Caribbean Institute for Meteorology and Hydrology

The Outfield

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Just about every cricket fan will be hoping for as much sunshine and as little rain as possible for cricket world cup 2007. What might the weather be like then?

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About this issue

The rainfall of Guyana is very different to the islands of the English-speaking Caribbean. It differs in both its pattern and quantities. This issue sheds some light on the climate of Guyana, in particular its rainfall. It also provides some statistics on the dry and rainy days for Guyana for the period 5 March to 28 April with some comparisons to the other countries highlighted in previous volumes.

This issue includes a rainfall outlook for the period February to April, 2007, which will be updated with each subsequent volume. Based on this forecast, it is likely to be a good year to host the cricket world cup.

Long lead seasonal precipitation forecast

by Lawrence Pologne, Meteorologist, CIMH

Introduction

Forecasting climate is a rather non deterministic, probabilistic task. Thus, taking a closer examination at some of the factors that can be considered agents that drive climate, if we know their consequences on climate patterns, then we have a tool to anticipate fluctuations in climate.

Research has demonstrated that the state of certain environmental conditions at the start of a season can impact the evolution of the climate of the coming season or seasons. One well known mechanism for seasonal climate change is changes in Sea Surface Temperature (SST) patterns, especially patterns in the tropics.

SST patterns often persist for a few months to seasons. This brings a degree of predictability to some atmospheric climate anomalies by assuming that the SST patterns will persist into the period being forecast and knowing the atmospheric patterns that the SST patterns are likely to generate.

Statistical Atmospheric Model

Rather than using a full atmospheric General Circulation Model (GCM), we employ a statistical atmospheric model to make seasonal climate forecasts at various lead times. Incidentally, this statistical model happens to be one of the models being used in CIMH's 'net assessment' for making seasonal precipitation outlooks.

Statistical methods normally utilize one or more variables called predictor(s) to forecast a target variable which is often referred to as the predictand. Here, our predictor of choice is SST while the predictand is seasonal precipitation anomalies for the Caribbean region over the last 30 years. In order to connect the SSTs to seasonal precipitation, special statistical techniques are applied which optimize relationships between the two variables into a simple regression equation, expressing predictand (seasonal rainfall average) in terms of predictor (seasonal SST). This means that given predictor at a particular season, a value for the predictand can be obtained.

Our goal is to make predictions at various lead times, so the model is applied on SST patterns at various lead times with seasonal rainfall patterns. For instance, if we are interested in predicting seasonal rainfall

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anomalies for January-February-March (JFM) at 1-season lead, we would use SST anomalies for October-November-December (OND). Clearly, we are using information from SST anomalies for the previous season to extrapolate seasonal rainfall for the following season. Having established the regression equation, the desired SST data (usually the latest) can now be used to make projections for the desired seasonal rainfall.

How can we make a prediction for FMA 2007 seasonal rainfall anomalies when we are several seasons away? Well, there are two ways around this problem. Firstly, we can choose to apply the model on predictor/predictand at 7-season lead i.e. we can use SST data for May-June-July (MJJ) to predict rainfall anomalies for FMA. However, due to considerable reduction in skill as lead time increases, results may not be too reliable. Secondly, the preferred method is to use forecasted SST anomalies for November-December-January (NDJ). In this case, the predictor is applied at 1-season lead thereby adding a greater degree of skill and reliability to the projected output.

Model Forecast for FMA 2007

Our statistical model utilized forecasted SSTs from the Hybrid Coupled Model (HCM), a GCM from the Max Plank institute. Forecasted SST anomalies for NDJ (2006/2007) were applied as predictor to generate a forecast for FMA 2007. Forecasts are expressed in terms of tercile probabilities (Figs 1, 2 and 3) for normal, below-normal and above-normal conditions respectively, and give an indication of direction relative to climatology; the normal category is considered to be climatology. Tercile probabilities always add up to 100 percent.

Interpretation of Forecasts and Implications for CWC 2007

Tercile probabilities not only show the most likely category, but also show the probability distribution of all categories. Clearly, over the Eastern Caribbean region, below-normal is the most likely category with tercile probabilities of 40 to 50 percent. Over Jamaica, tercile probabilities of 30 to 40 percent are distributed evenly among all three categories. In northern Guyana, which includes Georgetown, the tercile probabilities are distributed similar to those of Jamaica.

Forecasts, however, should be used with caution due to uncertainty in the outlook. One should always bear in mind that the forecasts span over a three month period and even the least likely category should never be disregarded. One isolated, intense precipitation event can be more than enough to account for a particular tercile probability.

This forecast will be updated with each subsequent issue of The Outfield.

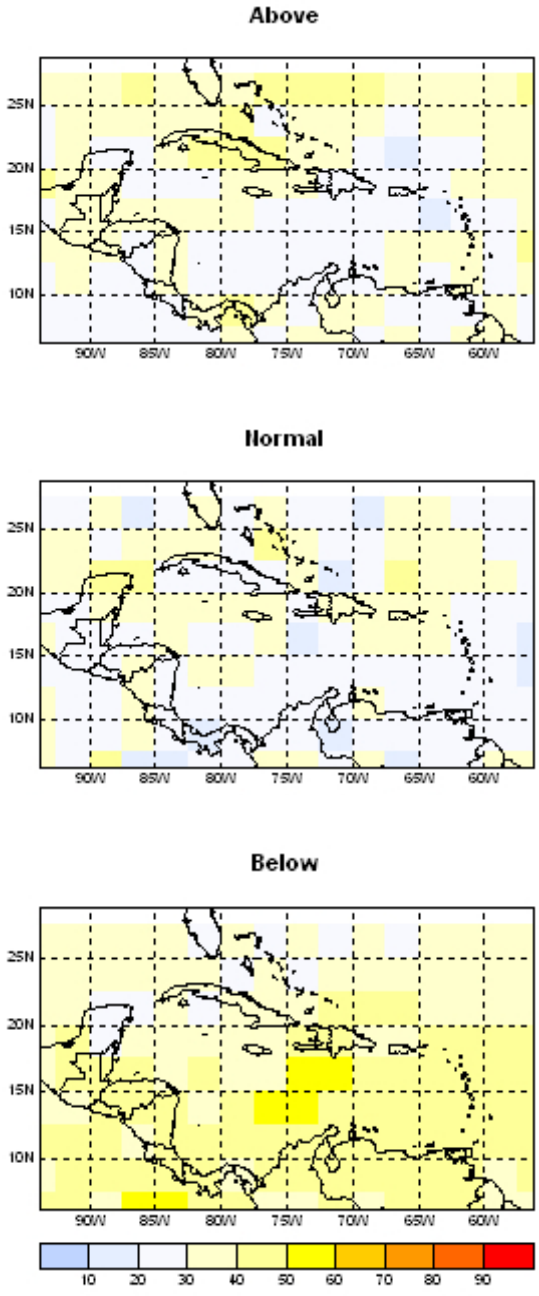

Figure 1. Above normal, normal and below normal rainfall forecast probability maps of the Caribbean for the period February-March-April 2007. The level of probability is indicated on the coloured legend

The climate of Guyana *by Horace Burton, Meteorologist, CIMH*

Introduction

What is the weather like in Guyana in March and April is probably one of the questions being asked by a number of the fans expecting to attend CWC 2007 in Guyana. The reasons for the question may differ from one fan to another, but the most common reason must be to determine the manner in which the cricket could be affected by the weather. Although it is impossible to say with any degree of certainty exactly what the weather will be on any day during the matches, we can give an idea of the typical weather conditions which are likely by examining the climate for that period.

Climate and weather have much in common, yet are not identical. ***Weather*** is the state of the atmosphere at any particular time and place and is described in terms of the atmospheric variables or weather elements, such as *temperature, humidity, clouds, precipitation, pressure, visibility and wind.* ***Climate***, on the other hand, refers to a more enduring regime of the atmosphere. It is the weather conditions at some locality averaged over a period of many years, and represents the accumulation of daily and seasonal events over a long period of time. Climate always applies to atmospheric conditions for a given period of time - a month, season, year.

This article presents an overview of the large-scale climate of Guyana, emphasising that for the period of March and April around Georgetown, where the games will be played.

The Large-Scale Climate of Guyana

Guyana is located on the northern shoulder of South America between approximately 1°N and 9°N latitude and 56°W and 62°W longitude. Guyana differs from the other cricket playing territories in a number of respects. It is the only territory that is not an island; it is situated the closest to the equator: it is not directly in the hurricane belt; and its climate differs from that of the other territories.

The most significant difference in the climate relates to the rainfall pattern. In all of the other territories the rainfall pattern exhibits one wet season between June and November and one dry season from January to May. Although a similar pattern exists over the southern part of Guyana, the northern part experiences two rainy seasons and two dry seasons. The primary wet season occurs between May and July when the equatorial trough or ITCZ is moving northward and the secondary wet season occurs from November to January when the system is moving southward. The dry seasons are February to April and August to November.

As a result of its large expanse the climatic type varies over the country, even though it can be categorized as broadly moist tropical with warm temperatures and abundant rainfall. Temperatures are generally above 20°C, humidity above 75 percent and annual rainfall in excess of 1500 mm. Table 1 shows the monthly averages of temperature, relative humidity and rainfall for Georgetown (GT) and rainfall for Lethem (LM).

The annual variation of temperature across Guyana is similar to that at Georgetown. The seasonal variation is usually less than 3°C but the daily temperature range far exceeds the mean annual temperature range, with values greater than 5° C. At Georgetown, the mean monthly temperature varies from 26.1°C in January to a high of 27.8°C in October.

The averaged monthly relative humidity exhibits maxima in June and December and minima in March and October. At 8 a.m. (RH08) the values range from approximately 67% to 87%, while at 2 p.m. (RH14) the range is from 70% to 78%.

Figure 2 shows the annual rainfall distribution of rainfall for Georgetown and Lethem. At Lethem, in the south western part of Guyana, the monthly averaged rainfall ranges from 10 mm in February to 282 mm in July. At Georgetown the driest months are February with 94 mm and September with 93 mm. The primary maximum rainfall occurs in June with 322 mm and the secondary maximum in December with 247 mm.

Climate of March and April and its Deviations

Averages can mask significant and important variations. Therefore it is useful to examine the deviations from the averages when studying the climate. To obtain a better picture of the weather possible during the period of CWC 2007 we now examine some of the variations of the rainfall using records for Georgetown for the years 1971 to 2003.

The averaged rainfall for Georgetown for March and April is 119 mm and 144 mm, respectively. Averaged over the two-month period the daily average rainfall is then approximately 4 mm. When the data is averaged by date, the values range between 1 mm and 9 mm, showing that the daily rainfall varies from the long term average.

Let us assume a daily rainfall of 15 mm as the threshold value which may effect the playing of cricket. This value was only exceeded 173 times over the 3013 days of the record. Then, the probability of the rainfall exceeding 15 mm is 8.5 percent, which may be considered as only a small chance.

The other important consideration is the maximum rainfall recorded on a specific day of the month over the period. The records indicate that amounts in excess of 25 mm, and in some cases over 80 mm, can still occur during the relatively dry months of March and April.

Conclusion

So in conclusion, what does all of this mean for CWC 2007 in Guyana? It is clear that the cricket is being played in one of the dry seasons in the Georgetown area. From the records, the normal daily precipitation is usually not significant enough to affect the playing of cricket. However, the records also show that heavy rainfall can still occur, even if the chance of this happening is small. Let us not forget that in 2005 heavy rains in January and February - the dry season – produced massive flooding in Georgetown. For the cricket fans, let us hope 2007 is not one of those years!

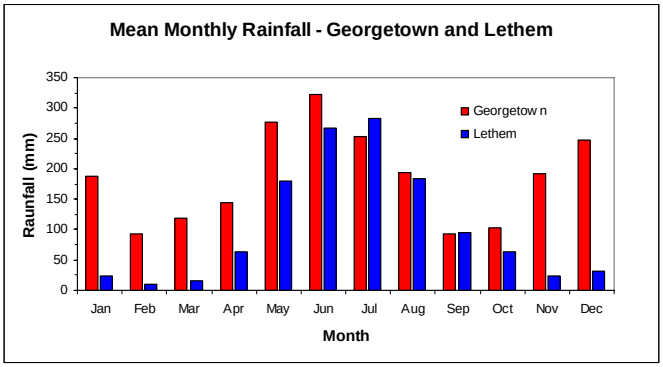

Figure 2. Mean Monthly Rainfall at Georgetown and Lethem, Guyana

Table 1. Monthly Averages of temperature relative humidity (at 0800 and 1400 hours) for Georgetown and the average monthly rainfall at Georgetown (GT) and Lethem (LM)

MONTH	Temperature(°C)			Relative Humidity (%)		Rainfall (mm)	
	MAX	MIN	MEAN	RH08	RH14	GT	LM
Jan	29.0	23.7	26.3	79.9	72.7	189	23
Feb	29.2	24.0	26.6	77.7	71.0	94	10
Mar	29.5	24.2	26.8	77.0	70.3	119	15
Apr	29.9	24.4	27.1	78.3	71.5	144	64
May	29.8	24.3	27.0	84.3	77.4	276	180
Jun	29.6	23.9	26.7	87.4	78.2	322	267
Jul	30.0	23.6	26.8	85.7	72.9	253	282
Aug	30.6	23.9	27.2	83.9	70.7	194	184
Sep	31.1	24.4	27.7	78.4	67.6	93	95
Oct	31.2	24.4	27.8	77.1	67.7	102	64
Nov	30.6	24.3	27.5	80.7	71.7	192	23
Dec	29.5	23.9	26.7	81.6	73.3	247	31

Dry and rainy days in Georgetown, Guyana

by Adrian Trotman, Agrometeorologist, CIMH

A dry day defined here is one when the rainfall was less than 1 mm, since this amount of rainfall is rapidly evaporated from plant and soil surfaces in the tropics. The length of a dry spell is the number of consecutive dry days. For the period of the cricket world cup, 5 March to 28 April, there will be a number of dry spells. The longest of these spells for each year is used in the dry spells stats. The daily rainfall data used to produce these stats for Georgetown, Guyana was from 1971 to 2004.

The longest dry spell and highest number of dry days in the 55 day period from 5 March to 28 April were 30 and 50 (Table 2.) respectively and occurred in 1996. The year with the fewest dry days was 1982 with 21 and the year with the minimum longest dry spell was 1976 with 3 (i.e. the longest dry spell in 1976 was 3 days and it was shorter than any of the longest spells from the other years) . On average, there were 35 dry days and a longest dry spell of 10.5.

The mean total rainfall for the period was 241.3 mm. The highest rainfall total was 654.2 mm in 1990 whilst the lowest total was 39.7 mm in 1988. The most rainfall in a day for the 55 day period occurred in 1976 with 118.1 mm. In 1984, the day with the most rainfall had 11 mm and it was lower than any of the maximum rainfall days for the other 33 years. The average maximum rainfall in a day in for the 34 years was 53.9 mm.

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The Caribbean Institute for Meteorology and Hydrology is a regional meteorological training centre with 16 member countries in the Caribbean. It is also a research and development centre for the region in the areas of meteorology and hydrology and a storage centre for the region's meteorological and hydrological data.

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In 1990, the year with the highest rainfall total, there were also the highest number of days of at least 5, 10 and 25 mm with 29, 20 and 10 days respectively. The year with the lowest rainfall total, 1988, was also the year with fewest occurrences of rainfall of at least 5, 10 and 25 mm with 2, 1 and 0 mm respectively. Over the 34 years there were on average 10.7, 6.4 and 2.7 days with at least 5, 10 and 25 mm of rainfall.

Georgetown, Guyana has exhibited great variability in rainfall and dry days for this period of the world cup, from the very wet to the very dry (Figure 3), even though this period is within one of the two dry seasons. Like the islands of the Caribbean, the nature of the climate in Georgetown is such that there can be wet spells in the dry season.

In the next volume a comparison of the Georgetown stats with those of the other Caribbean territories in previous volumes will be included.

Table 2. Mean and maximum dry and rainy days and longest dry spell for the period 5 March to 28 April for Georgetown, Guyana (1971-2004)

	Longest dry spell	Number of dry days	Total Rainfall	Max Daily Rainfall	At least 5 mm in a day	At Least 10 mm in a day	At least 25 mm in a day
Mean	10.5	35.0	241.3	53.9	10.7	6.4	2.7
Max	30	50	654.2	118.1	29	20	10
Min	3	21	39.7	11	2	1	0

(a) (b)

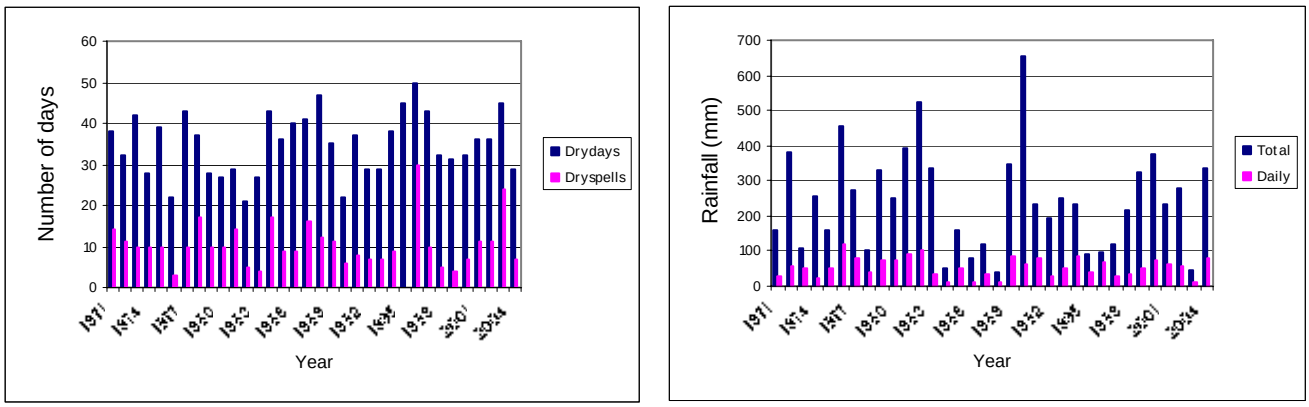

Figure 3. (a) The number of dry days and the longest dry spells and (b) total rainfall and the highest daily rainfall for the period 5 March to 28 April for Georgetown, (Guyana 1971-2004)