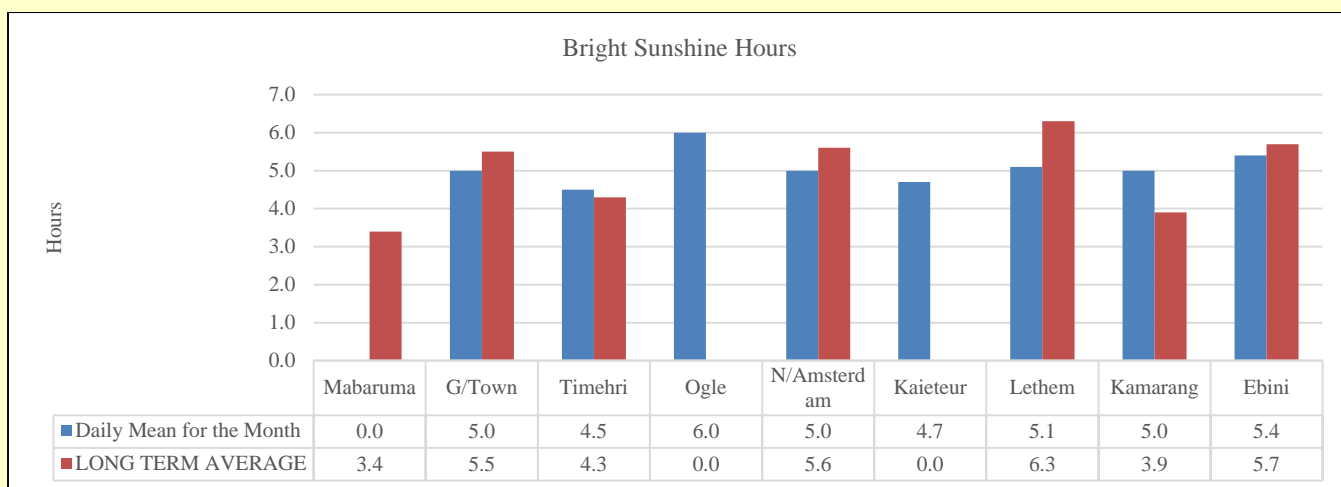


Figure 13 Comparison of June 2017 actual daily mean Bright Sunshine Hours with historical average for June for Synoptic Weather Stations across Guyana

Global Analysis

Warmer to much-warmer-than-average conditions prevailed across much of the world's land and ocean surface during June 2017. the combined global land and ocean surface temperature for June 2017 was 0.82°C (1.48°F) above the 20th century average of 15.5°C (59.9°F) and the third highest

June temperature in the 138-year record, behind 2016 (+0.92°C / +1.66°F) and 2015 (+0.89°C / +1.60). (see Figure 14 (b) below) June 2017 marks the 41st consecutive June and the 390th consecutive month with temperatures at least nominally above the 20th century average.

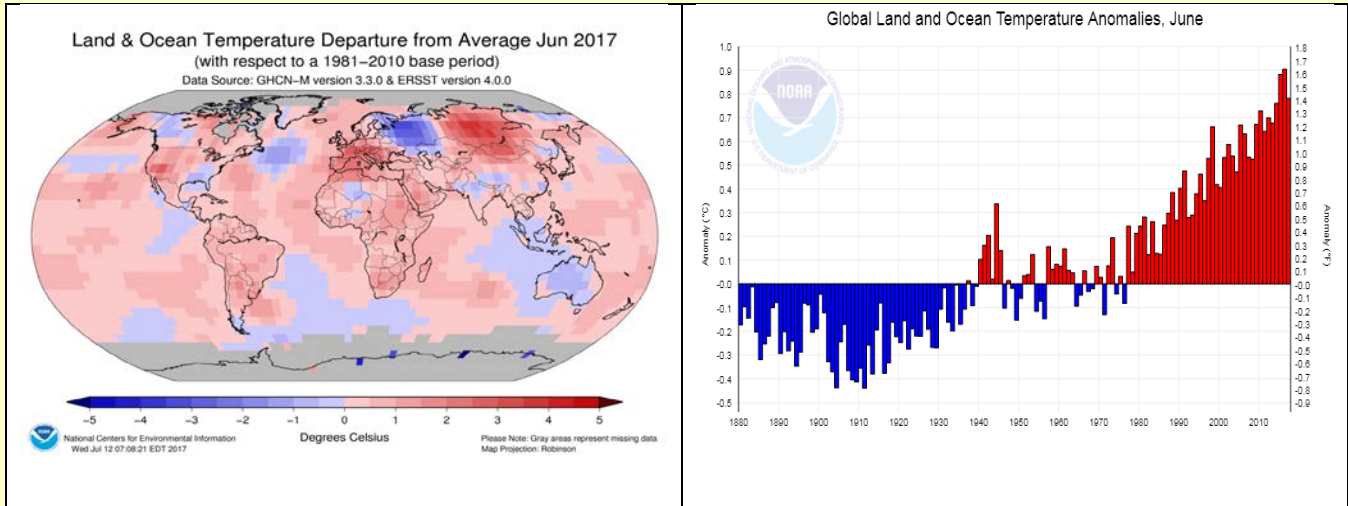


Figure 14(a) Global departure of June 2017 Land and Ocean Temperatures from the Historical averages taken for period 1981 - 2010. Compliments of NOAA². (b) Global Land and Ocean Temperature Anomalies for the month of June from 1880 to 2017³

The global land temperature for June 2017 was 1.15°C (2.07°F) above the 20th century average of 13.3°C (55.9°F). The fourth highest June global land temperature in the 138-year record, behind 2016 (+1.29°C / +2.32°F), 2015 (+1.28°C / +2.30°F), and 2012 (+1.22°C / +2.20°F). June 2017 was the 35th consecutive June with temperatures at least nominally above average. The last time global land surface temperatures were below average in June was in 1982. In addition,

across the oceans, the average global ocean surface temperature during June 2017 was 0.70°C (1.26°F) above the 20th century average of 16.4°C (61.5°F)—the third highest June temperature since global records began in 1880, behind 2016 (+0.78°C / +1.40°F) and 2015 (+0.74°C / +1.33°F). June 2017 marks the 41st consecutive June that the global sea surface temperature was nominally above the 20th century average..

² <http://www.ncdc.noaa.gov/sotc/service/global/map-blended-mntp/201706.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 July – September 2017

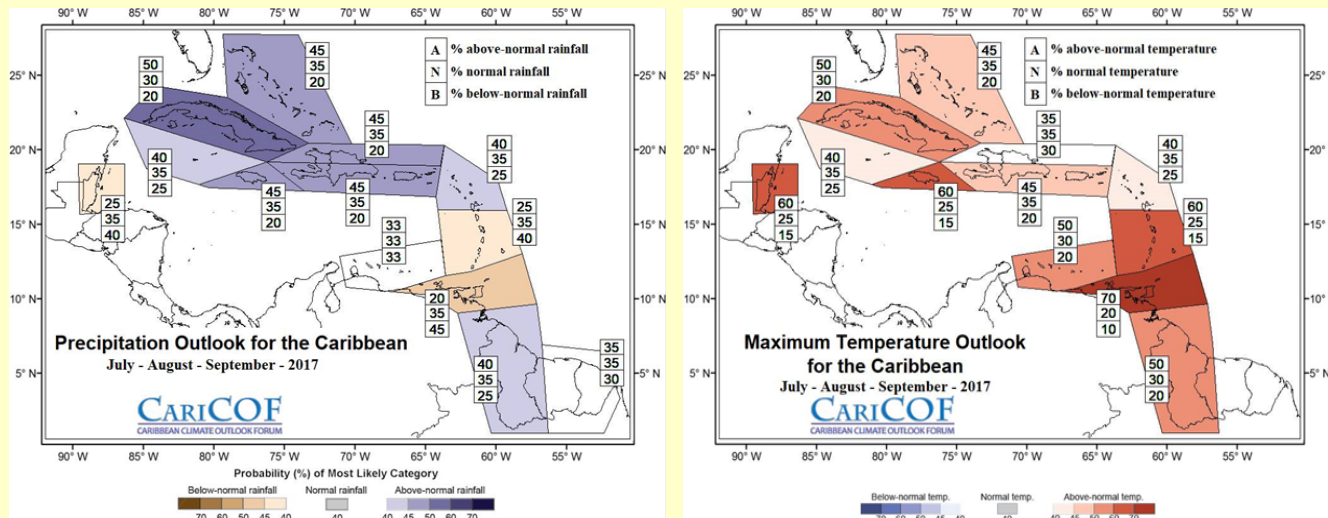


Figure 15 CariCOF (a) Precipitation and (b) Temperature outlook for the Caribbean for the period valid July – September, 2017 showing 75% confidence for *Above Normal to Normal* rainfall and 80% confidence for *Above Normal to Normal* Temperature for Guyana

According to the Outlook provided by CariCOF for the period July – September 2017, shown in Figure 15 (a) above, Expect wetter to pretty much like usual for this period with a confidence of 75%. Since this is the period of transition into the Primary Dry Season, the chance for extremely wet weather conditions are a bit low. Additionally,

according to the Temperature Outlook in Figure 15(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 July – September, 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 July to September, 2017

July to September 2017	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	17-26	14-25	1.7-3.9	1.4-4.8	0.4-2.6	0.6-2.7	0-0.2	0-0
Guyana (Albion)	26-42	21-39	2.1-4.7	2.4-5.5	0.9-3	0.9-2.9	0-1	0-0.8
Guyana (Blairmont)	33-46	29-44	2.1-5.1	2.1-5.8	0.9-2.6	0.9-3	0-1	0-0.9
Guyana (Enmore)	28-42	22-42	1.7-4.3	1.8-5.1	0.4-2.7	0.6-3	0-1	0-0.8
Guyana (Georgetown)	35-51	29-50	1.7-4.3	1.7-4.7	0.4-2.6	0.6-2.5	0-1	0-0.3
Guyana (New Amsterdam)	34-51	30-55	1.8-5.4	1.7-6.1	0.9-2.6	0.7-3.1	0-1	0-1.4
Guyana (Skeldon)	31-44	29-43	1.7-5.1	2-5.3	0.9-2.6	0.8-2.9	0-1	0-0.8
Guyana (Timehri)	31-38	28-38	2.1-3.9	1.8-4.4	0.9-2.6	0.7-2.8	0-1	0-1.3

Wet Days: Ususally, during July – August – September , 29 to 42 of the 92 days are Wet Days along Coastal Guyana as shown in Table 3 above. For July – September 2017, rainfall is likely to be above to normal for Guyana, as a result, slightly more 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 2 to 4 ‘Seven – Days’ Wet Spell, with up to 2 of them being Very Wet for the period July – September. For July – September 2017, according to the CariCOF Outlook shown in Table 3 above, either slightly more or the usual Wet and Very Wet spells are expected.

IRI-ENSO Forecast

Synopsis: ENSO-neutral is favored (50 to ~55% chance) through the Northern Hemisphere fall 2017.

During May, ENSO-neutral continued, though sea surface temperatures (SSTs) were above average in the east-central Pacific Ocean. The latest weekly Niño index values were near +0.5°C in most of the Niño regions, except for the easternmost Niño-1+2, which was at +0.2°C. The upper-ocean heat content anomaly increased during May, reflecting the expansion of above-average sub-surface temperatures across the central and eastern Pacific in association with a downwelling oceanic Kelvin

wave. While ocean temperatures were elevated, the atmosphere was close to average. Atmospheric convection anomalies were weak over the central tropical Pacific and Maritime Continent, while the lower-level and upper-level winds were near average over most of the tropical Pacific. Both the Southern Oscillation Index (SOI) and Equatorial SOI were also near zero. Overall, the ocean and atmosphere system remains consistent with ENSO-neutral..

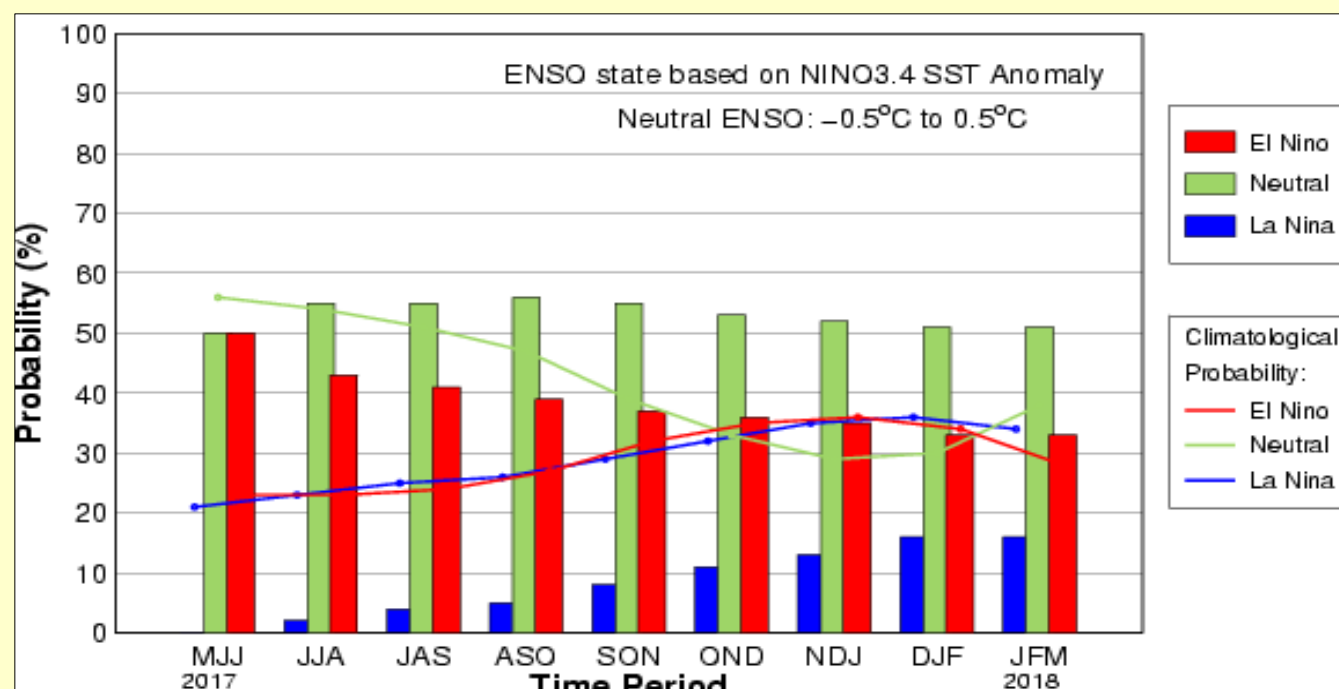


Figure 16 June 2017 CPC/IRI Official Probabilistic ENSO Forecast

Recent and Current Conditions

In mid-June 2017, the NINO3.4 SST anomaly hovered close to the borderline of a weak El Niño level. For May the SST anomaly was 0.46 C, near the borderline of weak El Niño, and for Mar-May it was 0.30 C, 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 in annex iv for each 3-month season. The

most recent weekly anomaly in the Nino3.4 region was 0.4, approaching the borderline of weak El Niño. The pertinent atmospheric variables, including the upper and lower level zonal wind anomalies, have been showing neutral patterns. The Southern Oscillation Index (SOI) had been somewhat below average, indicating an El Niño tendency, but recently has returned to near-average. Subsurface temperature anomalies across the eastern equatorial Pacific have been just slightly above average. Overall, given the SST and the atmospheric conditions, an ENSO-neutral diagnosis remains appropriate.

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 ENSO-neutral has an approximately 50 to 55% chance of persisting during northern summer and fall, with slightly lower chances for El Niño development. The model ENSO predictions from mid-June is shown

below (Figure 17) in the IRI/CPC ENSO prediction plume. Those predictions suggest that the SST has the greatest chance for being in the ENSO-neutral or the weak El Niño range for June-Aug and show a slowly increasing likelihood (but still below 50%) for El Niño development in fall and early winter.

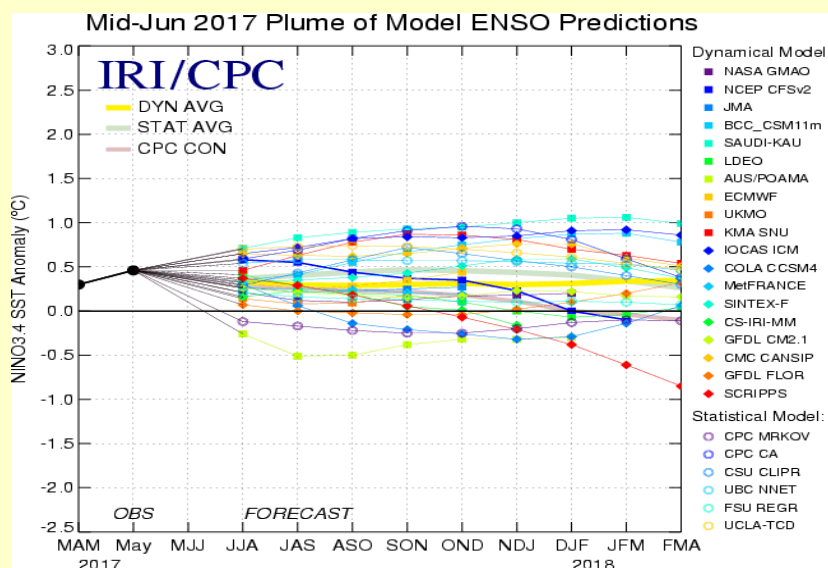


Figure 17 June 2017 Plume of Model ENSO Predictions

Table 4 Showing IRI/CPC Mid – June model-Based Forecast probabilities for La Niña, neutral, and El Niño conditions for each 3-month season.

Season	La Niña	Neutral	El Niño
JJA 2017	1%	67%	32%
JAS 2017	5%	60%	35%
ASO 2017	9%	52%	39%
SON 2017	12%	47%	41%
OND 2017	14%	43%	43%
NDJ 2017	15%	43%	42%
DJF 2018	13%	45%	42%
JFM 2018	10%	50%	40%
FMA 2018	6%	59%	35%

In summary, as of mid-June, the probabilities derived from the models on the IRI/CPC plume, 72% of the dynamical or statistical models predicts a preference for ENSO-neutral throughout the

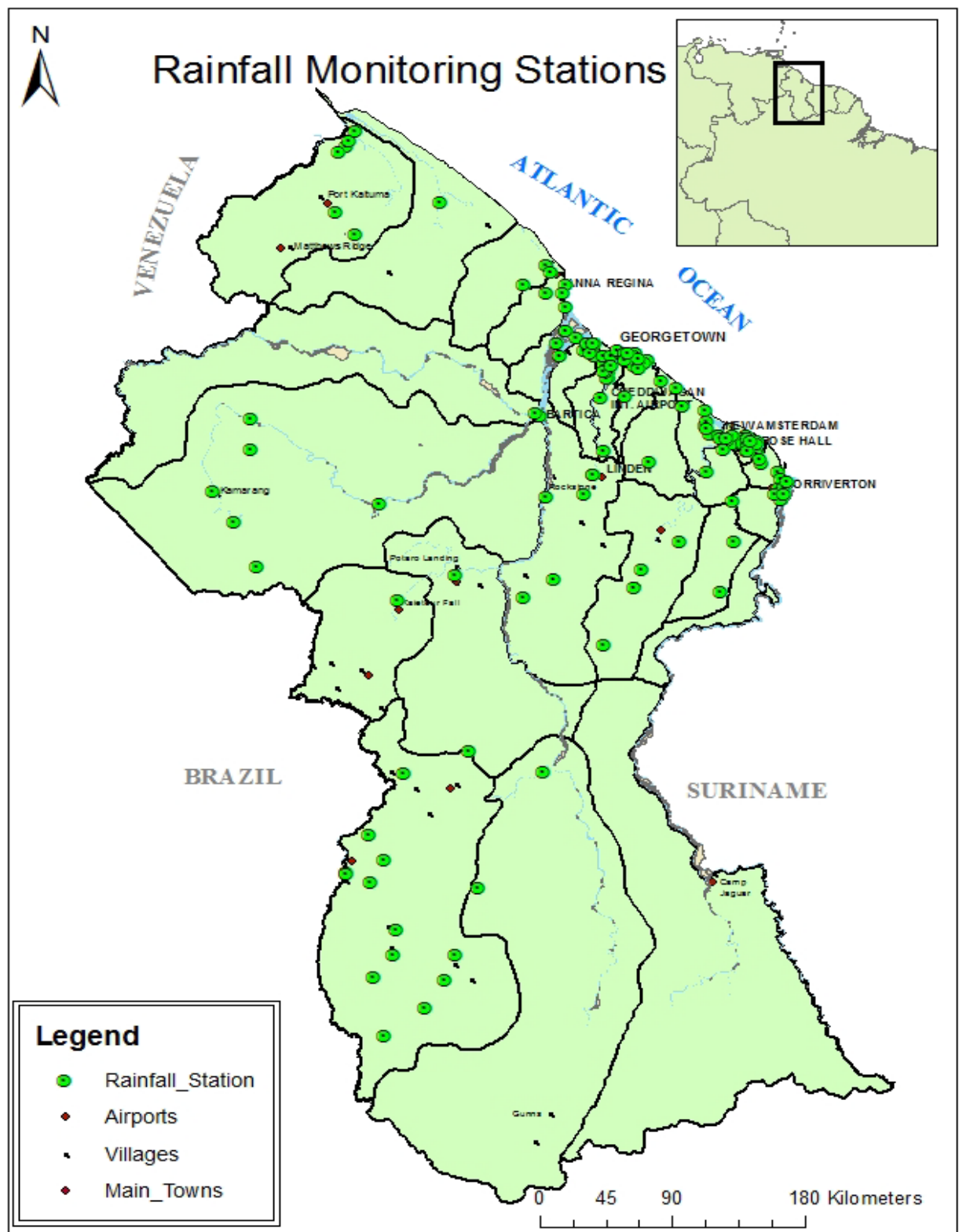
period Jun-Aug 2017, while 28% of the models predicts chances for El Niño peaking at 40-45% during fall and winter. Chances for La Niña are relatively low throughout the forecast period.

Annex I

Glossary of Terms

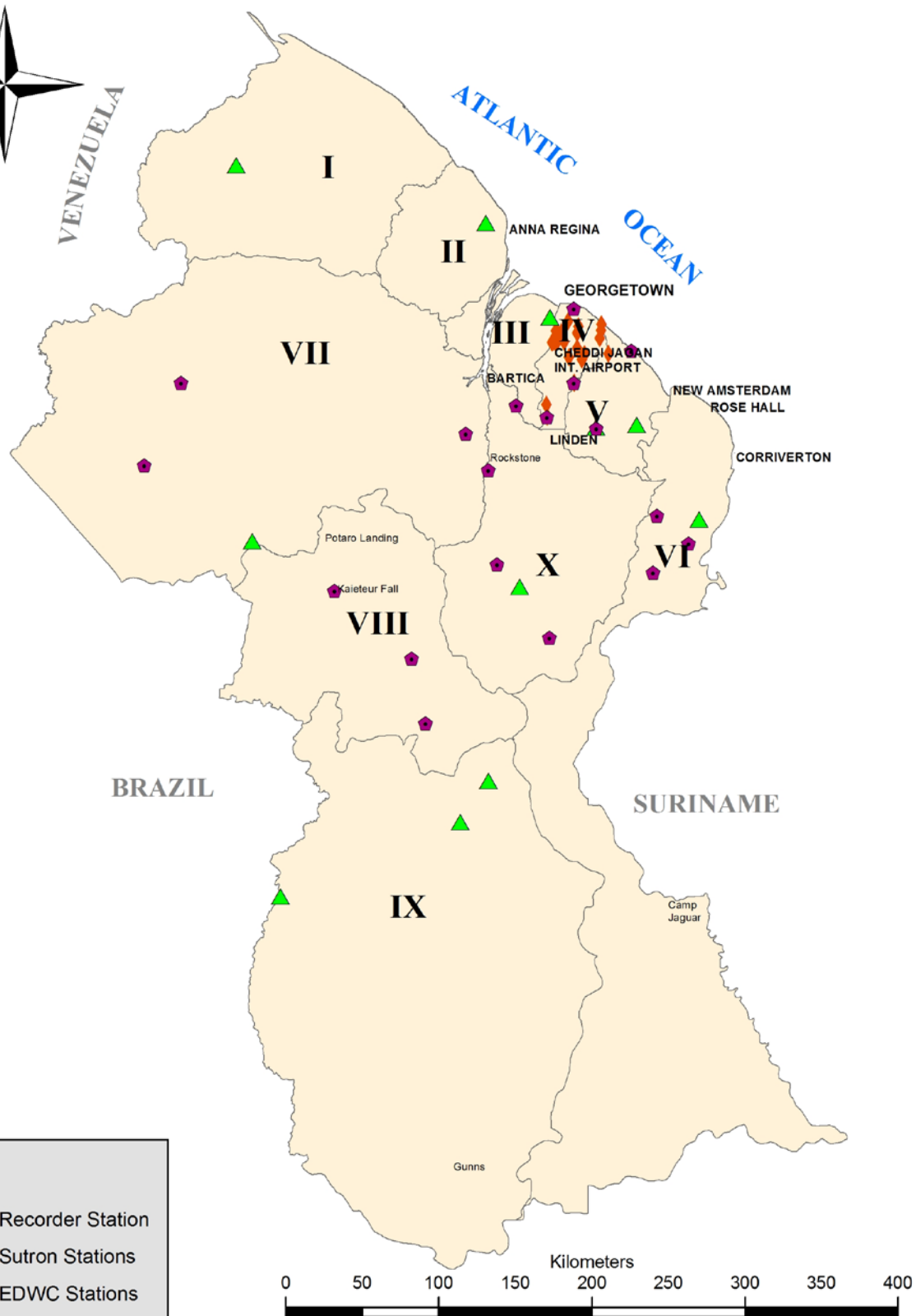
- **CariCOF** - Caribbean Climate Outlook Forum
- **CPC** – Climate Prediction Center
- **ENSO** - *El Niño–Southern Oscillation* is an irregularly periodical variation in winds and sea surface temperatures over the tropical eastern Pacific Ocean, affecting much of the tropics and subtropics.
- **Historical 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**
- **Secondary 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





Administrative Distribution of Hydrological Stations



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

Table 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%

Sources

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- http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html
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- <http://iri.columbia.edu/wp-content/uploads/2017/06/figure1.gif>
- http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

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