

# **Climate Variability and Change in The Caribbean:**

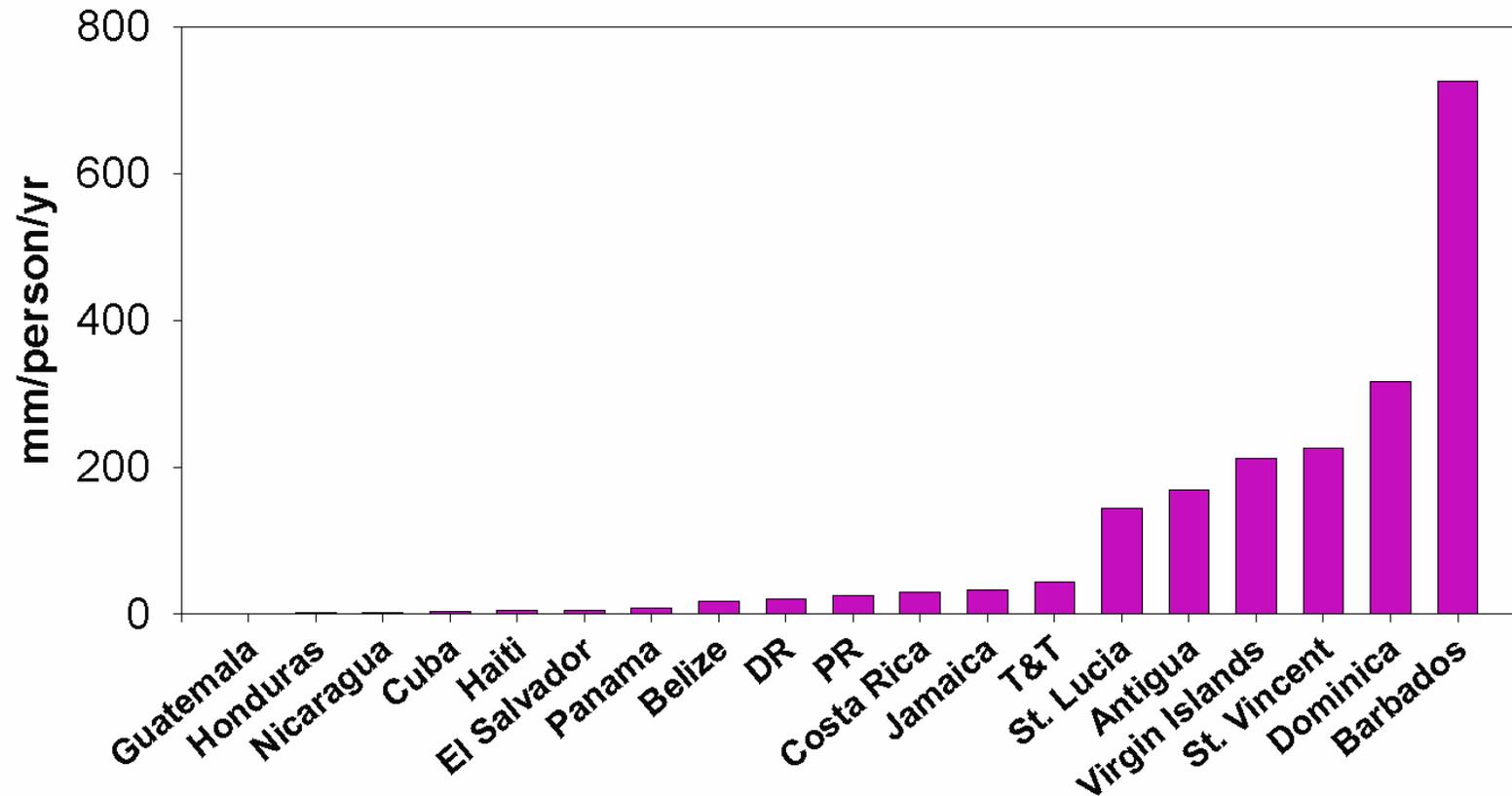
## **Implications for Water Resources.**

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**[john.charlery@cavehill.uwi.edu](mailto:john.charlery@cavehill.uwi.edu)**

# Water withdrawal per capita and area

( mm/person/year )

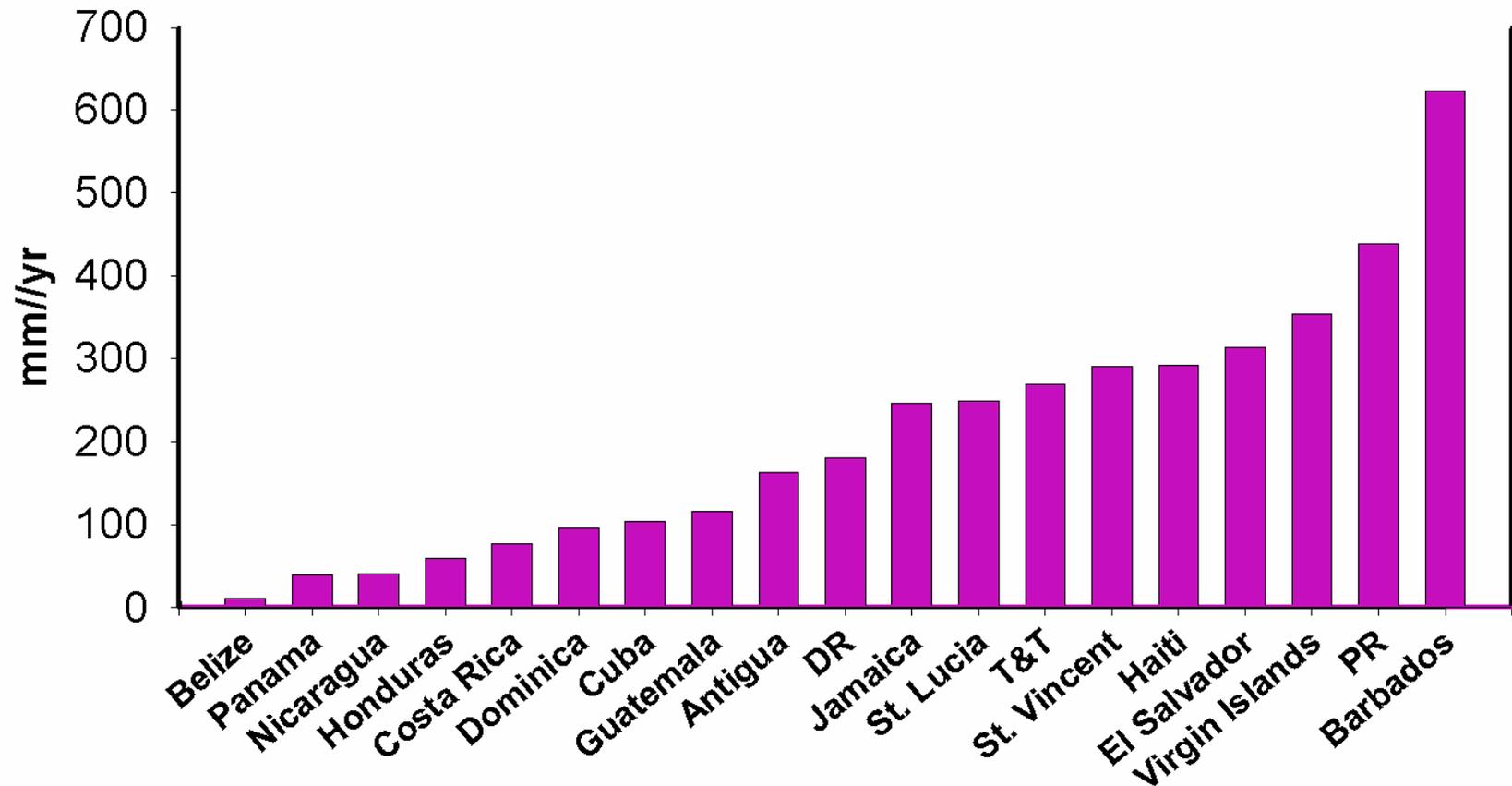


$$\text{mm/person/yr} = k(\text{withdrawal/person})/(\text{area of country})$$

Source: F.N. Scatena (U of Penn); M.C. Larsen (USGS-Puerto Rico)

# Water needs to produce national diet

( mm/year )

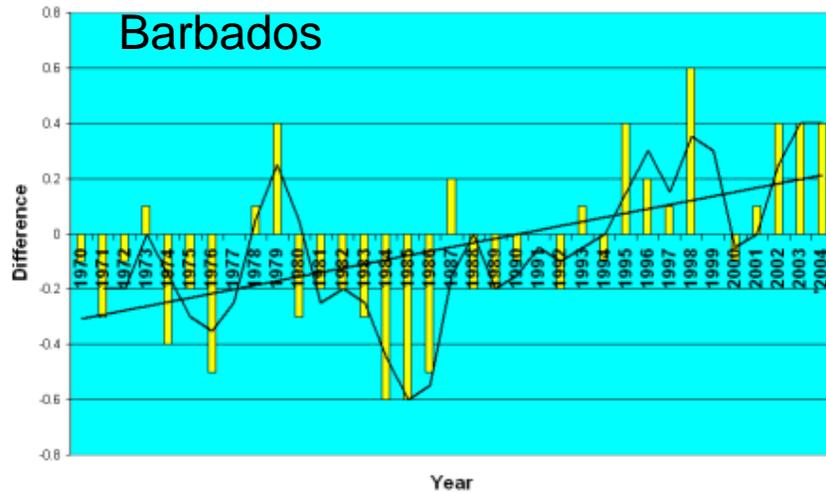


Based on 1030 m<sup>3</sup> per person per year

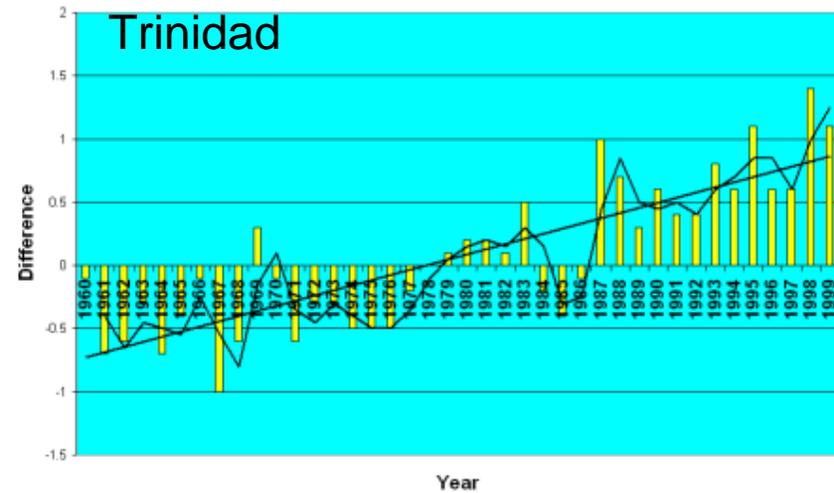
Source: F.N. Scatena (U of Penn); M.C. Larsen (USGS-Puerto Rico)

# Annual Mean Temperature Anomaly

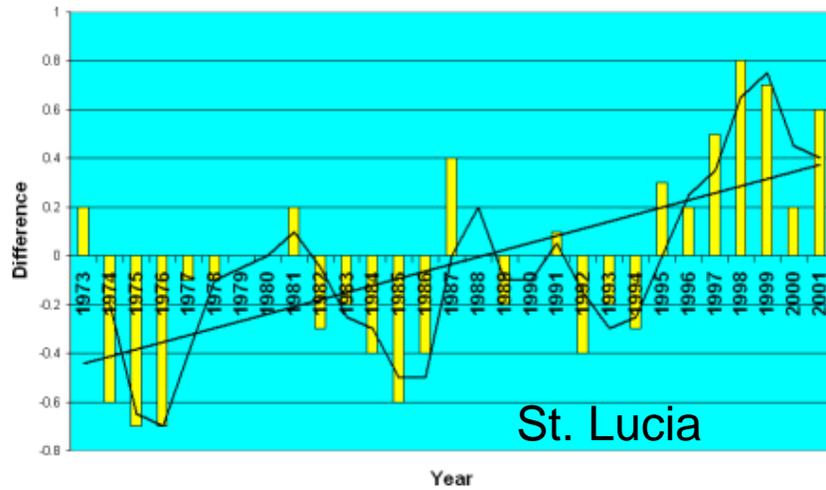
Temperature Difference



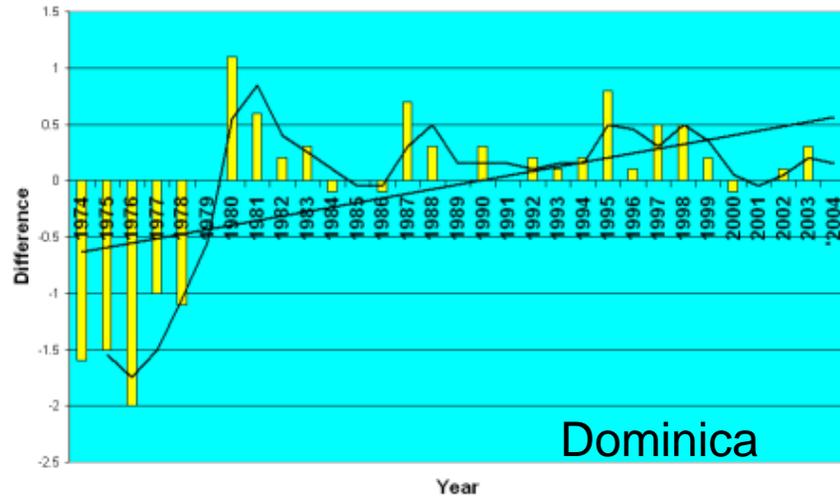
Temperature Difference

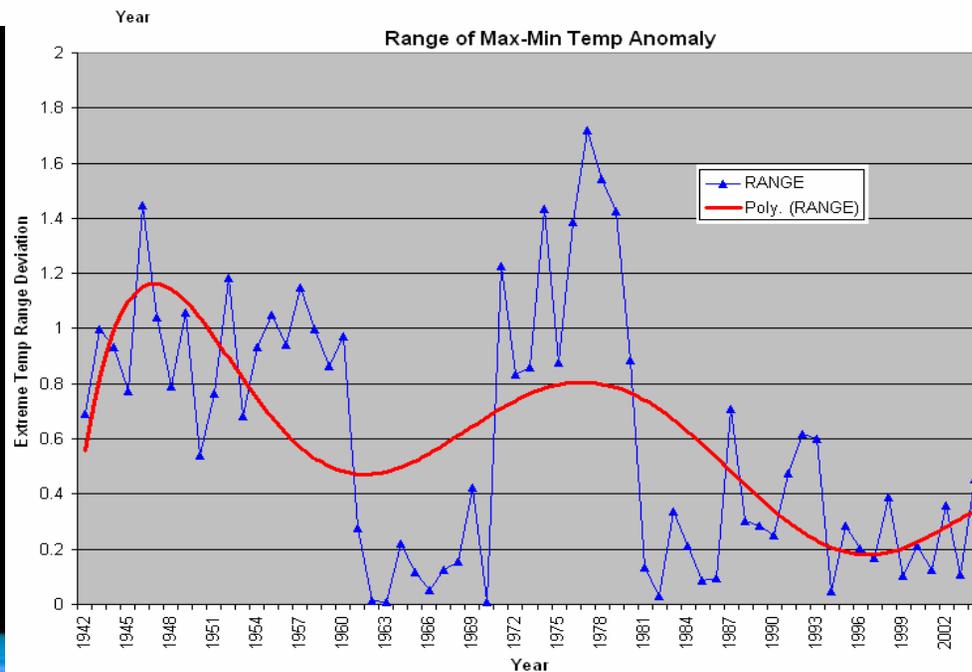
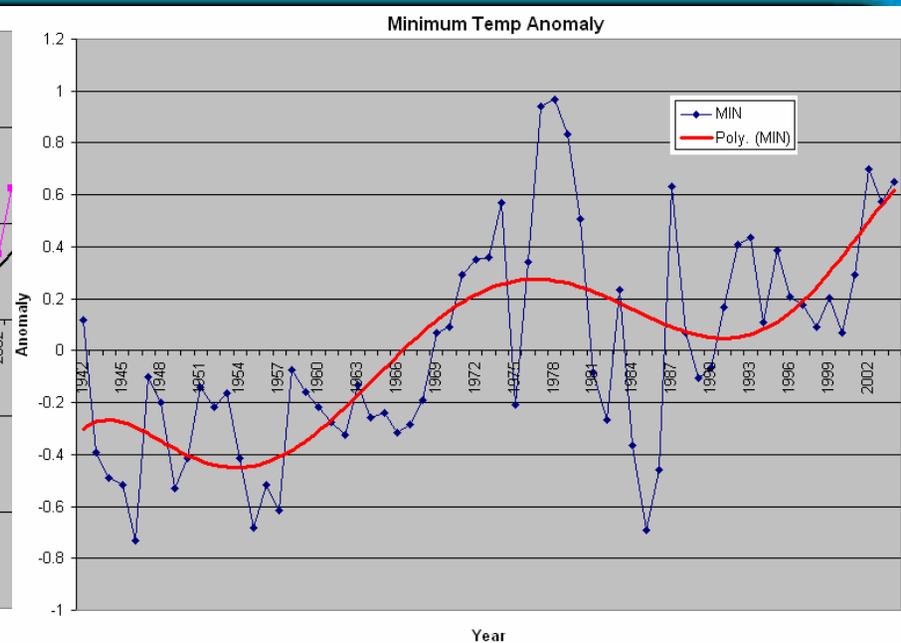
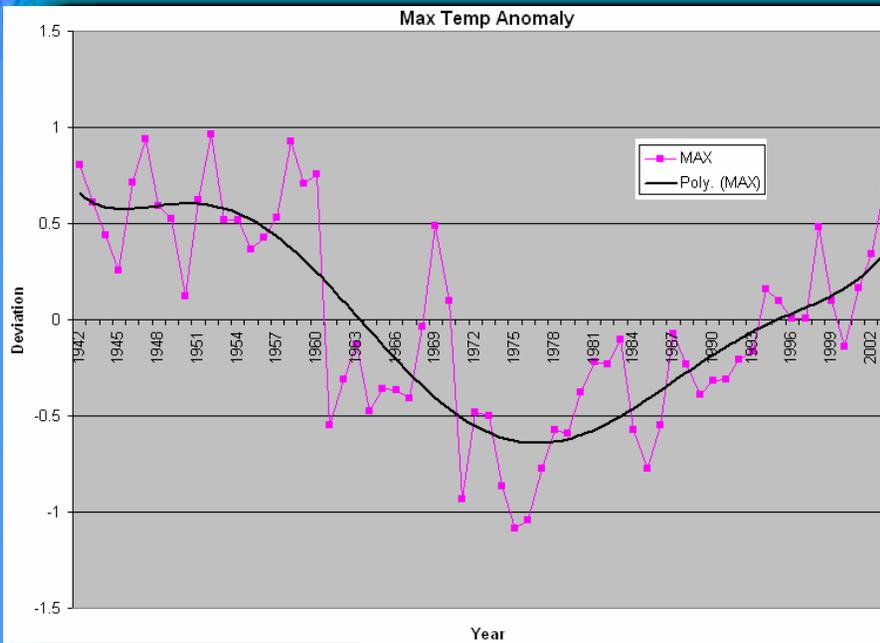


Temperature Difference



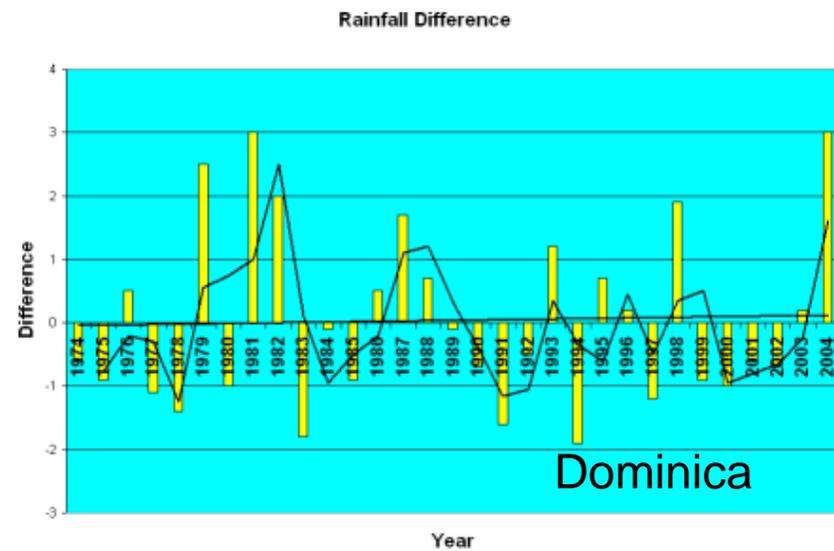
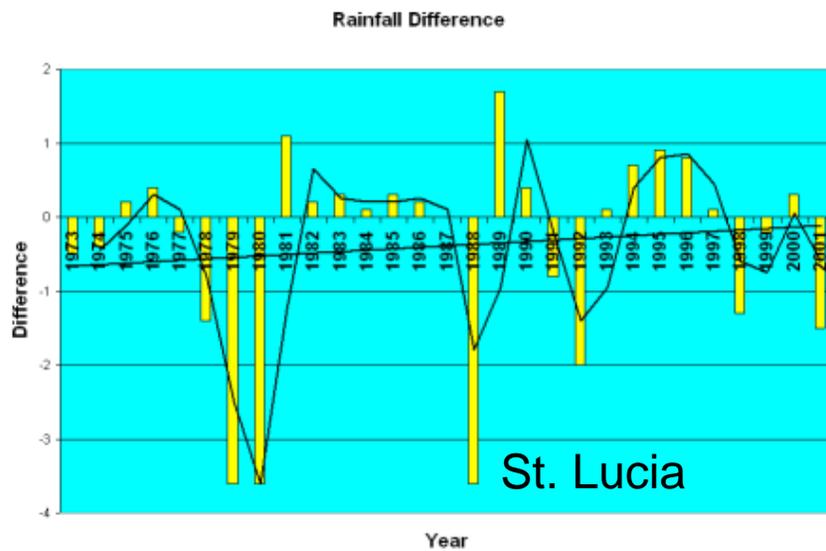
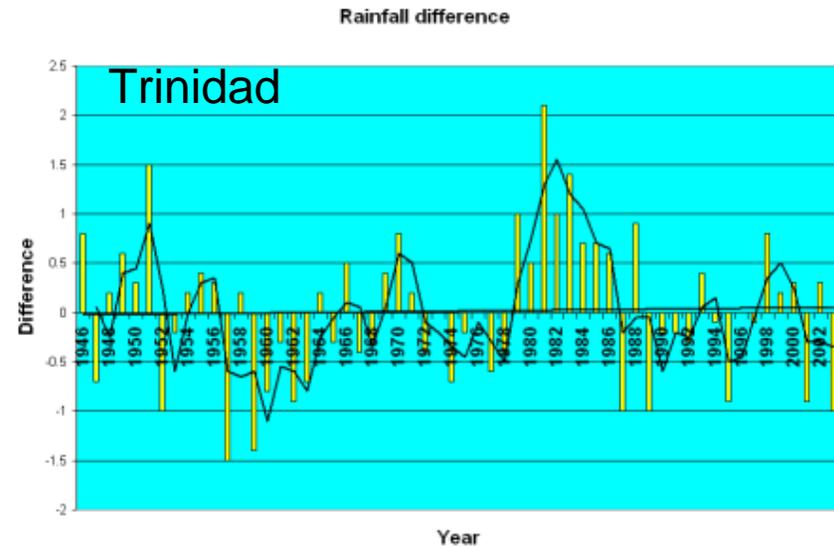
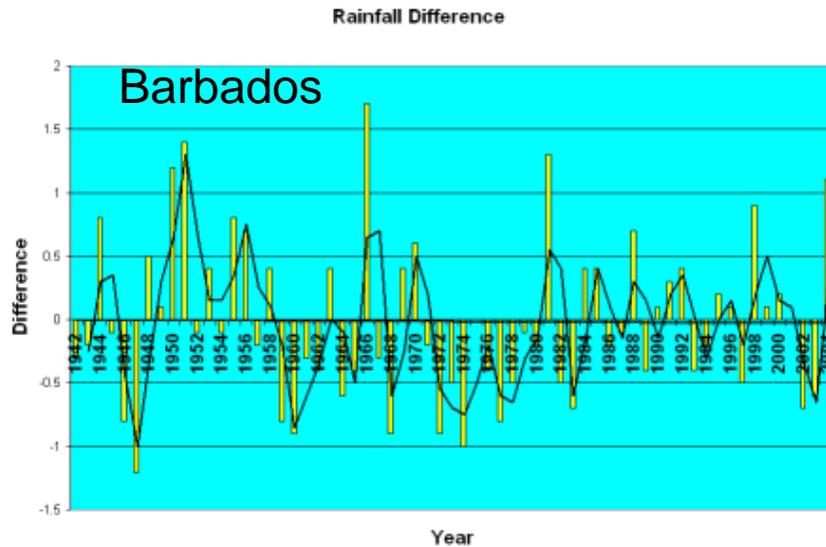
Temperature Difference





**Barbados  
Extreme  
Temps**

# Annual Mean Rainfall Anomaly

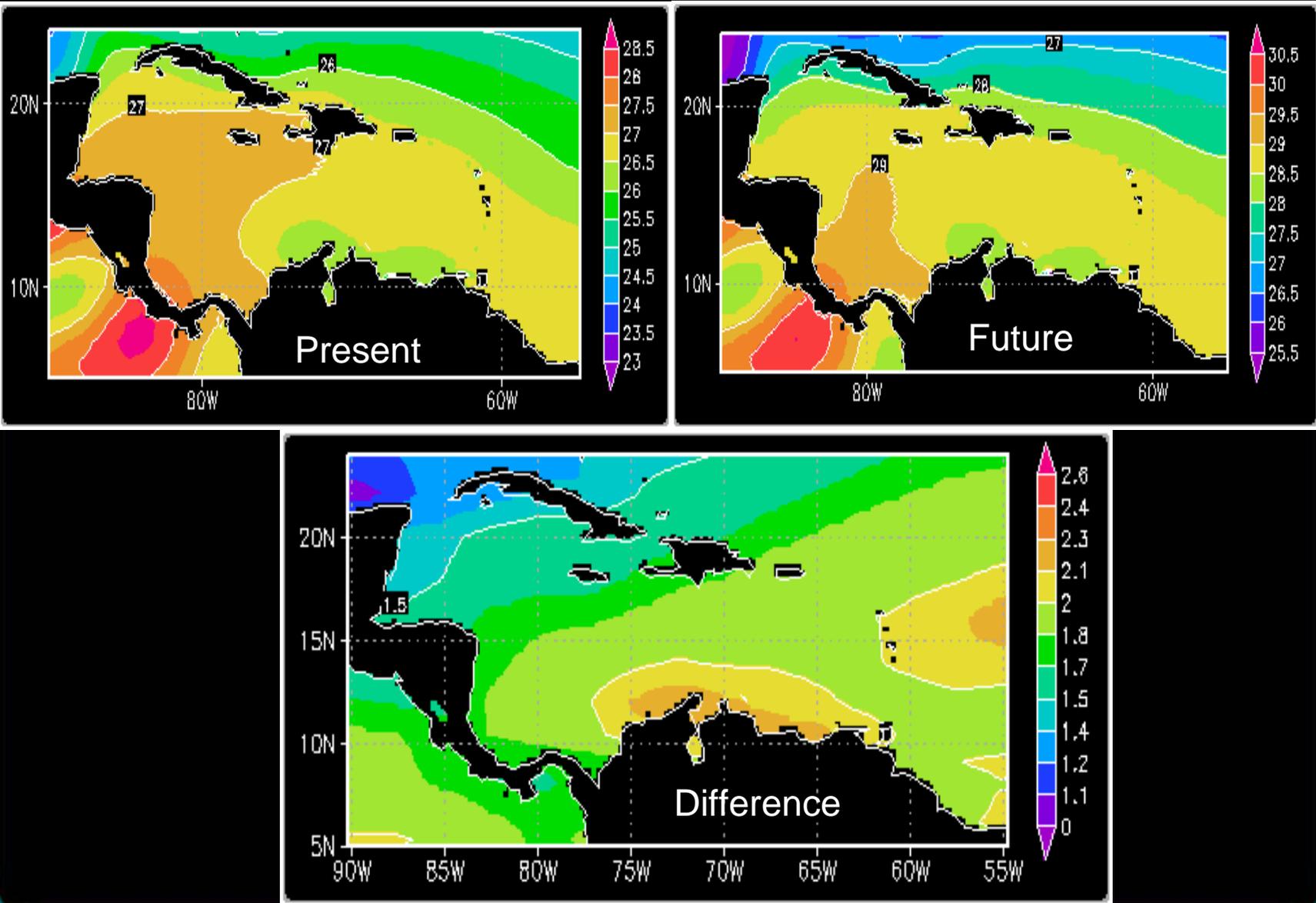


## Modelling Storylines Used: A1B, A2, B2

### A1B:

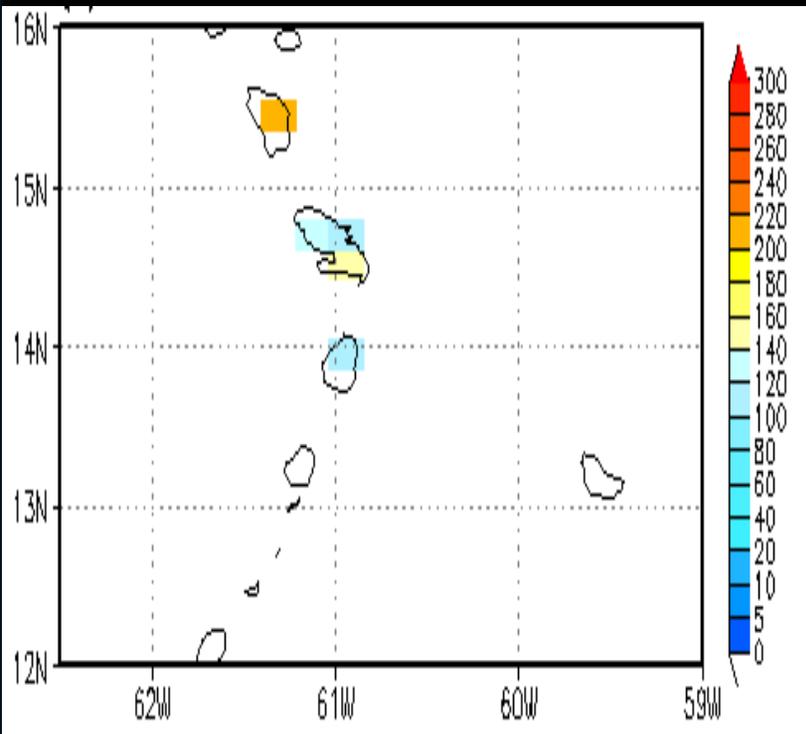
1. Very rapid economic growth.
2. Global population peaks in mid-century and declines thereafter.
3. Rapid introduction of new and more efficient technologies.
4. Economic convergence among regions.
5. Capacity building and increased cultural and social interactions.
6. Substantial reduction in regional differences in per capita income.
7. Balanced consumption of energy across all energy sources.
8. Assumes similar improvement rates apply to all energy supply and end-use technologies.

## Mean Annual Sea Surface Temperature

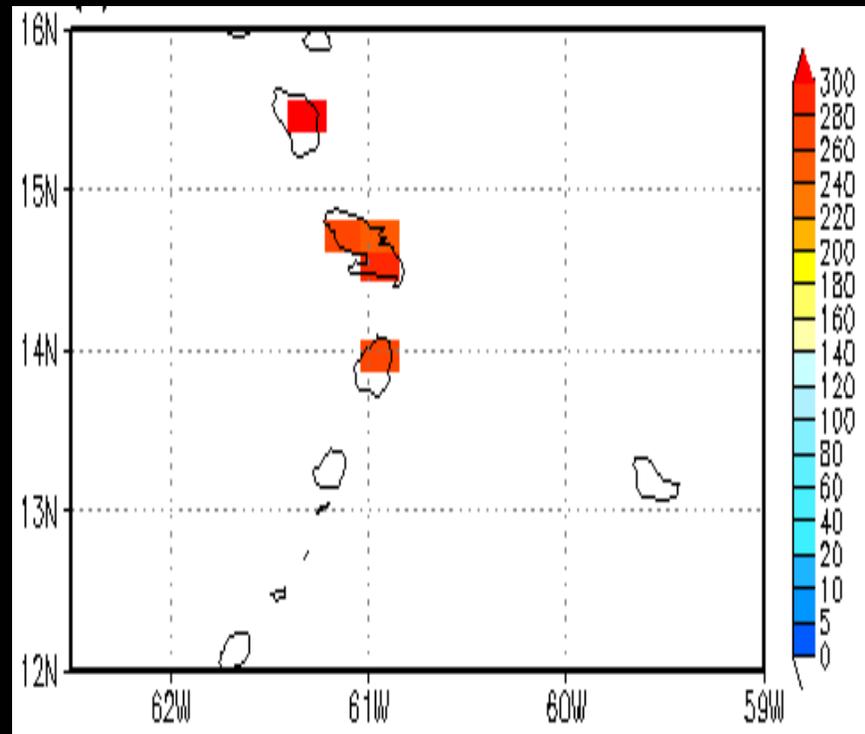


# Extreme Temperature change over the Windward Islands.

Tropical Days (Days MaxTemp  $\geq 30^{\circ}$  Celsius)



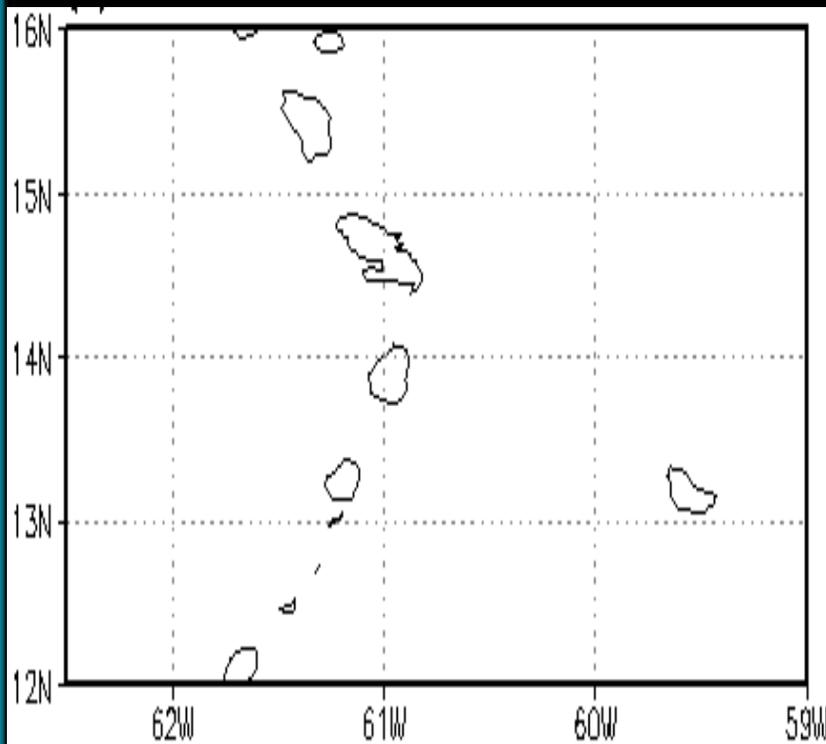
Present Climate



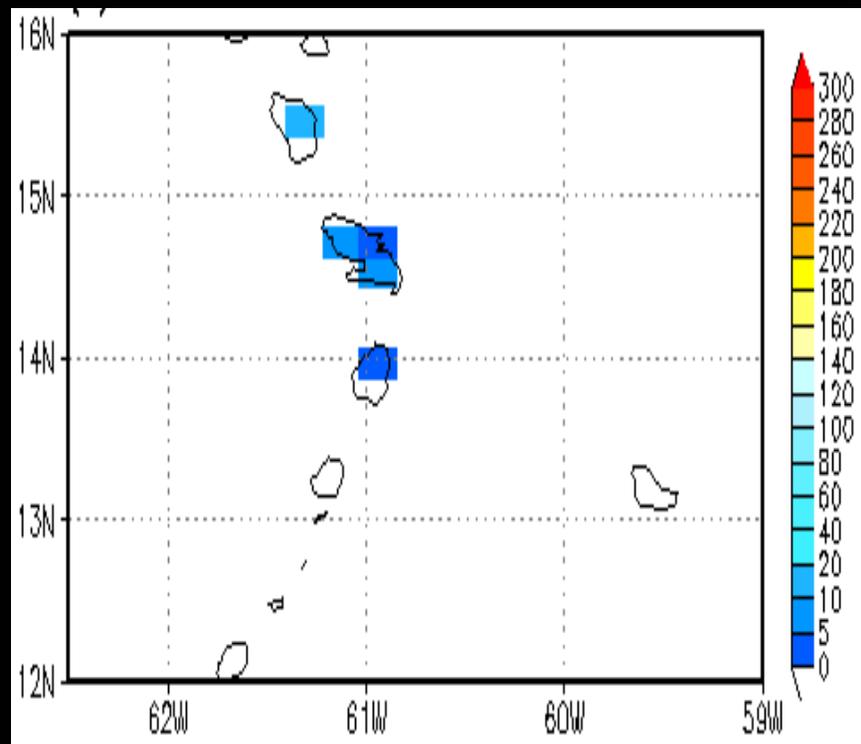
Future Climate

# Extreme Temperature change over the Windward Islands.

**Very Hot Days** (Days MaxTemp  $\geq 35^\circ$  Celsius)

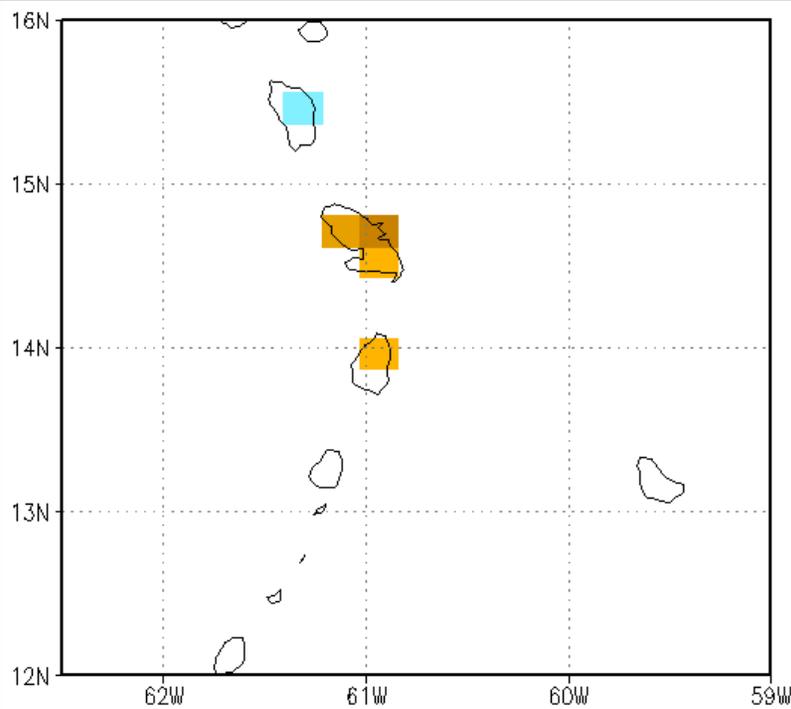


**Present Climate**

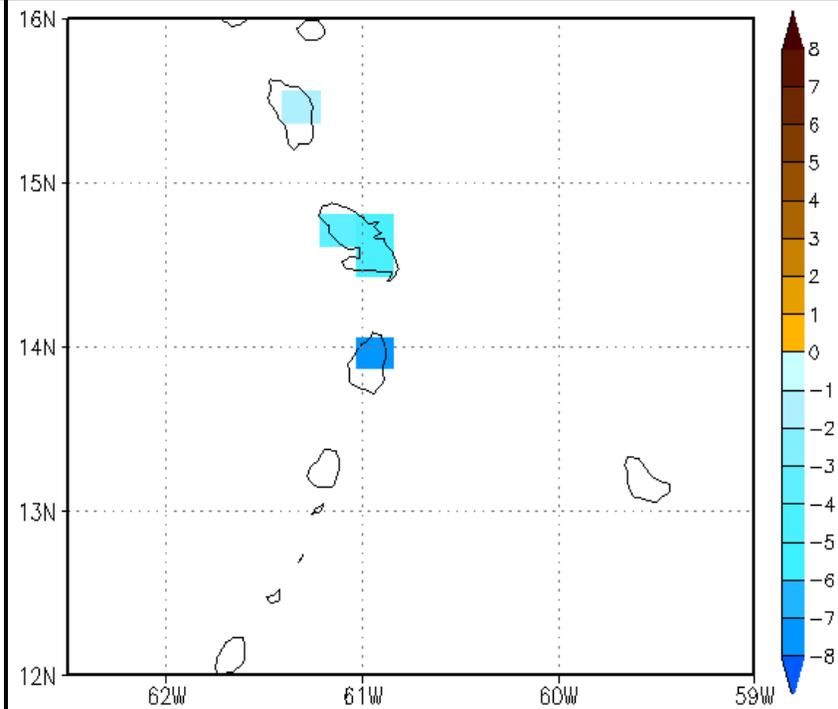


**Future Climate**

# Rainfall change over the Windward Islands (present – future climate)

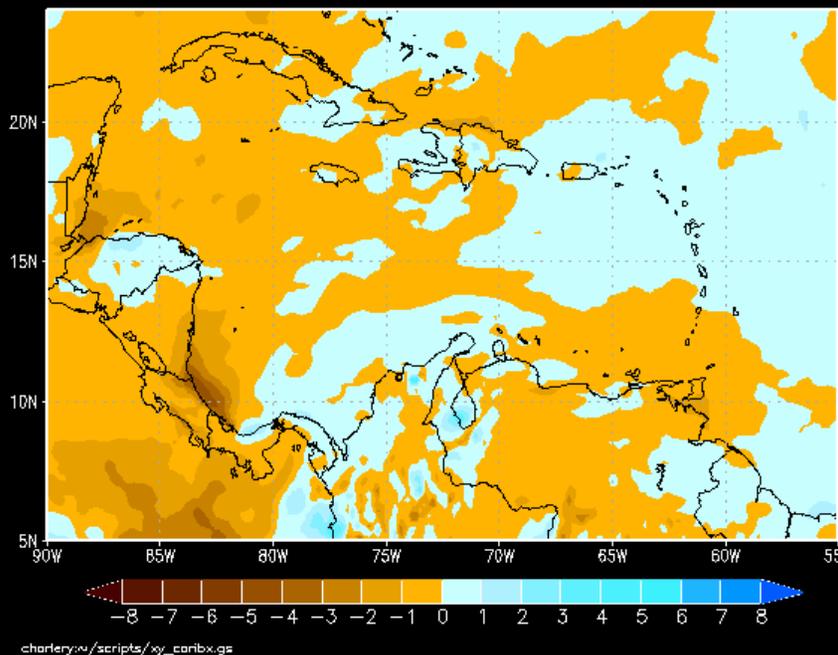


**Consecutive Dry Days**



**Consecutive Wet Days**

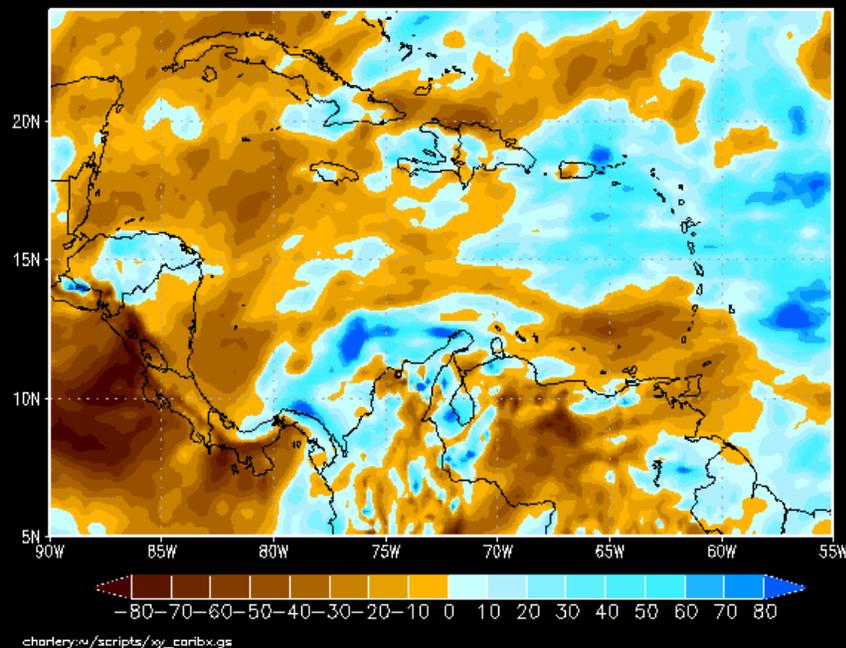
Precipitation (mm/day) Climatology Month= 1  
Future - Present



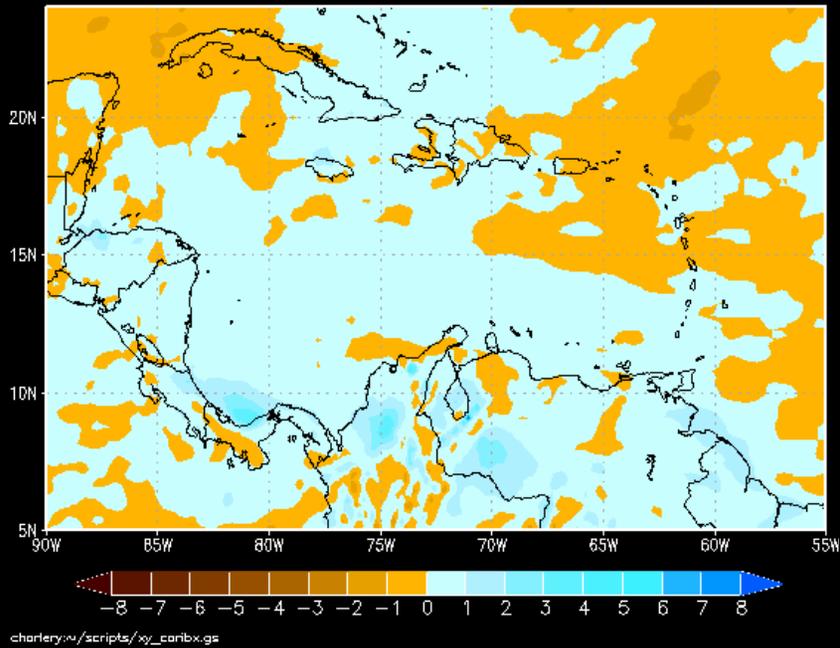
**Rainfall  
A1B  
Scenario**

January

Precipitation (Percentage) Climatology Month= 1  
Future - Present



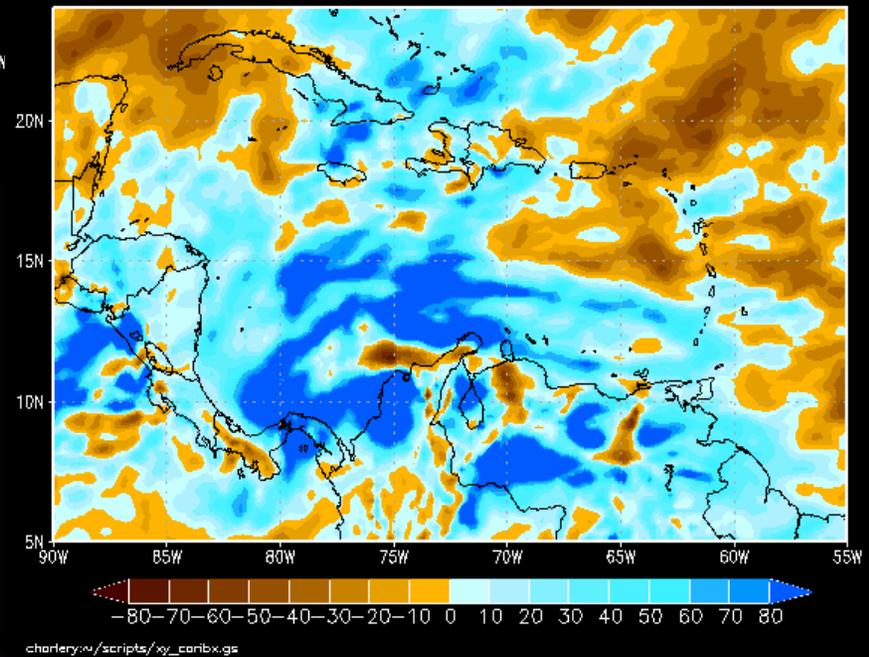
Precipitation (mm/day) Climatology Month= 2  
Future - Present



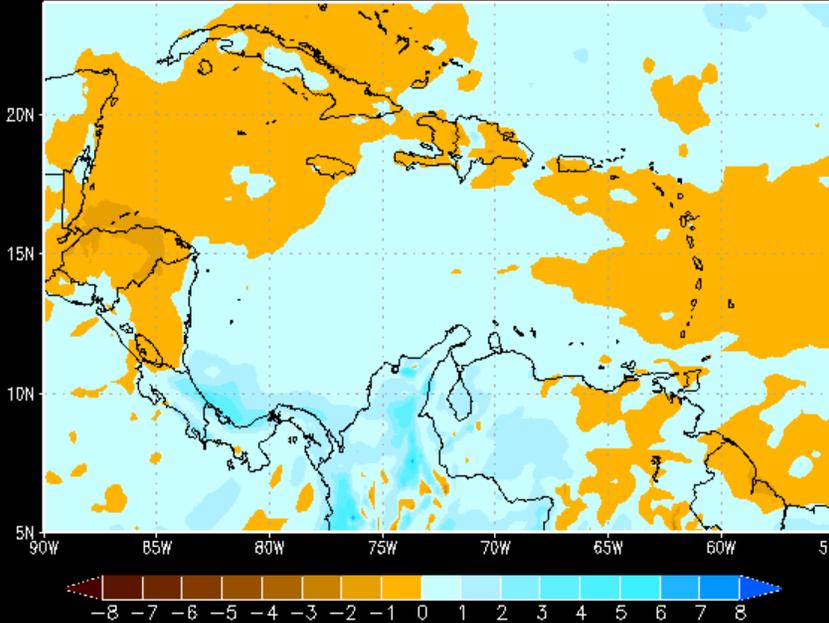
**Rainfall  
A1B  
Scenario**

February

Precipitation (Percentage) Climatology Month= 2  
Future - Present



Precipitation (mm/day) Climatology Month= 3  
Future - Present

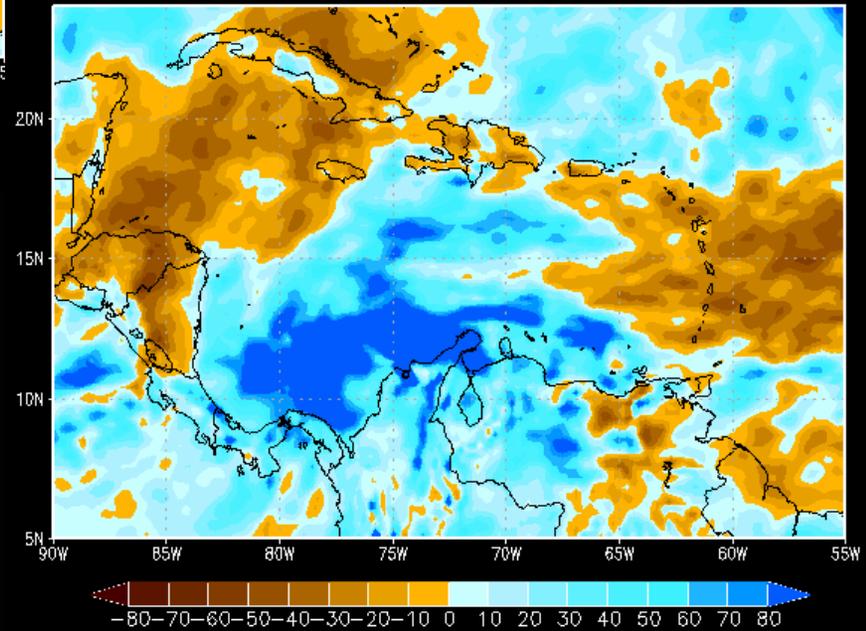


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**Rainfall  
A1B  
Scenario**

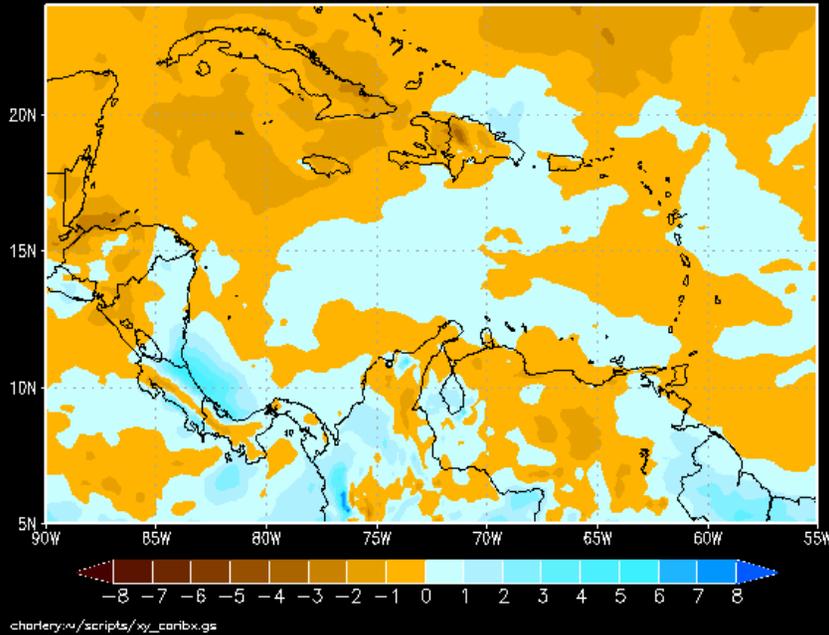
March

Precipitation (Percentage) Climatology Month= 3  
Future - Present



charley.w/scripts/xy\_caribx.gs

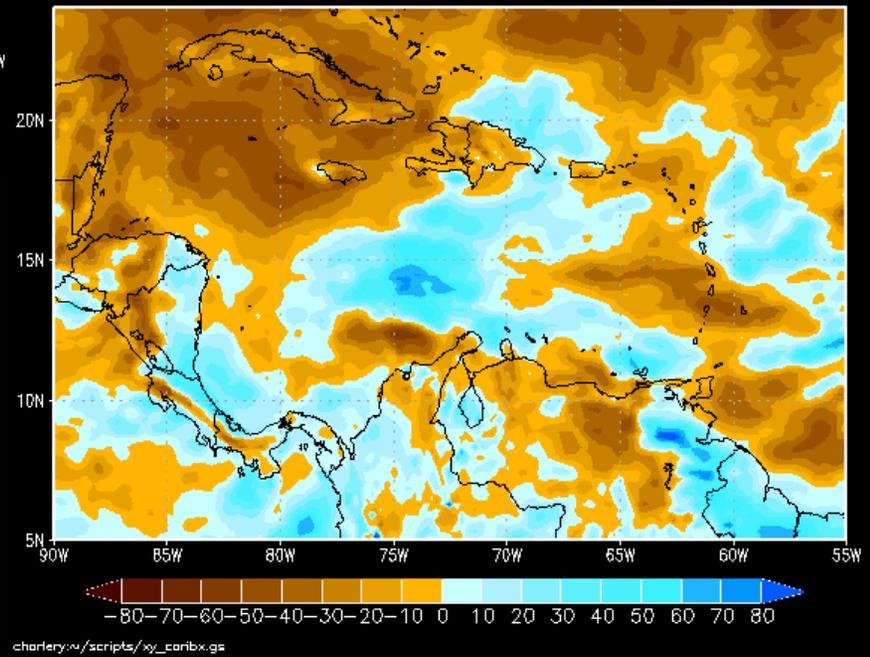
Precipitation (mm/day) Climatology Month= 4  
Future - Present



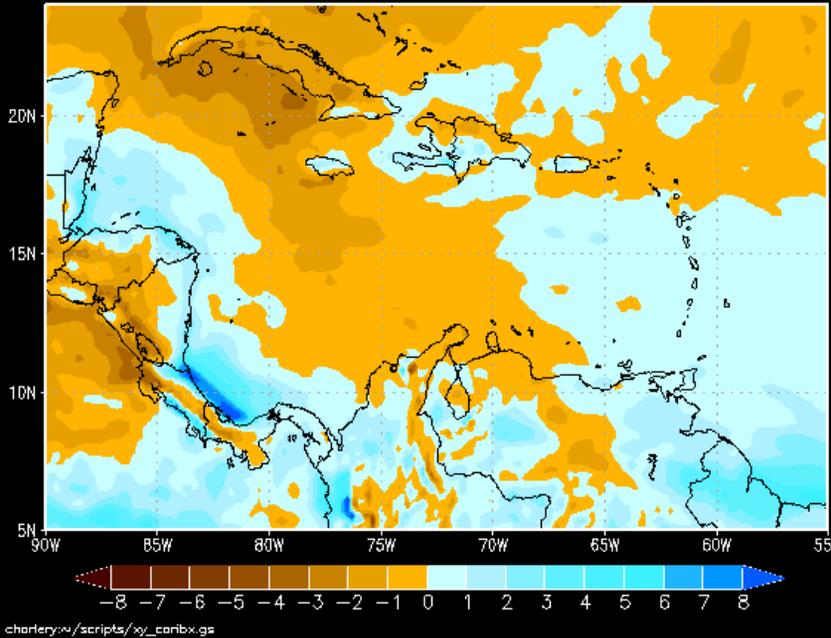
**Rainfall  
A1B  
Scenario**



Precipitation (Percentage) Climatology Month= 4  
Future - Present



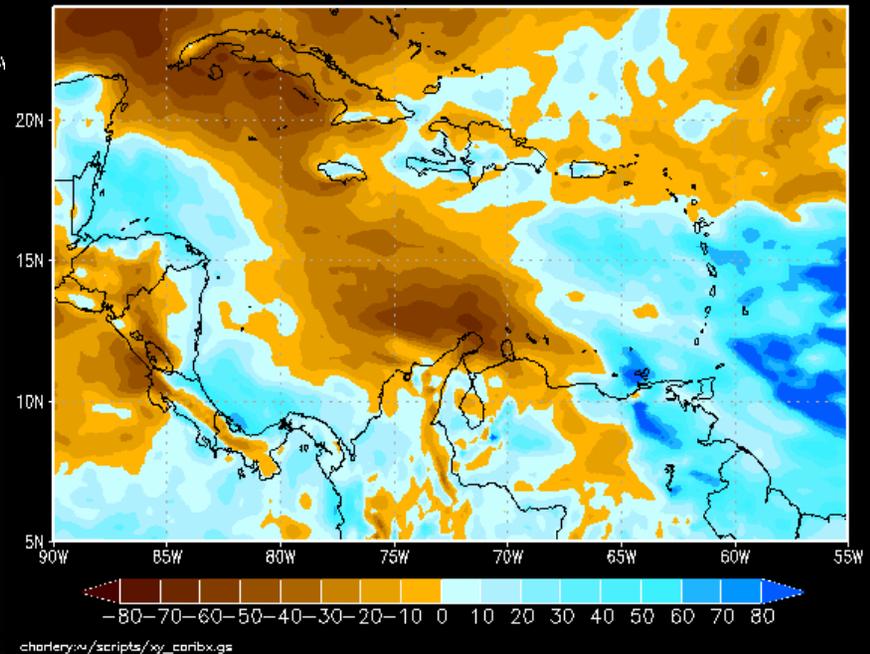
Precipitation (mm/day) Climatology Month= 5  
Future - Present



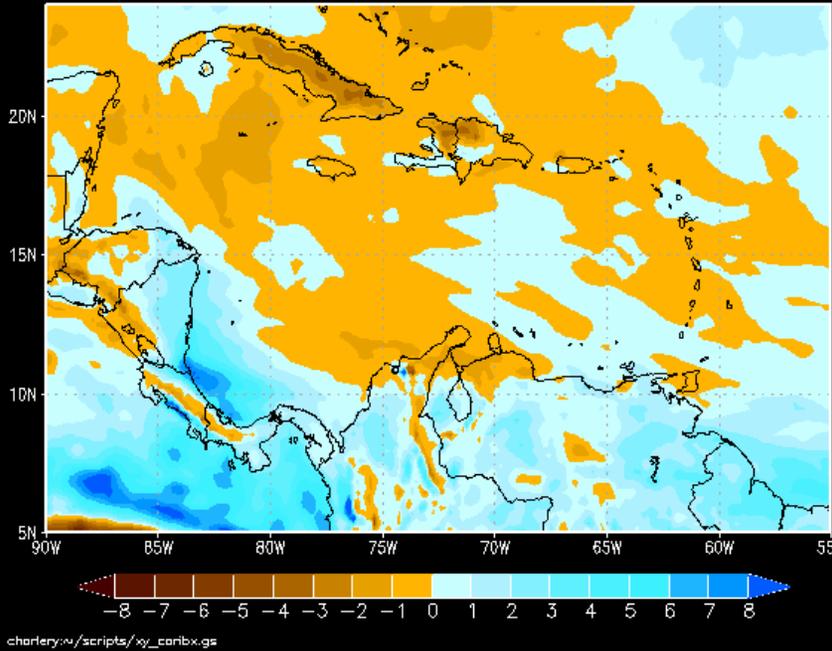
**Rainfall  
A1B  
Scenario**



Precipitation (Percentage) Climatology Month= 5  
Future - Present



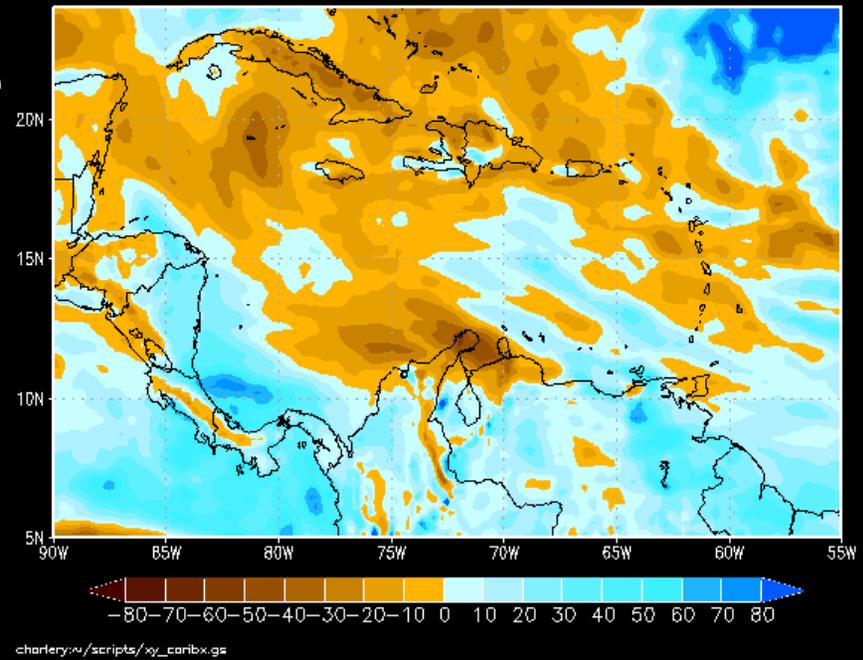
Precipitation (mm/day) Climatology Month= 6  
Future - Present



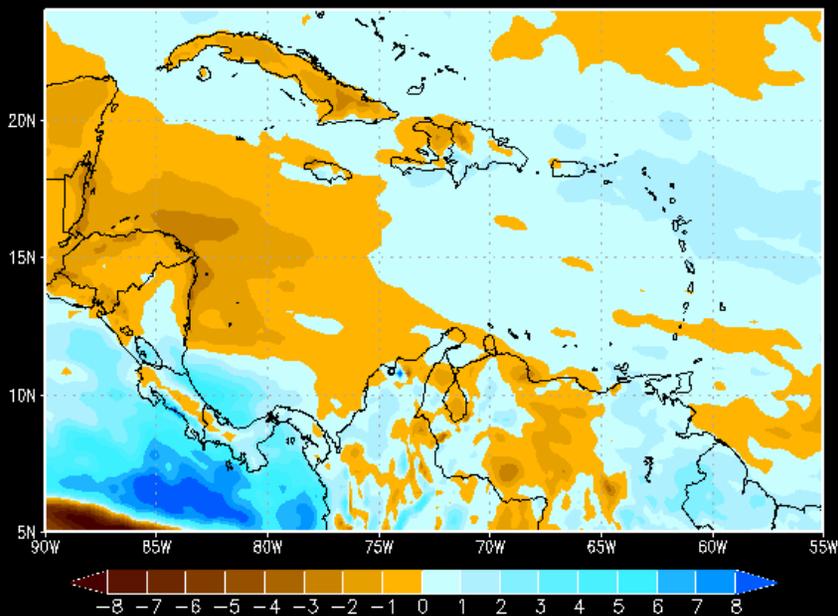
**Rainfall  
A1B  
Scenario**



Precipitation (Percentage) Climatology Month= 6  
Future - Present



Precipitation (mm/day) Climatology Month= 7  
Future - Present

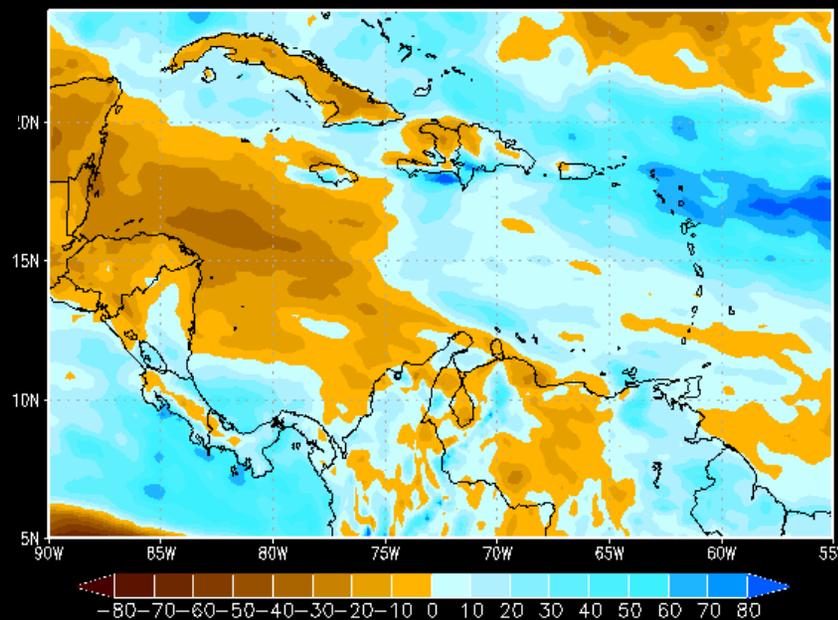


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**Rainfall  
A1B  
Scenario**

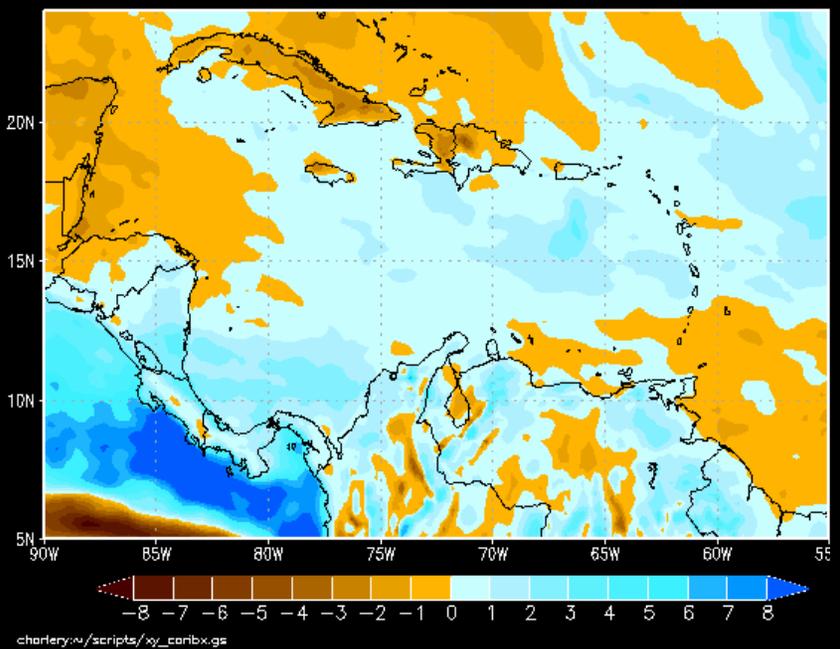


Precipitation (Percentage) Climatology Month= 7  
Future - Present



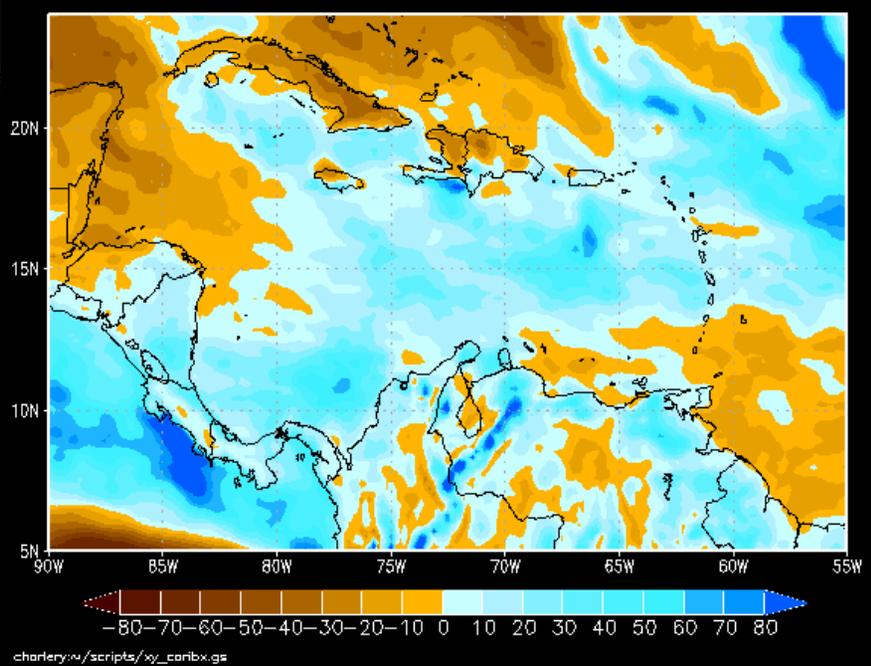
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Precipitation (mm/day) Climatology Month= 8  
Future - Present



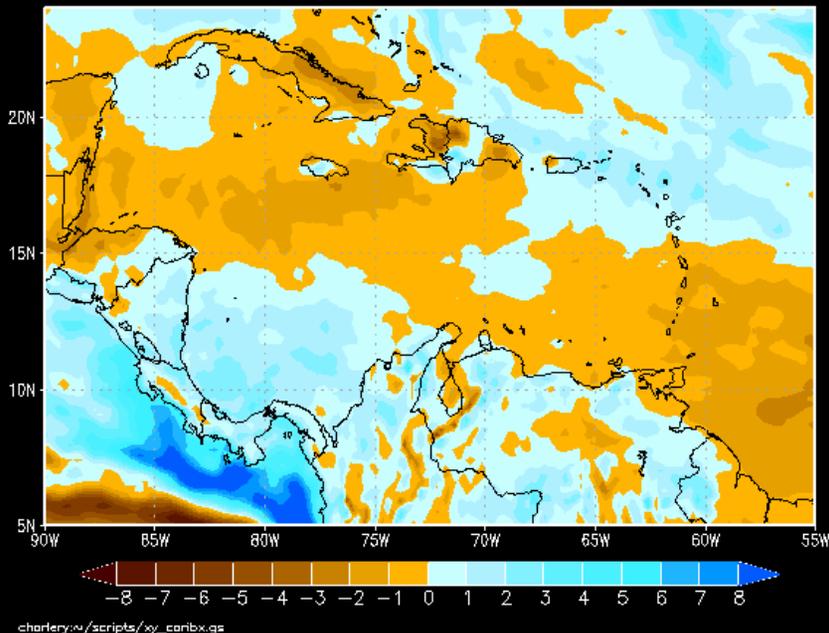
August

Precipitation (Percentage) Climatology Month= 8  
Future - Present



Rainfall  
A1B  
Scenario

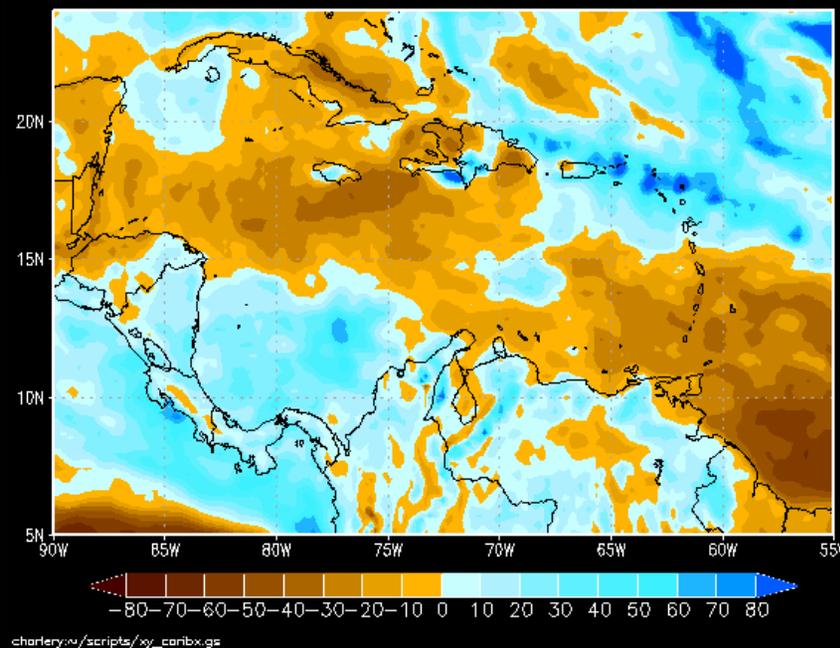
Precipitation (mm/day) Climatology Month= 9  
Future - Present



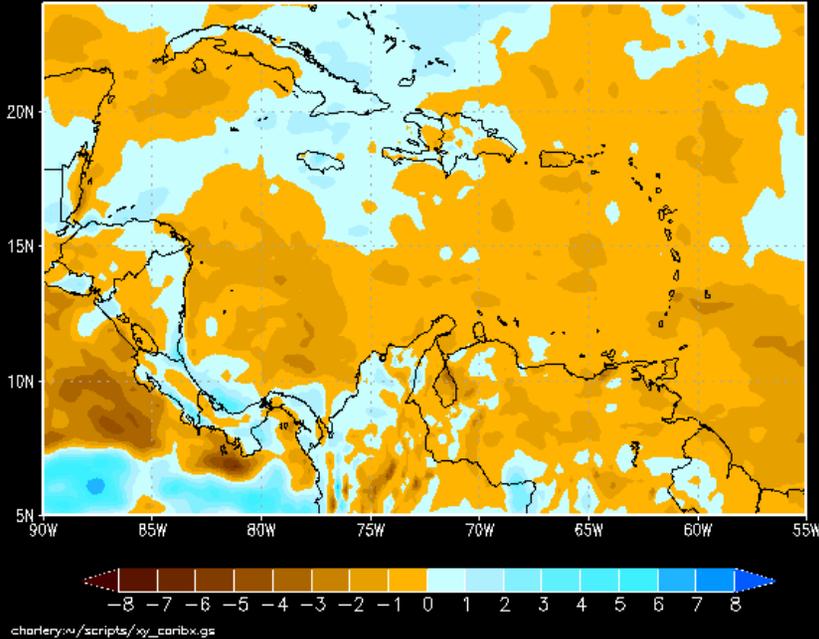
**Rainfall  
A1B  
Scenario**

September

Precipitation (Percentage) Climatology Month= 9  
Future - Present



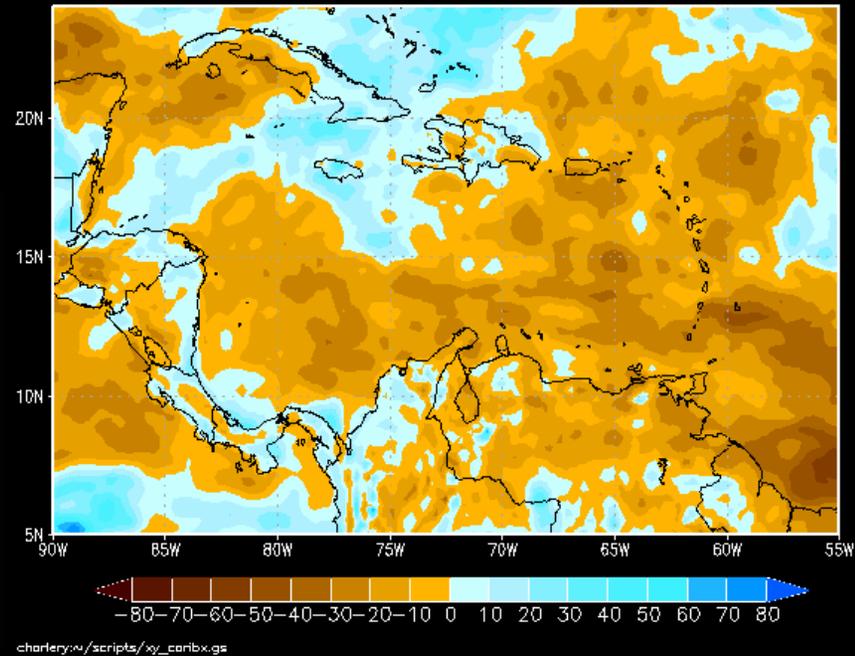
Precipitation (mm/day) Climatology Month= 10  
Future - Present



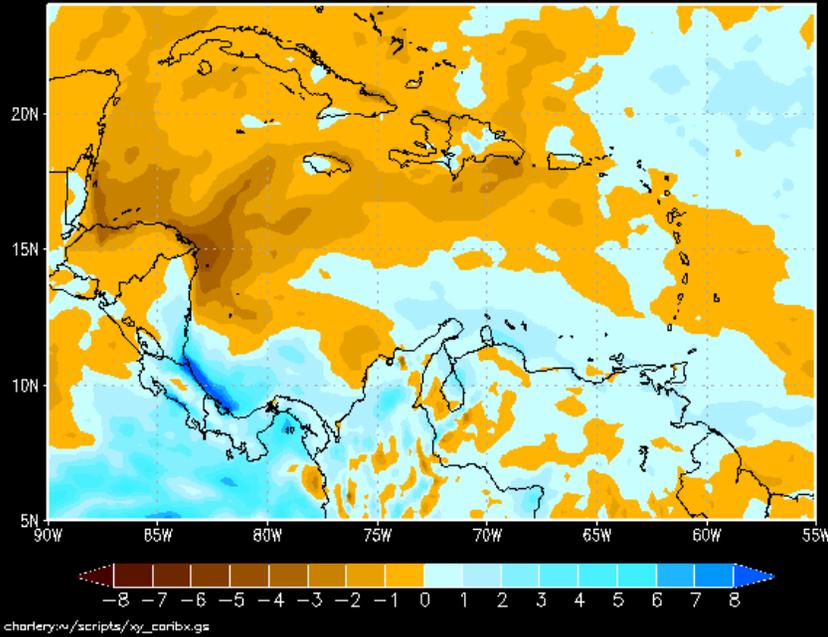
**Rainfall  
A1B  
Scenario**

October

Precipitation (Percentage) Climatology Month= 10  
Future - Present



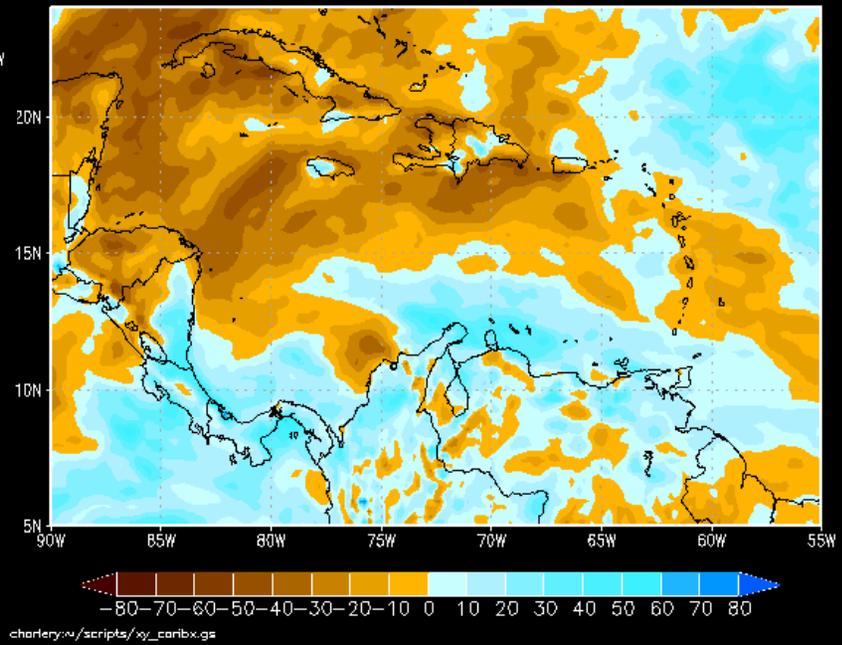
Precipitation (mm/day) Climatology Month= 11  
Future - Present



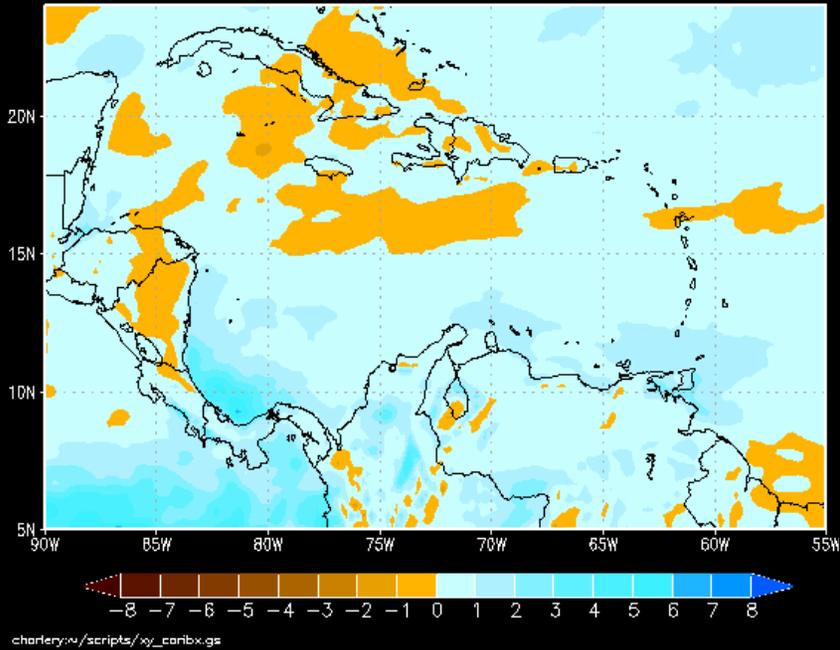
**Rainfall  
A1B  
Scenario**

November

Precipitation (Percentage) Climatology Month= 11  
Future - Present



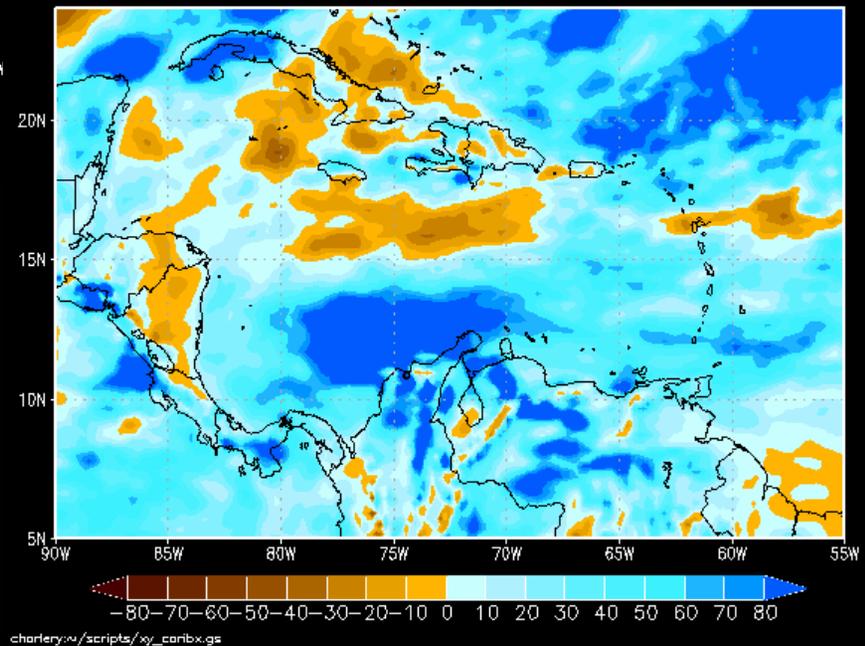
Precipitation (mm/day) Climatology Month= 12  
Future - Present



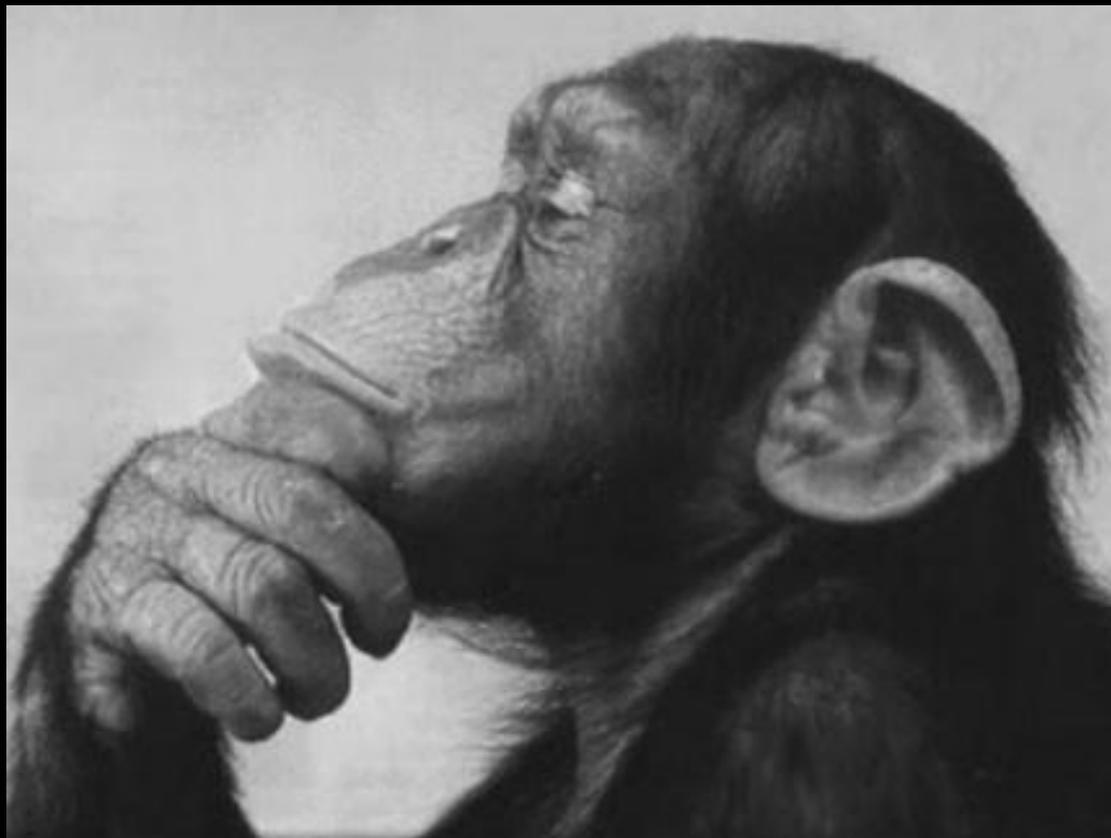
**Rainfall  
A1B  
Scenario**

December

Precipitation (Percentage) Climatology Month= 12  
Future - Present



**So where does that leaves us?**



# Conclusion from The A1B Model

Broad agreement with IPCC-WG1 (Chapter 11 – Regional Climate Projections' Summary for Caribbean Simulations)

## Temperature:

- ▶ Annual temperature increases by end of the 21<sup>st</sup> century: range from 1.4°C to 3.2°C (median of 2.0°C)
- ▶ Average of approx. 1°C increase in sea surface temperature
- ▶ Increase in number of very warm days

## Rainfall:

- ▶ Models project decreases in annual precipitation but increase in intensity (up to 20% by 2050)
- ▶ Reduced length of rainy season 7-8% by 2050
- ▶ Increased length of dry season 6-8% by 2050

## **Conclusion from the A2 and B2 Scenarios models (PRECIS)**

- **General drying across the Caribbean basin:**

The decreases in rainfall range from **25 to 50%** depending on the scenario and section of the Caribbean basin

The exception to the overall drying trend is in the far north of the Caribbean, including western Cuba and the southern Bahamas – **all are up to 25% wetter under the scenarios.**

## Conclusion from the A2 and B2 Scenarios models (PRECIS)

- **The effect of climate change appears to enhance the existing climatic pattern:**
  - Making the wet and dry zones wetter and drier respectively, during the first 4 – 6 months of the year.
  - In May to October the entire Caribbean is up to **25% drier**.
  - The changes in average rainfall show a pronounced north-south gradient in rainfall change during the January to April dry season.
  - Indicates summer drying to become more severe during the wet season.

So what are the implications for water resources?

**That's for you  
to answer!**

# What mitigation/adaptation actions could be taken?

(Re: Dr. Adrian Cashman)

- **Supply Side – harness more of the available water;**
- **Demand side – utilise what we have more efficiently and effectively;**
- **Water management systems – ensure that they are physically and institutionally robust and resilient.**

**Thank  
You!**