



CAMI Conference

**Breaking New Ground in the Caribbean:
Weather and Climate serving Agriculture**

*Knustford Hotel, Kingston, Jamaica
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Caribbean Climate Trends

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Temperature and Rainfall Trends

- Caribbean regions:
 - Western (Belize, Jamaica)
 - Northern (Antigua, Dominica)
 - Eastern (Saint Lucia, St. Vincent, Barbados)
 - Southern (Grenada, Trinidad and Tobago, Guyana)

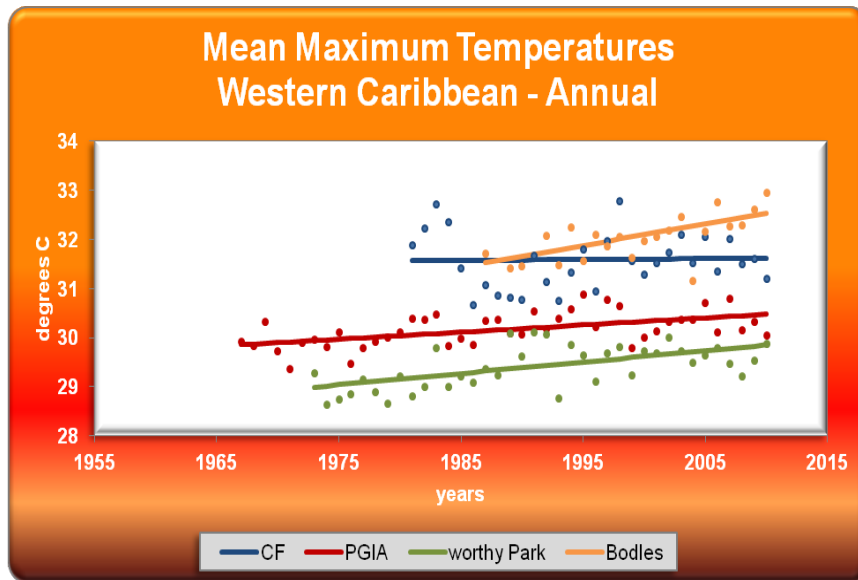
Model Projections:

- Increase in temperature by ~ 0.5 to 4.2°C by 2100
- Increase in the number of very hot days
- Decrease in annual rainfall totals with an increase in intense rainfall occurrences

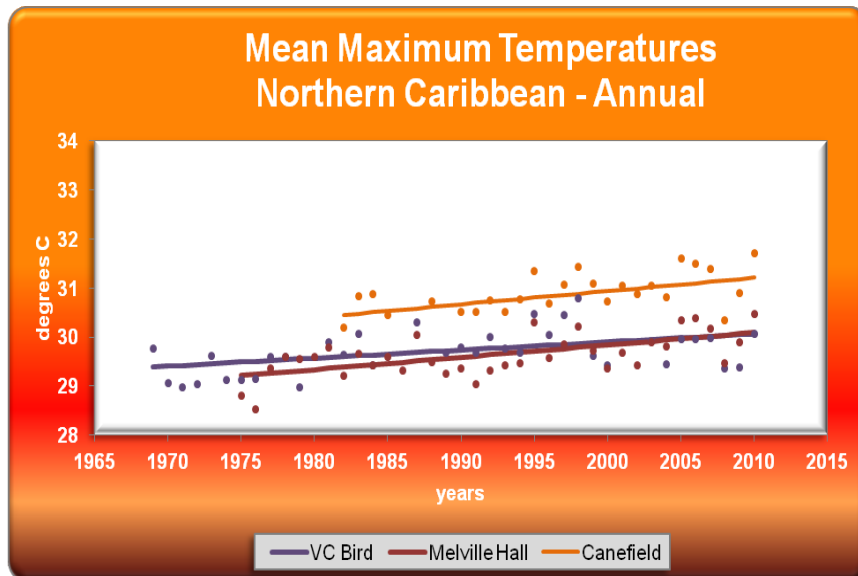
Methodology

- Quality control data using Rclimindex v 2.12.1
- Temperature analyses in InStat v3.36 (means, totals, extremes per month/annum)
 - Max, Min, Average daily temperature
 - Temperature extremes ($T_{\max} > 30^{\circ}\text{C}$, $T_{\min} > 25^{\circ}\text{C}$, Temps $> 10^{\text{th}}$ and 90^{th} percentile)
 - Maximum daily temperature range
 - Intra-annual temperature range
 - Rainfall totals
 - Rainfall totals exceeding the 95^{th} percentile
- Linear regression analyses using GenStat 13th Edition

Maximum Annual Temperatures



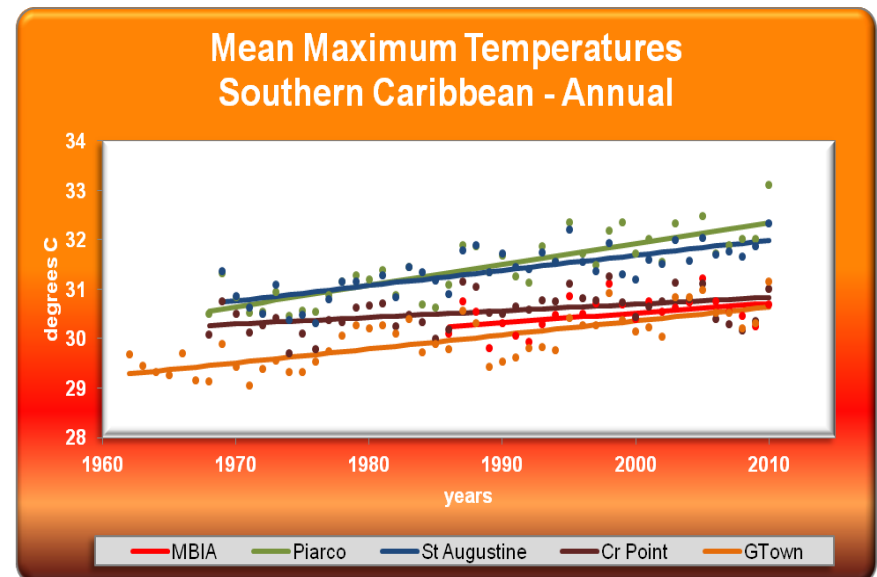
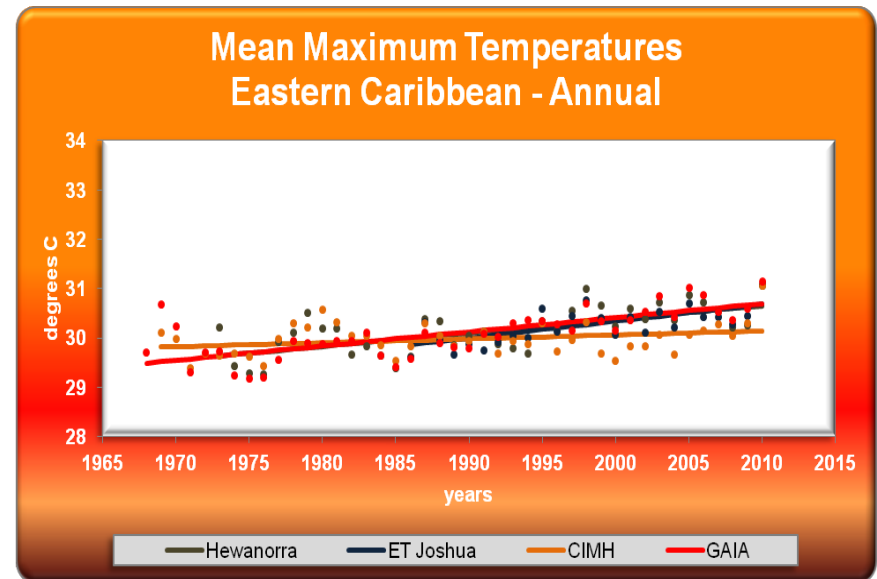
- **Statistically significant increases (except Central Farms, Belize)**



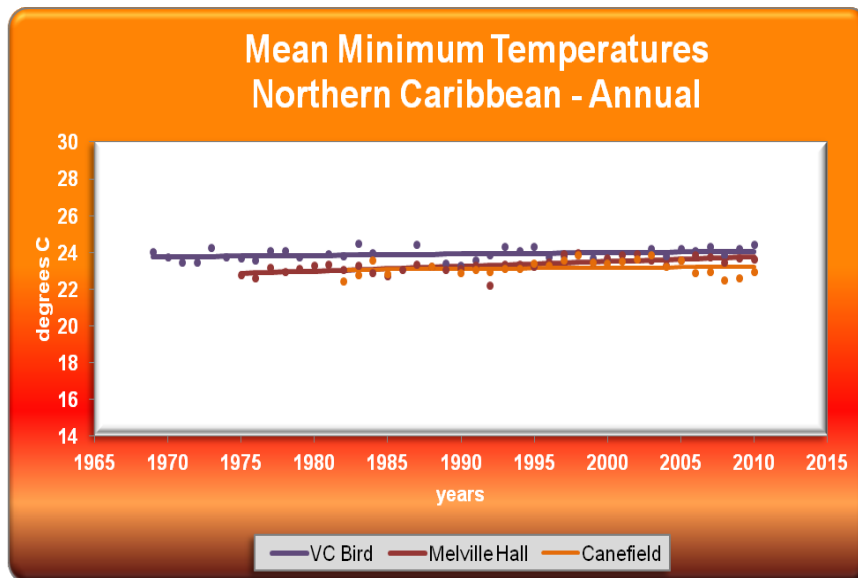
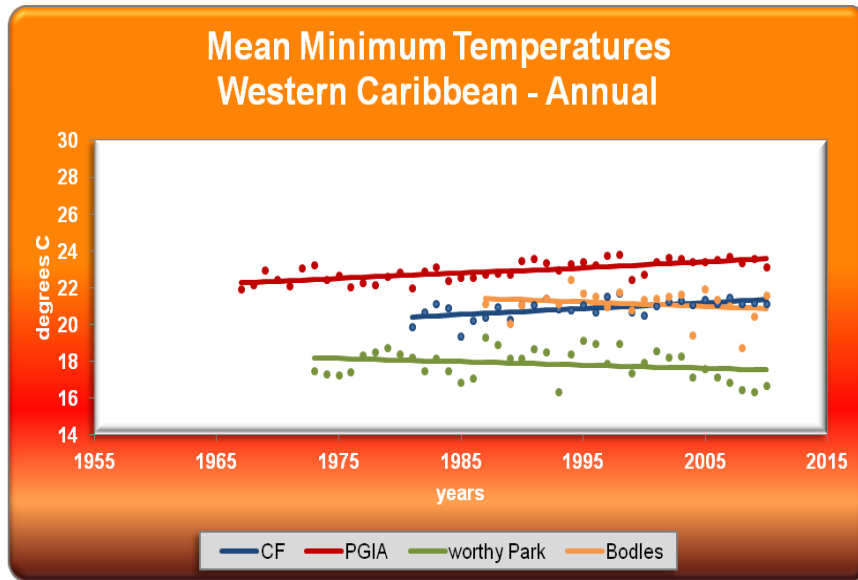
- Average increase of 0.02°C per annum ($\sim 2^{\circ}\text{C}$ by 2100)

Maximum Annual Temperatures

- **Statistically significant increases**
- Average increase of 0.03°C per annum ($\sim 3^{\circ}\text{C}$ by 2100)



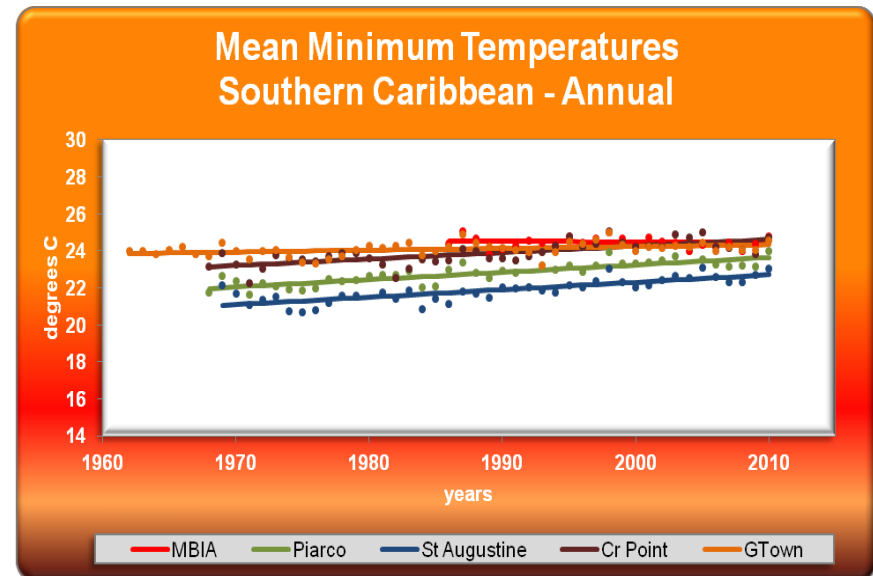
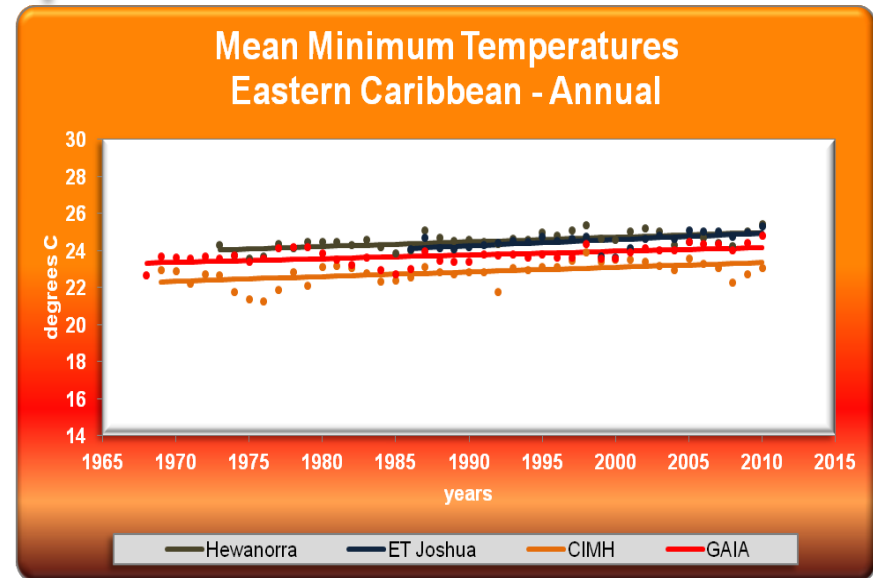
Minimum Annual Temperatures



- **Statistically significant increases (except Worthy Park and Bodles, Jamaica)**
- Average increase of $\sim 1.3^{\circ}\text{C}$ (Northern) and $\sim 0.5^{\circ}\text{C}$ (Western) by 2100

Minimum Annual Temperatures

- **Statistically significant increases except MBIA, Grenada**
- Average increase of 2.6°C (Eastern) and 2.4°C (Southern) per annum by 2100



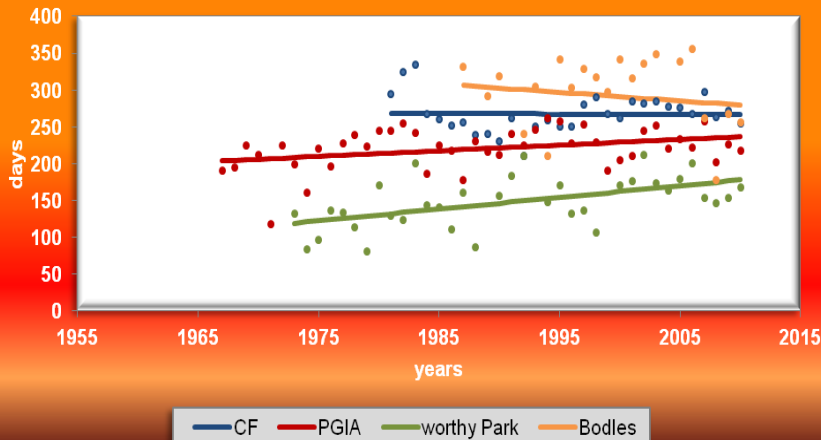
Point to Note

- These averages do not necessarily represent the actual trend in any individual country.
 - E.g. An increase of $\sim 4^{\circ}\text{C}$ by the end of the century is observed for Trinidad and Tobago (Piarco, St. Augustine and Crown Point) for minimum temperatures and $3 - 4^{\circ}\text{C}$ for max temps (Piarco and St. Augustine as well as Bodles in Jamaica).

Annual	Max Temperature		Min Temperature		Mean Temperature	
	ΔT (100yrs)	p-value	ΔT (100yrs)	p-value	ΔT (100yrs)	p-value
CentralFarms	0.17	0.891	3.21	0.001	1.71	0.077
PGIA	1.44	<0.001	3.04	<0.001	2.22	<0.001
Worthy Park	2.32	<.001	-1.80	0.142	0.14	0.86
Bodles	4.42	<0.001	-2.39	0.384	1.07	0.546
VC Bird	1.64	0.003	0.75	0.069	1.19	0.004
Melville	2.51	<0.001	2.59	<0.001	2.55	<0.001
Canefield	2.70	0.002	0.58	0.545	1.65	0.037
Hewanorra	2.76	<.001	2.50	<.001	2.64	<0.001
ET Joshua	3.40	<0.001	3.40	0.002	3.40	0.679
CIMH	0.80	0.054	2.51	<.001	1.65	<0.001
GAIA	2.87	<.001	1.98	<.001	2.43	<0.001
MBIA	1.94	0.035	-0.35	0.685	0.83	0.276
Piarco	4.26	<.001	3.99	<.001	4.13	<0.001
St Augustine	3.07	<.001	4.02	<.001	3.55	<0.001
Crown Point	1.35	0.002	3.51	<0.001	2.43	<0.001
GTown	2.83	<0.001	1.00	0.005	1.24	0.025

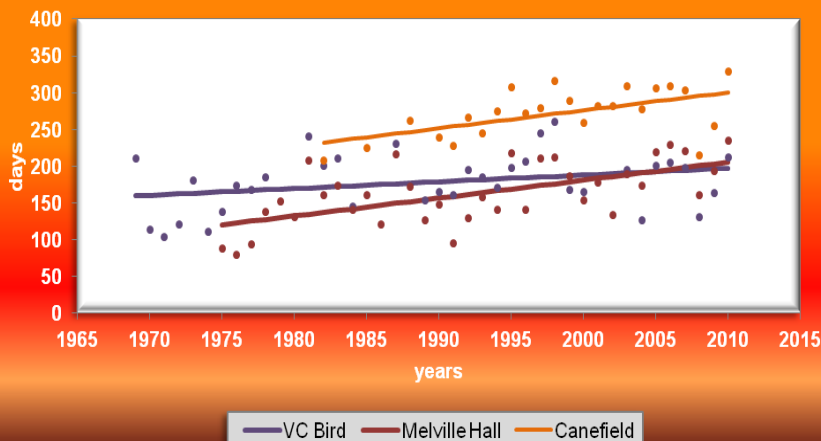
Temperature Extremes: $T_{\max} > 30^{\circ}\text{C}$

No. of Days Max Temperature $> 30^{\circ}\text{C}$
Western Caribbean - Annual



- **Mixed trends, however negative trends are not statistically significant (Bodles and Central Farm)**

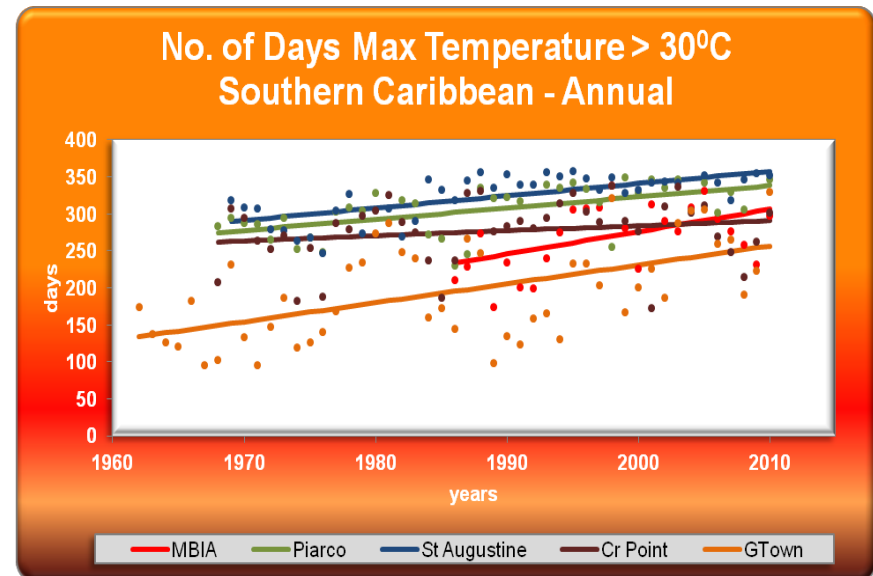
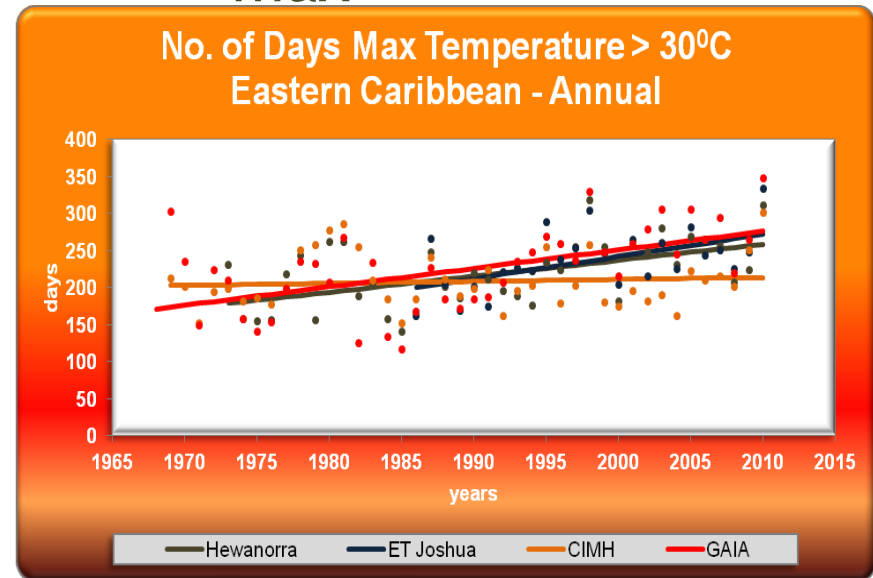
No. of Days Max Temperature $> 30^{\circ}\text{C}$
Northern Caribbean - Annual



- **Increasing trend at VC Bird, but not statistically significant**

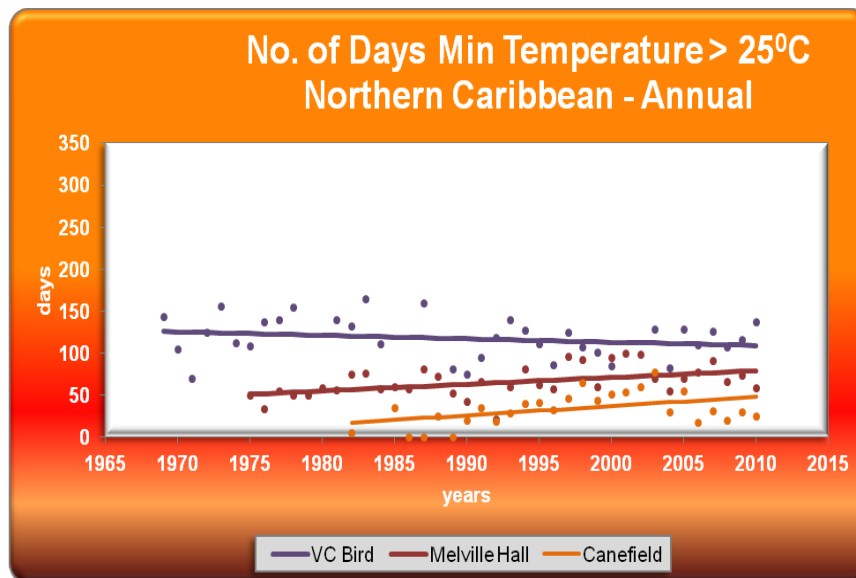
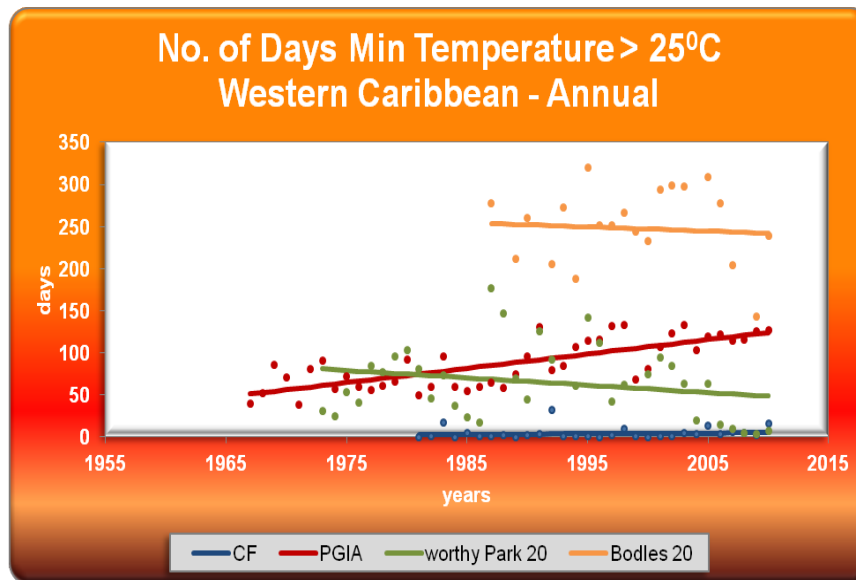
Temperature Extremes: $T_{\max} > 30^{\circ}\text{C}$

- Increasing trends but not all statistically significant (CIMH, Piarco, St. Augustine and Crown Point)



Temperature Extremes: $T_{\min} > 25^{\circ}\text{C}$

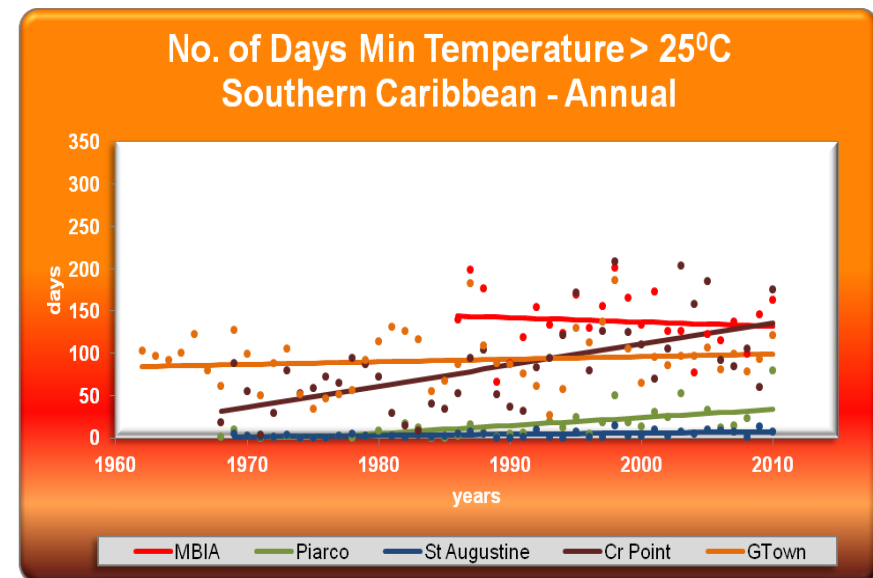
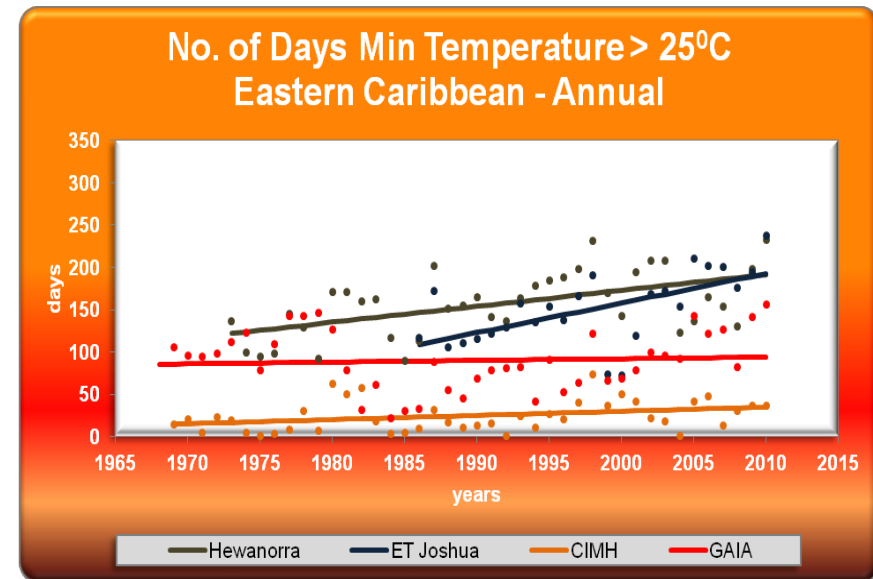
- Significant increases for Belize (PGIA) and Dominica (Melville Hall and Canefield)



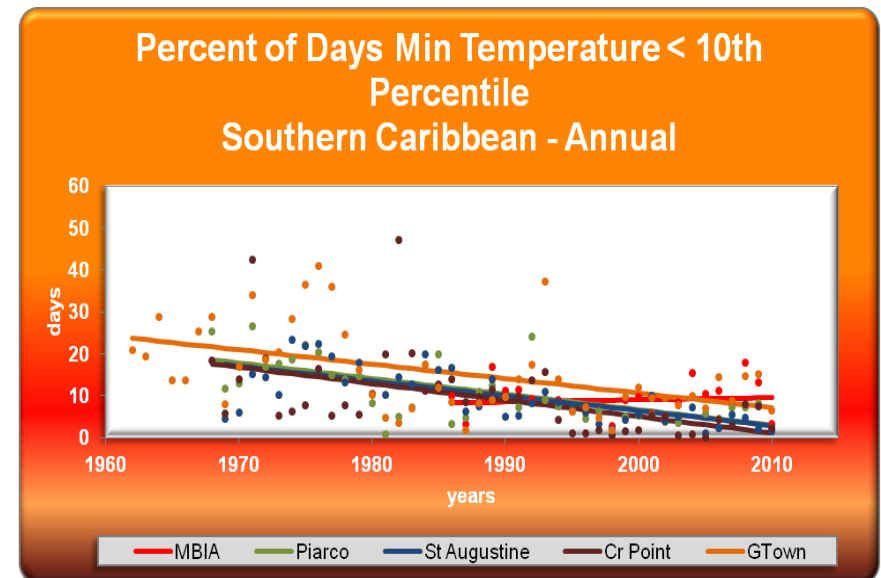
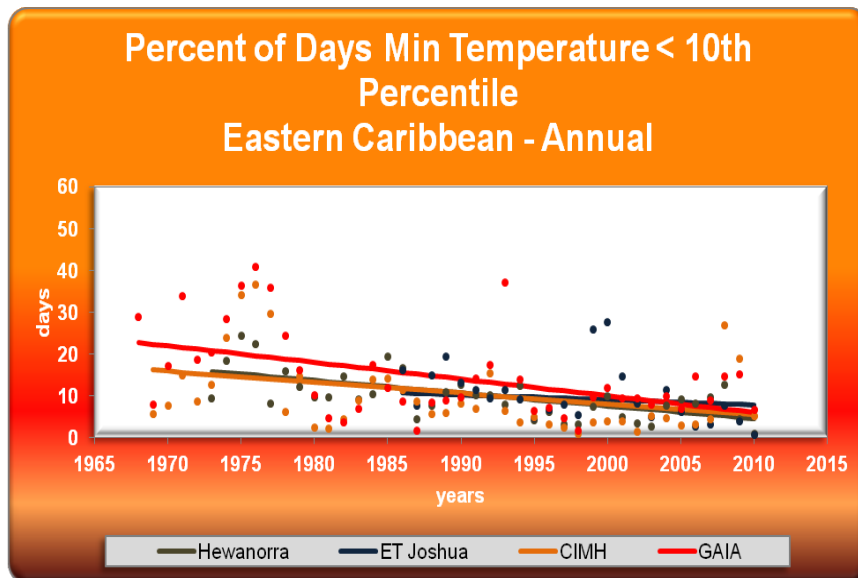
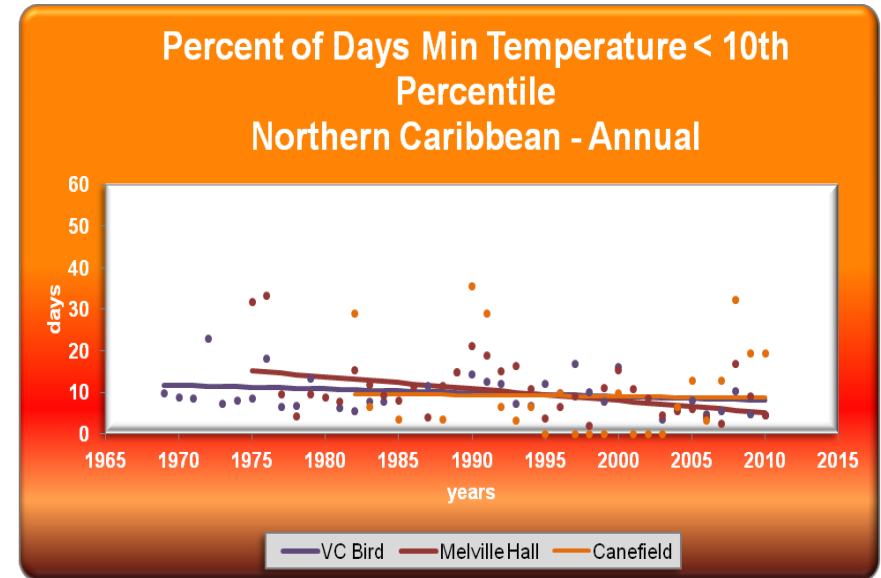
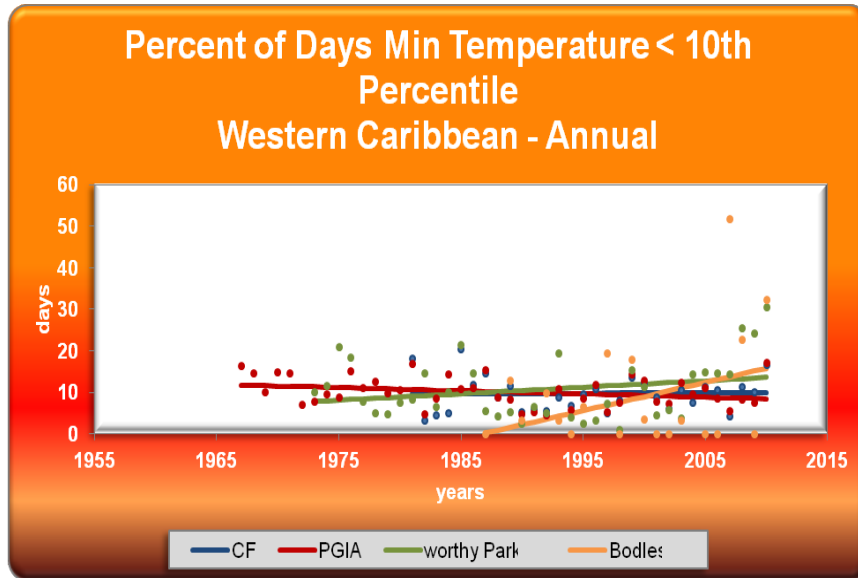
**Analysis done for $T_{\min} > 20^{\circ}\text{C}$
for Jamaica (Worthy Park and
Bodles)**

Temperature Extremes Cont'd:

- Significant increases in eastern and southern Caribbean except at Barbados (GAIA), Grenada (MBIA) and Guyana (Georgetown).

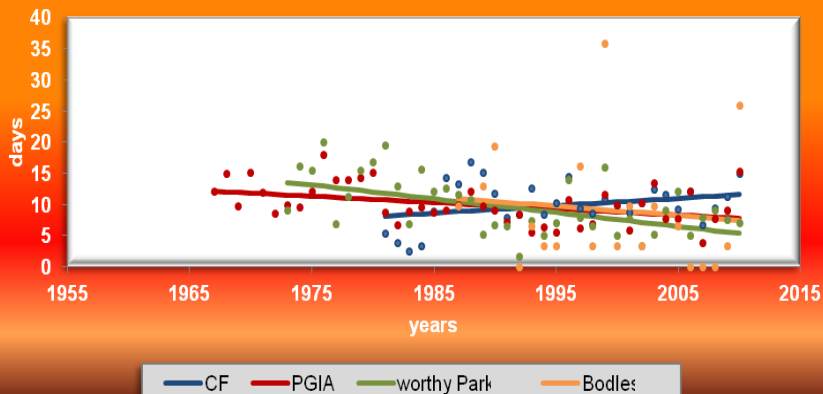


Temperature Extremes: $T_{\min} < 10^{\text{th}}$ percentile

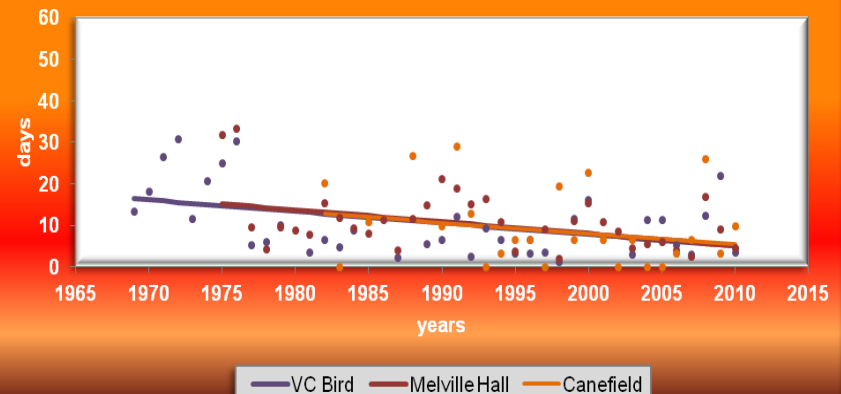


Temperature Extremes: $T_{\max} < 10^{\text{th}}$ percentile

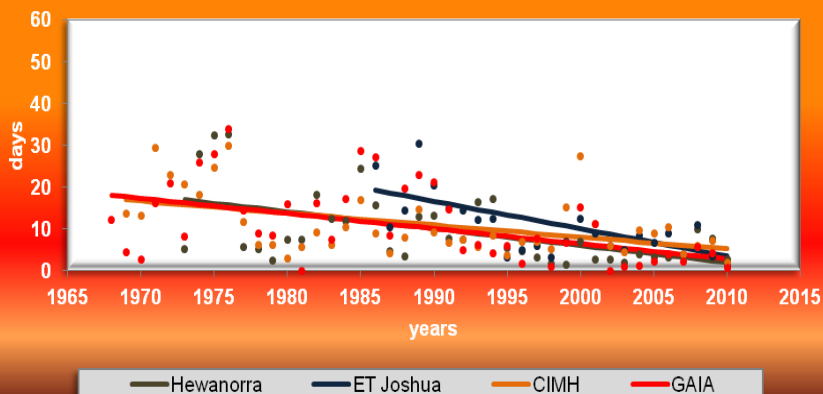
Percent of Days Max Temperature < 10th Percentile
Western Caribbean - Annual



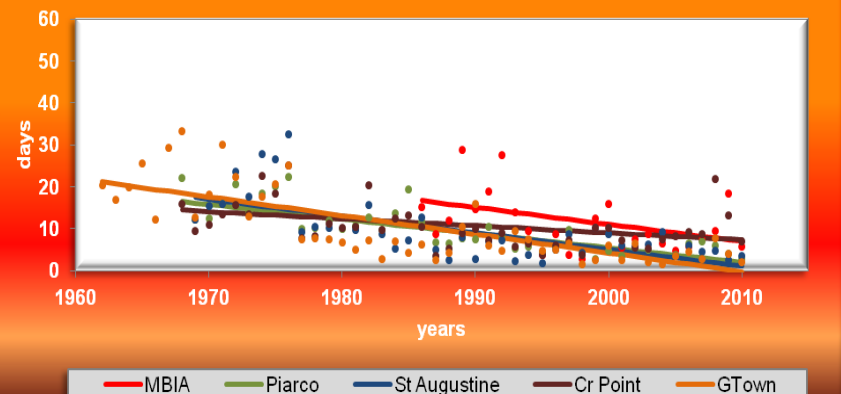
Percent of Days Max Temperature < 10th Percentile
Northern Caribbean - Annual



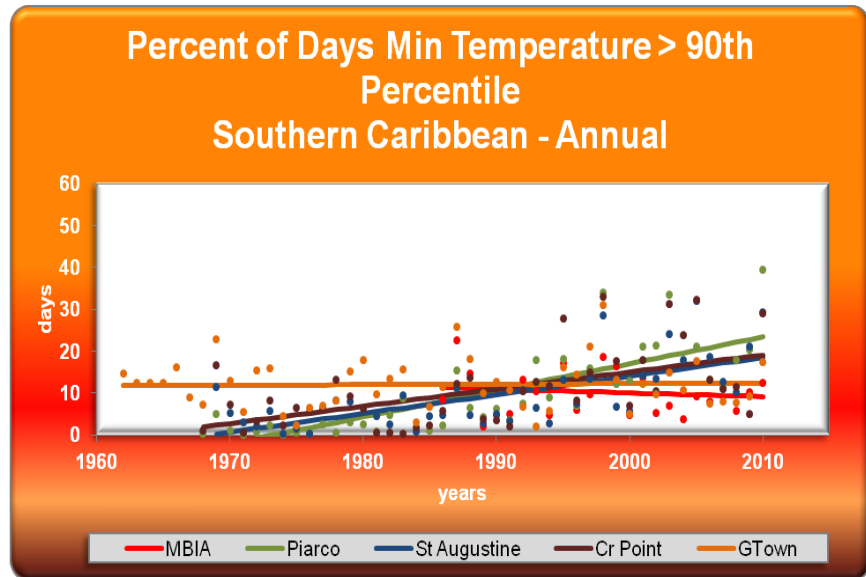
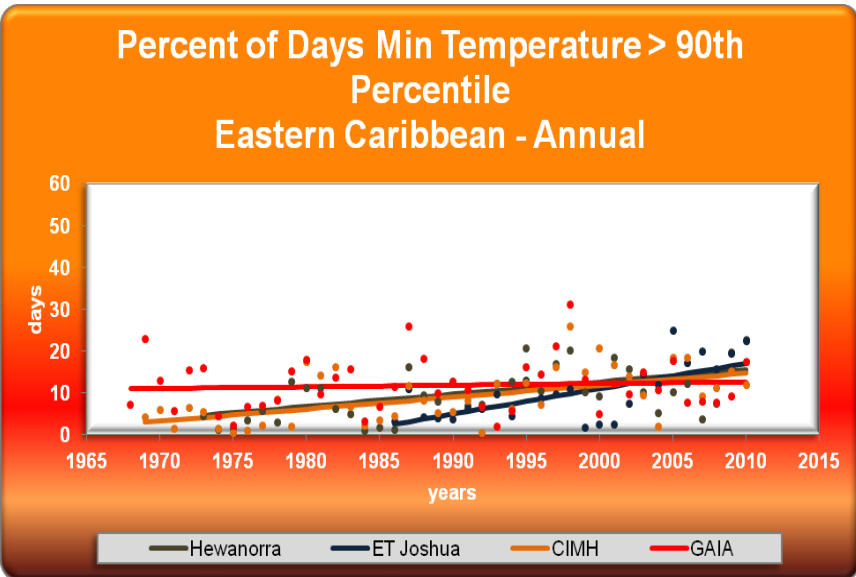
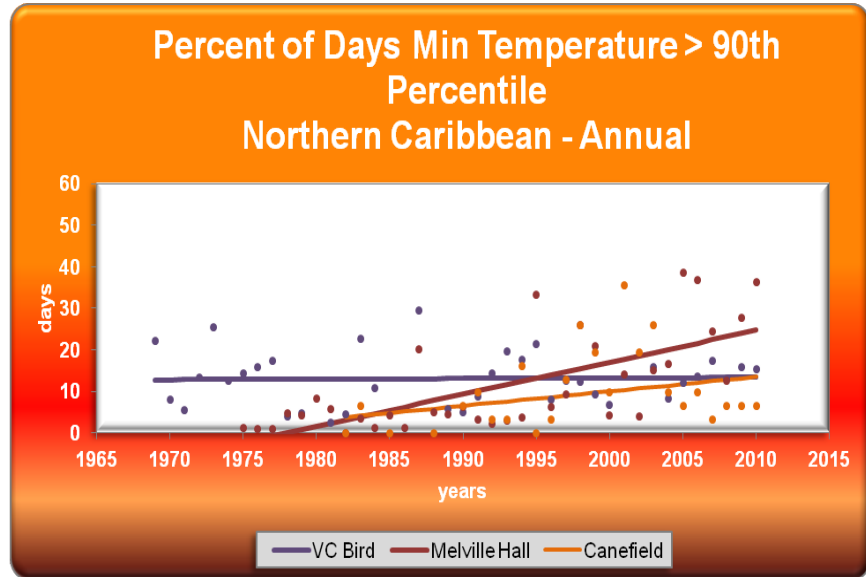
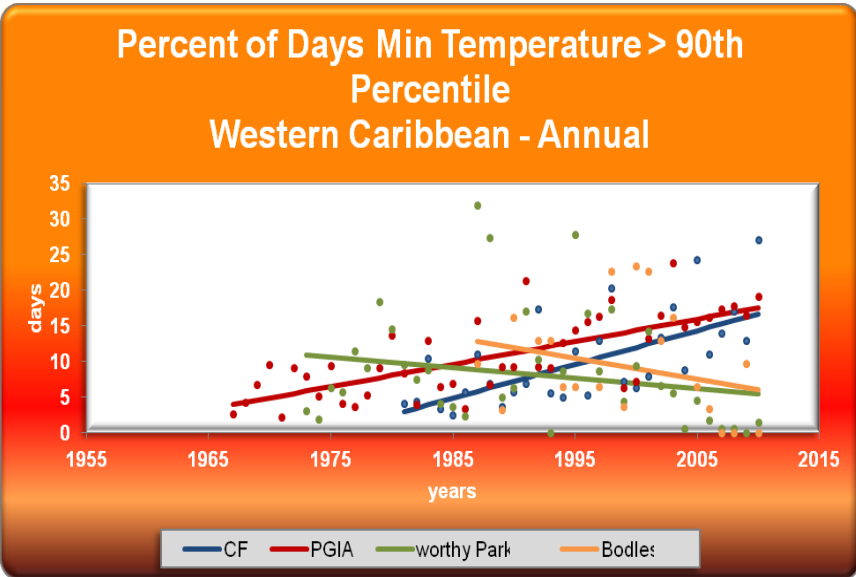
Percent of Days Max Temperature < 10th Percentile
Eastern Caribbean - Annual



Percent of Days Max Temperature < 10th Percentile
Southern Caribbean - Annual

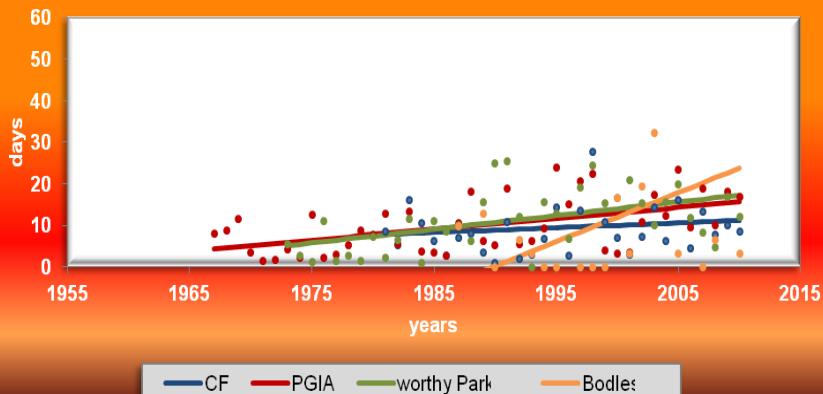


Temperature Extremes: $T_{min} > 90^{th}$ percentile

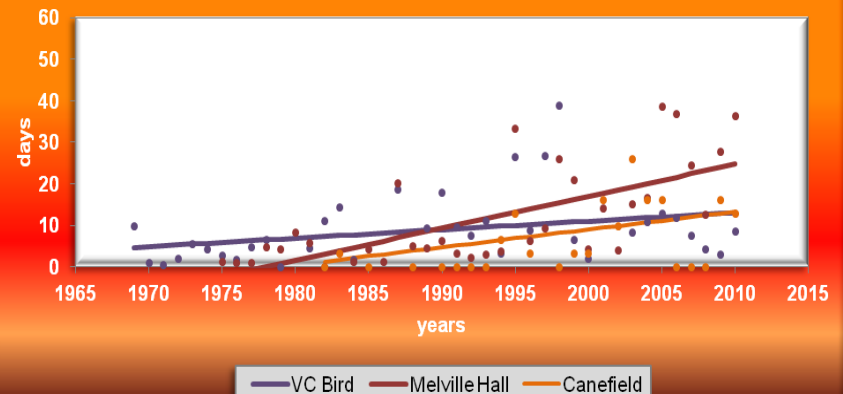


Temperature Extremes: $T_{\max} < 10^{\text{th}}$ percentile

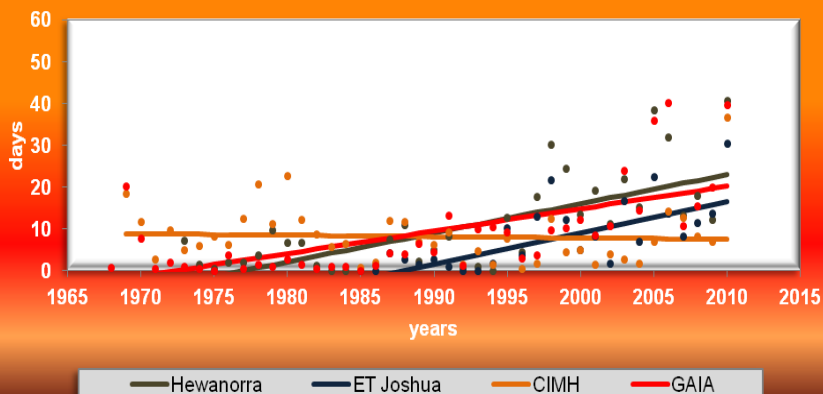
Percent of Days Max Temperature > 90th Percentile
Western Caribbean - Annual



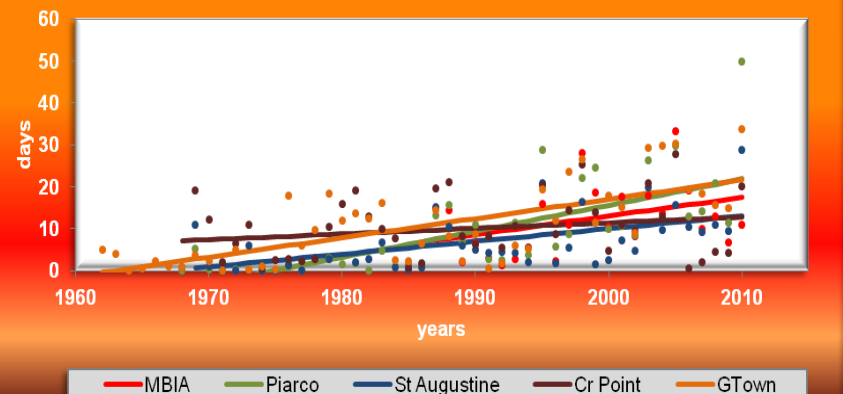
Percent of Days Max Temperature > 90th Percentile
Northern Caribbean - Annual



Percent of Days Max Temperature > 90th Percentile
Eastern Caribbean - Annual



Percent of Days Max Temperature > 90th Percentile
Southern Caribbean - Annual



Annual	Rainfall Totals	
	slope	p-value
CentralFarms	3.7	0.401
PGIA	0.79	0.843
Worthy Park	9.46	0.096
Bodles	5.5	0.753
Sangster	1.96	0.645
Manley	11.66	0.023
VC Bird	-1.18	0.752
Christian Valley	6.54	0.277
Melville	0.1	0.989
Canefield	-4.47	0.368
Hewanorra	6.24	0.103
Barthe Nursery	-3.87	0.288
ET Joshua	5.7	0.607
Dumbarton	-9.25	0.188
CIMH	3.25	0.308
Edgecumbe	2.71	0.267
MBIA	5.45	0.295
Piarco	-0.00474	0.268
St Augustine	2.19	0.508
GTown	1.55	0.716

Annual	Rain Above 95 th Percentile	
	slope	p-value
CentralFarms	0.045	0.679
PGIA	0.137	0.129
Worthy Park	0.243	0.14
Bodles	0.062	0.875
VC Bird	-0.146	0.377
Christian Valley	0.254	0.131
Melville	-0.059	0.676
Canefield	-0.044	0.808
Hewanorra	-0.031	0.78
Barthe Nursery	0.1056	0.197
ET Joshua	0.041	0.858
Dumbarton	0.191	0.121
CIMH	0.065	0.517
Edgecumbe	0.2787	<0.001
MBIA	0.031	0.896
Piarco	-0.0203	0.809
St Augustine	0.092	0.378
GTown	-0.0846	0.325

The Way Forward:

- Move from investigating linear trends into more polynomial trends to observe whether we would obtain a better fit.