

**CLIMATE CHANGE IN THE CARIBBEAN – THE NEED FOR
IMMEDIATE RESEARCH INTO THE EXPECTED EFFECTS ON
AGRICULTURAL PRODUCTION**

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INTRODUCTION

Climate change seems to be an emotive subject. There seems to be little doubt that there have been changes in the climate in the last decades of the twentieth century.

However, not everybody is convinced about this. A recent survey of persons who had been involved in a project to prepare for the effects of climate change brought the distressing comment from one Caribbean country “Our meteorologists have indicated to the government that climate change is not affecting this country”.

A similar problem arises when certain parts of the globe suffer extreme events such as the floods which recently occurred in Central Europe. When events such as this occur some climatologists come forward and attribute the cause to global warming. However, others claim that extremes are events which do occur from time and there is no evidence that these are becoming more frequent or more extreme.

This leads many to say that scientists cannot agree that there is any global warming and therefore what needs to be done is to study whether there is any global warming before deciding whether it is necessary to do anything about it. This approach is nothing short of “fiddling while Rome burns” as far as tropical countries are concerned, particularly low-lying countries with long coastlines.

The difficulty is that global warming will, assuming the absence of undesirable secondary effects, be quite beneficial to many countries.

Those of us who know about North American and Eastern European winters will agree that a degree or two (or even a three or four degree) rise in temperature will make conditions rather more comfortable. Also, and perhaps more important, the growing season will be longer and this together with the higher temperatures will allow a wider range of crops to be grown. It is true that in some places the summers may become unbearably hot, but the peak summer conditions are often short lived (a month or two) and most people agree that too hot is better than too cold.

Thus it could be argued that the ‘problem’ of global warming is a tropical one. This ignores not only the possibilities of disruptive extremes, but also the alarming increase in Carbon Dioxide (CO₂) levels which have been observed around the planet.

SOME DATA ANALYSES

In Trinidad and Tobago data provided by the National Meteorological Service at Piarco show clearly that temperatures did rise during the last 20 years of the 20th century when compared with the years from 1950-1979. Figures 1 and 2 are Box plots of monthly extreme maximum and minimum temperatures for the five decades in the second half of the century. A Box plot shows boxes in which 50% of the observations fall for each class. The horizontal line in each box indicates the median value and the antennae indicate the range of values. Analysis of variance of extreme maximums and minimums by month, decade and month decade interaction are summarised in Table 1.

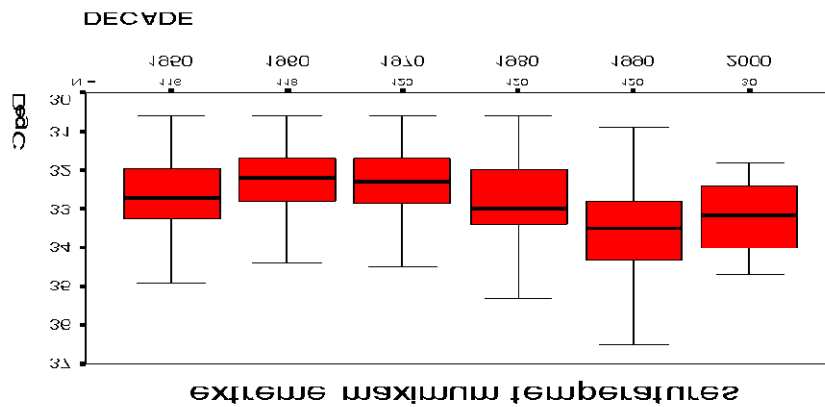


Figure 1. Box plots of monthly

These analyses are very clear in indicating temperature differences over the decades, but there is no evidence of any interaction; in other words seasonal differences are constant.

With regards to maximum temperature the decade of the 1950s saw higher values than the 1960s and 1970s; there was a definite warming trend through the 1980s and 1990s. The decade of the 2000s is only 25% complete; so far this decade maximum monthly temperatures have been quite remarkable for the lack of extreme values (note the lengths of the antennae for 2000 in Figure 1); also so far the high levels of the 1990s have not been repeated. Otherwise maximum temperatures for the years 2000-2 have been above all the decades from 1950s to 1980s.

Table 1. Analyses of variance of extreme maximum and minimum temperatures at Piarco, Trinidad by decade and month for the period 1950–2002.

Maximum Temperature				Minimum Temperature		
Source	DF	F	P	DF	F	P
Decade	5	55.06	0.000	5	76.90	0.000
Month	11	41.33	0.000	11	123.46	0.000
Decade & month	55	0.71	0.942	55	0.55	0.996
Error	552			553		
Total	623			624		

The minimum temperature data is more regular with little difference between the 1950s and 1960s, but the 1970s saw the beginning of a slow rise which is continuing into the present decade.

Analyses of some other meteorological variables are shown in Table 2. Unfortunately the data to hand when the paper was being prepared was not complete for the 1950s and 1960s.

Figure 2. Box plots of monthly extreme minimum temperatures

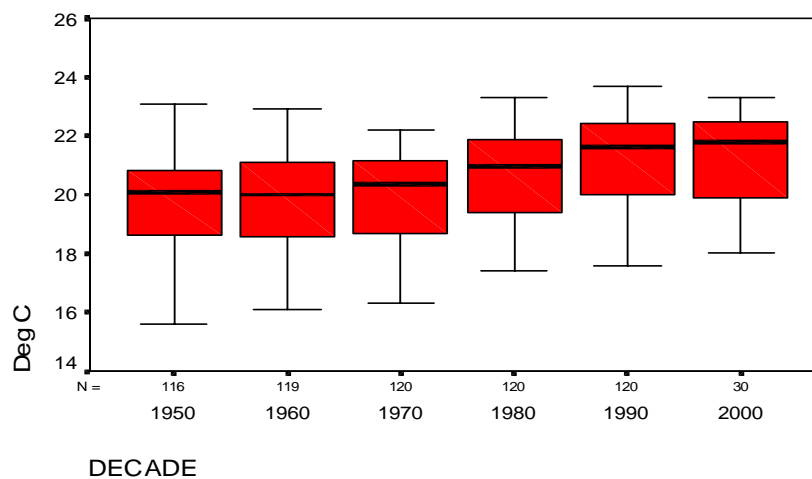


Table 2: Monthly means by decade for various meteorological variables at Piarco, Trinidad.

Decade	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Mean Relative Humidity	Monthly Wind Speed (Knots)	Sunshine (Hours)	Rainfall (mm)
1950 _s	-	-	-	5.0	-	-
1960 _s	30.9	22.1	-	4.9	221.1	128.9
1970 _s	30.8	22.1	77.8	5.6	220.5	151.4
1980 _s	31.2	22.6	81.1	5.6	209.7	170.3
1990 _s	31.7	23.0	81.3	5.5	223.1	145.6
S.E.	0.06	0.04	0.20	0.08	2.71	6.26
P	0.000	0.000	0.000	0.000	0.002	0.000

These analyses reinforce the conclusions about rising temperatures, but there are no clear trends for wind speed, sunshine and rainfall even though the decade differences are very significant. The 1980s were relatively dull and wet and wind speeds in the 1960s were lower than the last three decades of the 20th century. Once again there were no significant month by decade interactions.

The missing data from the 1950s and 1960s needs to be sourced, but it appears that the only clear trend is rising temperature (at least as far as Trinidad weather is concerned). For this reason and because of the controversy over the frequency of incidence of extreme events, it is strongly urged that most research be geared towards predicting the effects of rising temperatures on agricultural production. Work to predict the effect of increased temperatures on other climatic factors could go on in parallel, but until these predictions are clear it is best to prepare for higher temperatures and not necessarily less or more rain, wind etc.

PRESENT AND FUTURE CONSEQUENCES

Despite growing concern over environmental issues and the health of the planet, it is rather unfortunate that economic development takes much higher priority in some agendas. This could explain some of the apathy towards the effect of global warming in the developed temperate countries. As already indicated their agriculture is likely to be given a boost which will be good

for their economies; also there may be less need for energy to heat buildings which could also boost economies. Warmer temperatures in the winter months may also reduce the number of man-days lost to minor illnesses related to cold weather.

However the picture for lowland tropical countries is very different. The Caribbean, in particular is becoming more and more dependent on tourism for economic development. Most of these tourists seek sun, sea and sand. Temperature rises of a few degrees are definitely not going to make our sunshine more enjoyable, especially as similar rises a couple of thousand miles further north will be improving conditions there. Rises in sea temperatures will destroy coral reefs and have negative effects on other marine life and perhaps worst of all the sandy beaches will be threatened by sea level rise.

Sea level rise is inevitable as polar ice caps and mountain snows thaw. These days ice breaker boats can take tourists near to the North Pole in mid summer and for the last two summers it has been found that tourists arriving by this method cannot get off the boat and walk on the ice; it is dangerously thin. The South Pole ice is protected by the large land mass of the Antarctic continent and also by the high altitude, but at the Antarctic coast huge ice flows are breaking off and floating towards warmer seas where they will melt down.

Anybody familiar with Caribbean coastlines can see alarming effects of coastal erosion already taking place. In Trinidad a visit to Icacos Point will reveal buildings already destroyed by encroaching water and others where the owners have built large retaining walls which are sure to crumble unless government steps in and builds sea defences around the whole peninsula. On the other side of the island at resorts such as Salybia and Balandra steps lead down from cliff top properties. In many cases the lower steps no longer exist; it seems only a matter of time before all the steps are washed away and the properties themselves will follow.

On the West Coasts of practically all the Windward Islands, in particular Dominica, Grenada and St Lucia one can see large engineering works in operation. Storm surges following recent hurricanes destroyed a lot of the coastal infrastructure in these islands. Already the future look of Caribbean coastlines is emerging. High walls are being built to protect the land from further encroachment. On the ocean side of these walls are, not sandy beaches, but large rocks placed to break up the waves. The ultimate result can easily be predicted. Throughout the Caribbean there will be sea walls. On one side of these walls there will be heavy rocks where the beaches used to

be; on the other side coastal villages and (probably abandoned) hotels on land which is below the level of high tides.

AGRICULTURAL RESEARCH NEEDS

All this is very bad economic news, especially as agriculture in the region has been allowed to decline. However, even if it were to revive what will happen to the crops and animals? Whereas further north they will start to grow 'our crops' will we be able to grow 'our crops'? Research in Trinidad (EMA, 2000) suggested that sugar cane harvests decline as minimum night temperatures increase. With minimum temperatures rising (Figure 2) that is not good news.

Many of our export crops (e.g. sugar, bananas) seem to be in terminal decline, but we have special advantages for some exotic flavoured products (e.g. Jamaican coffee and Trinidadian cocoa). These advantages are caused by unique temperature and humidity conditions in the growing areas. What will happen to these flavours if (when) temperature rise continues? What is going to happen to specialist small island industries such as arrowroot in St Vincent and nutmeg in Grenada? Will rice be able to continue as a mainstay of the Guyana economy?

Obviously a lot of work needs to be done; models of crop growth and general behaviour under differing temperature conditions are needed. But models are only predictions and are frequently not too reliable. We need to use controlled environments to see how crops and animals really will react to higher temperatures. We also urgently need to try to breed new varieties which will not only withstand higher temperatures, but also maintain some advantage over other regions in producing food. What about the taste of products we do manage to grow in warmer conditions?

If this work is not done global warming will be all bad news for the Caribbean. There seems to be nothing we as a region can do to prevent global warming, we must immediately work to mitigate and look for benefits.

If we don't do this work nobody will want to visit (or even live) here and we may find that the richer, more powerful countries completely lose interest in us. We will have nothing to sell them, we will not be able to afford their products and they certainly will not want our immigrants unless they can provide some economic advantage.

Acknowledgements

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Reference

EMA (2000) Republic of Trinidad and Tobago's first national communication to the United Nations Framework Convention on Climate Change. Environmental Management Authority (EMA), Trinidad and Tobago