# On the ability of CMIP3 and CMIP5 models in representing Caribbean current climate

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# Context and Motivations

CORDEX Simulations

How to choose the “best model” or “best models”?

CMIP3 and CMIP5 evaluation over Central America, Amazon, Northeast Brazil and Caribbean

# Key question:

**Why my students would look at CMIP3 and CMIP5 over the Caribbean (but not over the Amazon or other parts of our CORDEX domain)?**

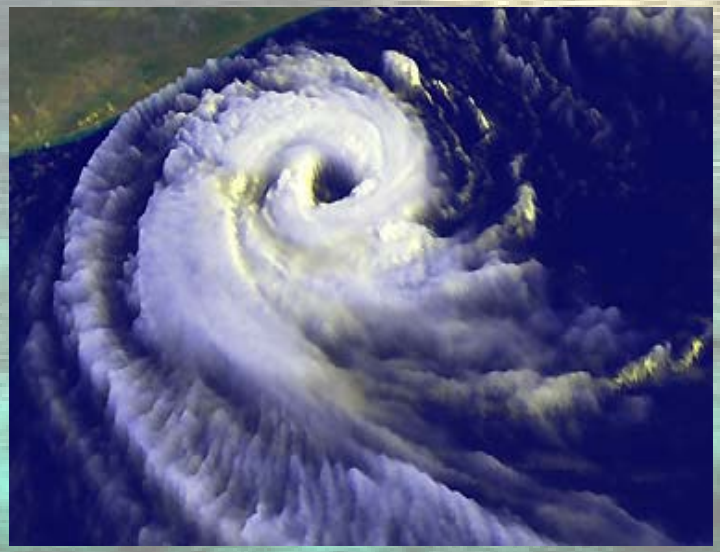
Few studies over that region?

Are they aware of the difficulties in articulating studies among People from the many insular countries?

Are they looking for a job (or at least some vacation) over there?

# Caribbean climate

- Hot throughout the year, with a typical Mid Summer Drought (MSD).
- Tempered by trade winds in local areas.
- Hurricane season from July to November.
- Despite greater precipitation during storms and other peak periods, more frequent and longer droughts are expected in parts of the Caribbean this century (Bueno et al 2008).



# Climate changes projected for the Caribbean

- Higher temperatures
- Sea level rise
- Increased hurricane intensity

# Projected by IPCC (SPECIAL REPORT, 2012)

*"Likely that the global frequency of tropical cyclones will either decrease or remain essentially unchanged. Likely increase in average tropical cyclone maximum wind speed, although increases may not occur in all ocean basins. Heavy rainfalls associated with tropical cyclones are likely to increase. Projected sea level rise is expected to further compound tropical cyclone surge impacts".*

# Model resolution (degrees)

**LIMITS:**

**LONGITUDE=86W:60W**

**LATITUDE=24N:14N**

**CMIP3**

| R < 1,25 | 1,25 < R <3 | 3 < R |
|---|---|---|
| MIROC3.2-HR | CGCM3.1-HR | ECHO-G |
| | CGCM3.1-MR | GISS-AOM |
| **1 model** | CNRM-CM3 | GISS-EH |
| | CSIRO-Mk3.0 | GISS-ER |
| | FGOALS-g1.0 | HadCM3 |
| | GFDL-CM2.0 | INM-CM3.0 |
| | GFDL-CM2.1 | IPSL-CM4 |
| | HadGEM1 | |
| | MIROC3.2-MR | **7 models** |
| | MPI-ECHAM5 | |
| | MRI-CGCM2.3.2 | |
| | NCCCSM3 | |
| | NCPCM | |
| | BCCR-BMC2.0 | |
| | **14 models** | |

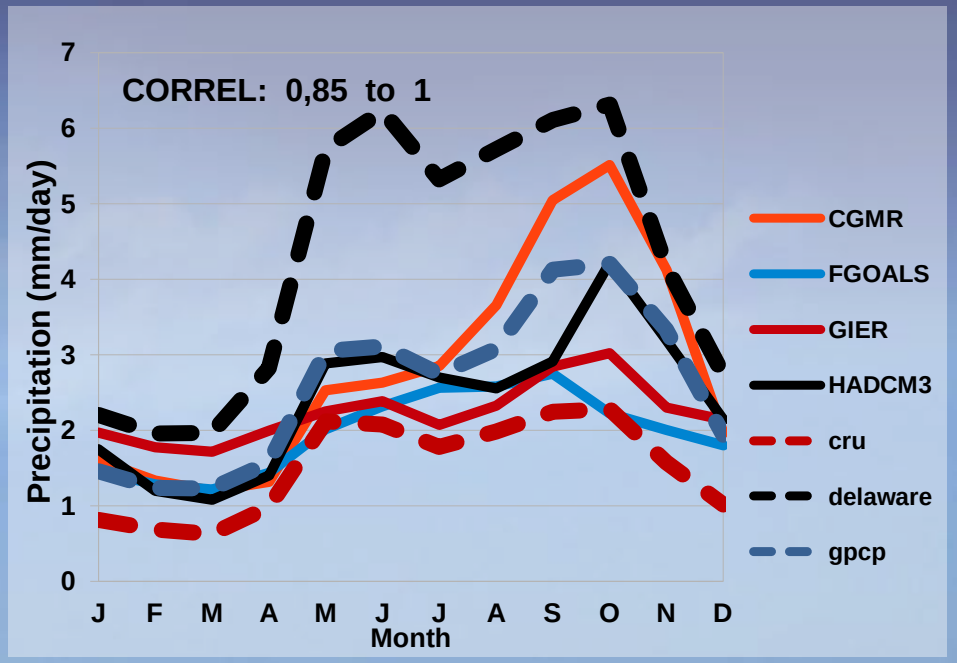
**CMIP5**

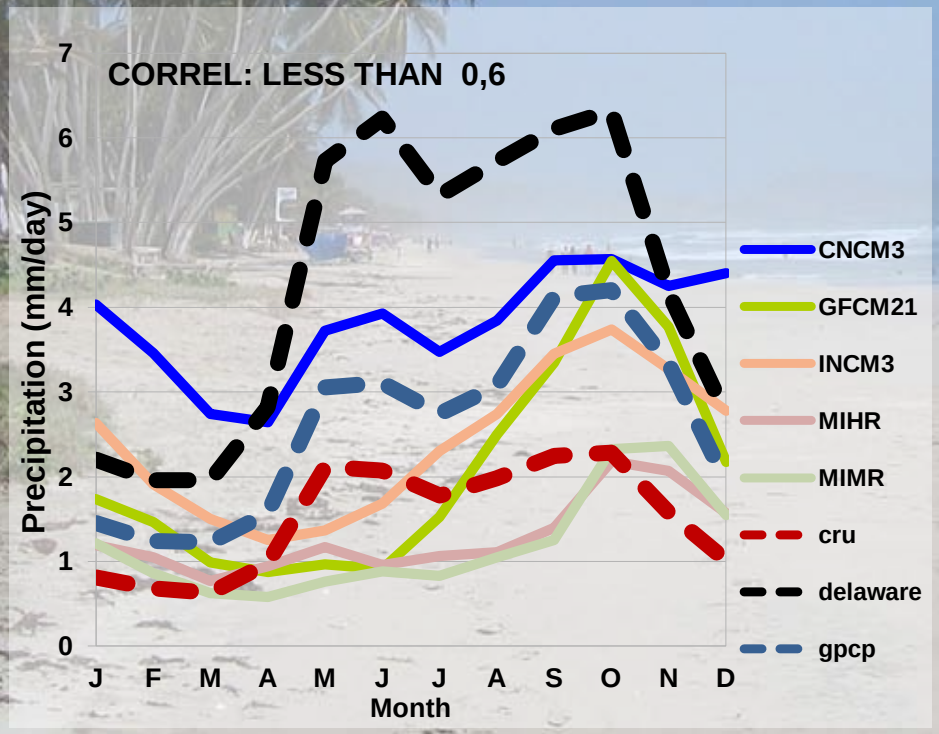
| R < 1,25 | 1,25 < R <3 | 3 < R |
|---|---|---|
| ACCESS1-0 | CanCM4 | HadCM3 |
| CCSM4 | FGOALS-g2 | IPSL-CM5A-LR |
| EC-EARTH | FGOALS-s2 | |
| MIROC4h | GFDL-CM3 | **2 models** |
| MRI-CGCM3 | GFDL-ESM2G | |
| | GFDL-ESM2M | |
| **5 models** | HadGEM2-ES | |
| | HadGEM2-CC | |
| | IPSL-CM5A-MR | |
| | MIROC5 | |
| | MIROC-ESM-CHEM | |
| | MIROC-ESM | |
| | MPI-ESM-LR | |
| | CSIRO-Mk3-6-0 | |
| | CNRM-CM5 | |
| | CanESM2 | |
| | Bcc-csm1-1 | |
| | Inmcm4 | |
| | **16 models** | |

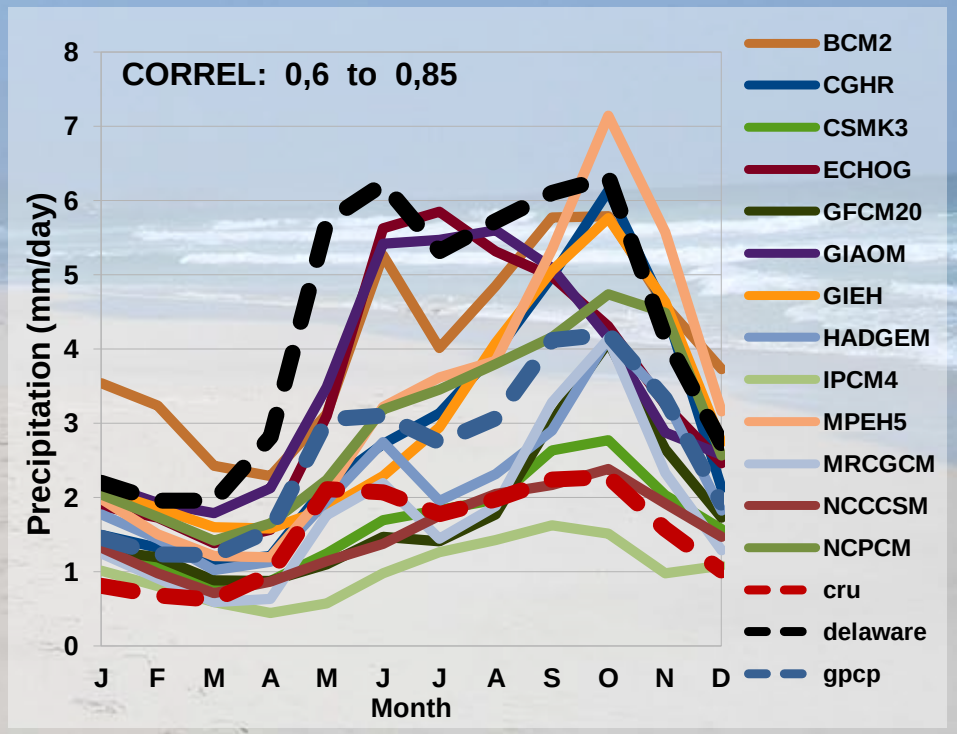
# CMIP3 Precipitation

Annual Cycle
Caribbean ( 1961-1990 )

**Correlation analysis**



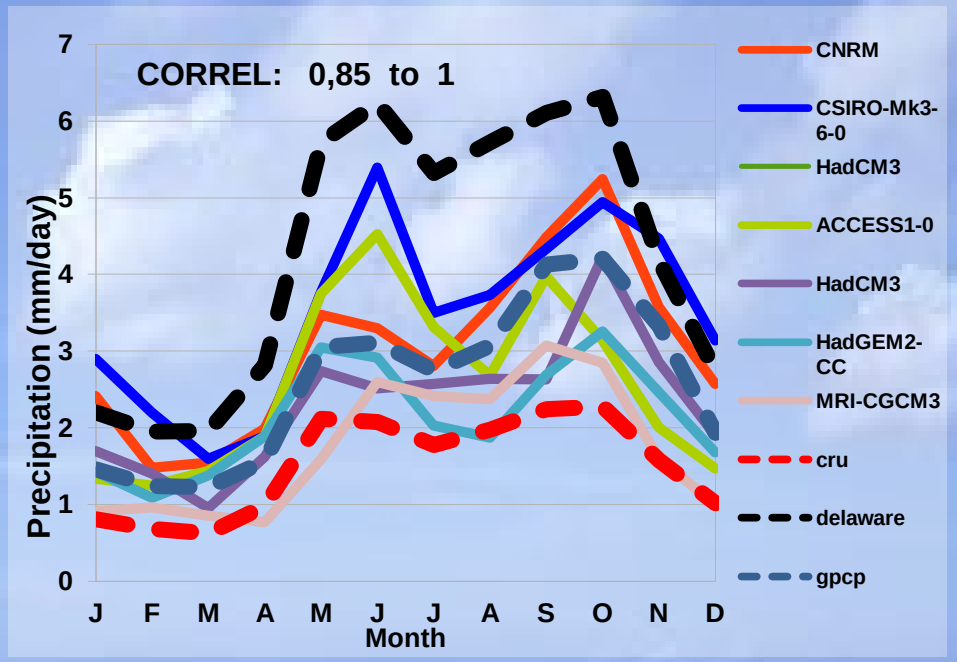



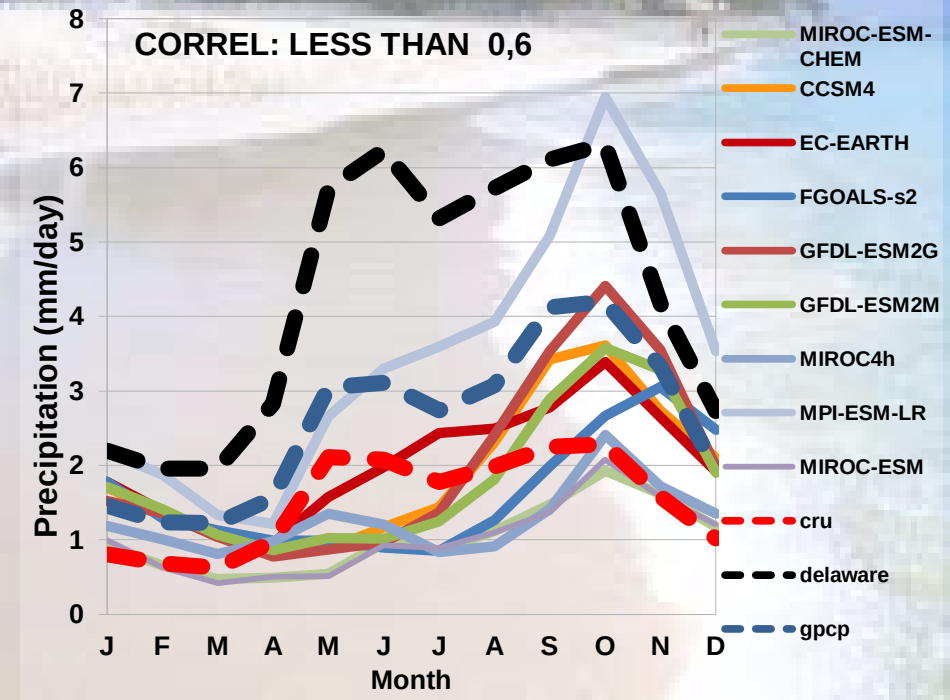



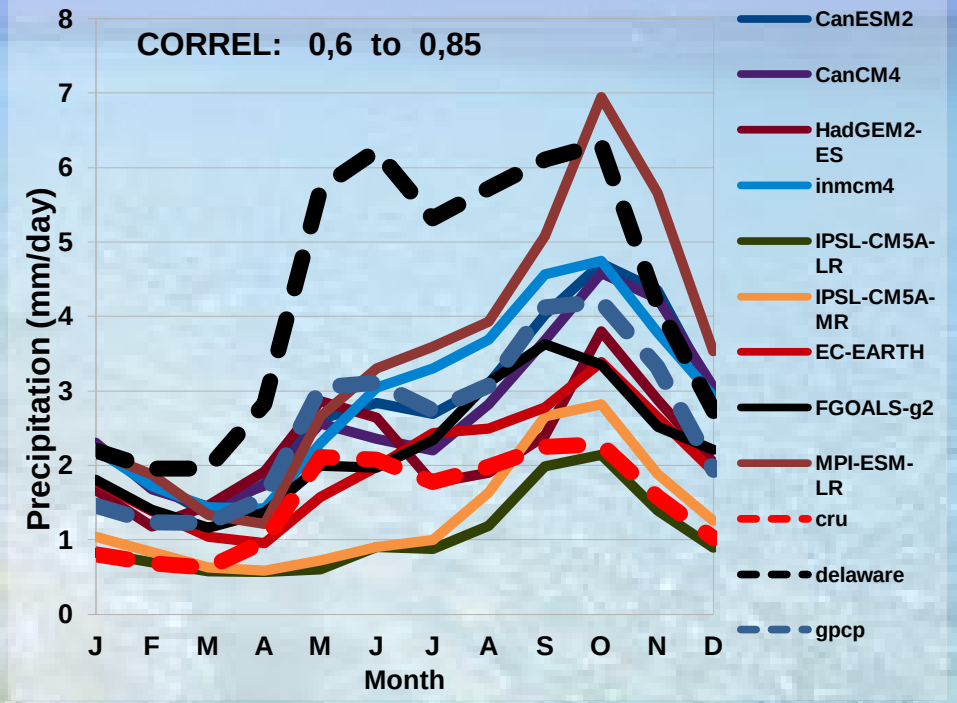
# CMIP5 Precipitation

Annual Cycle of Daily Precipitation
Caribbean ( 1961-1990 )

## Correlation analysis



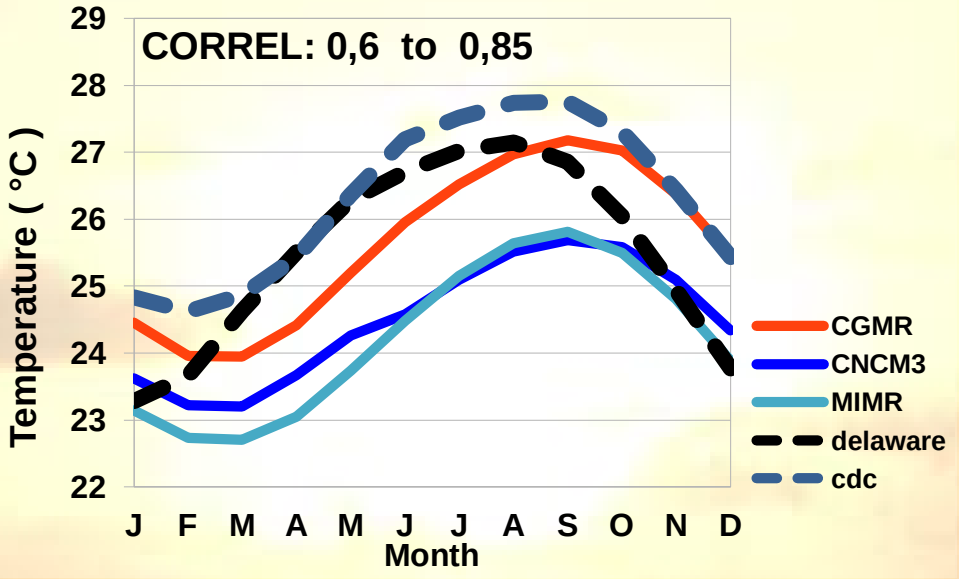



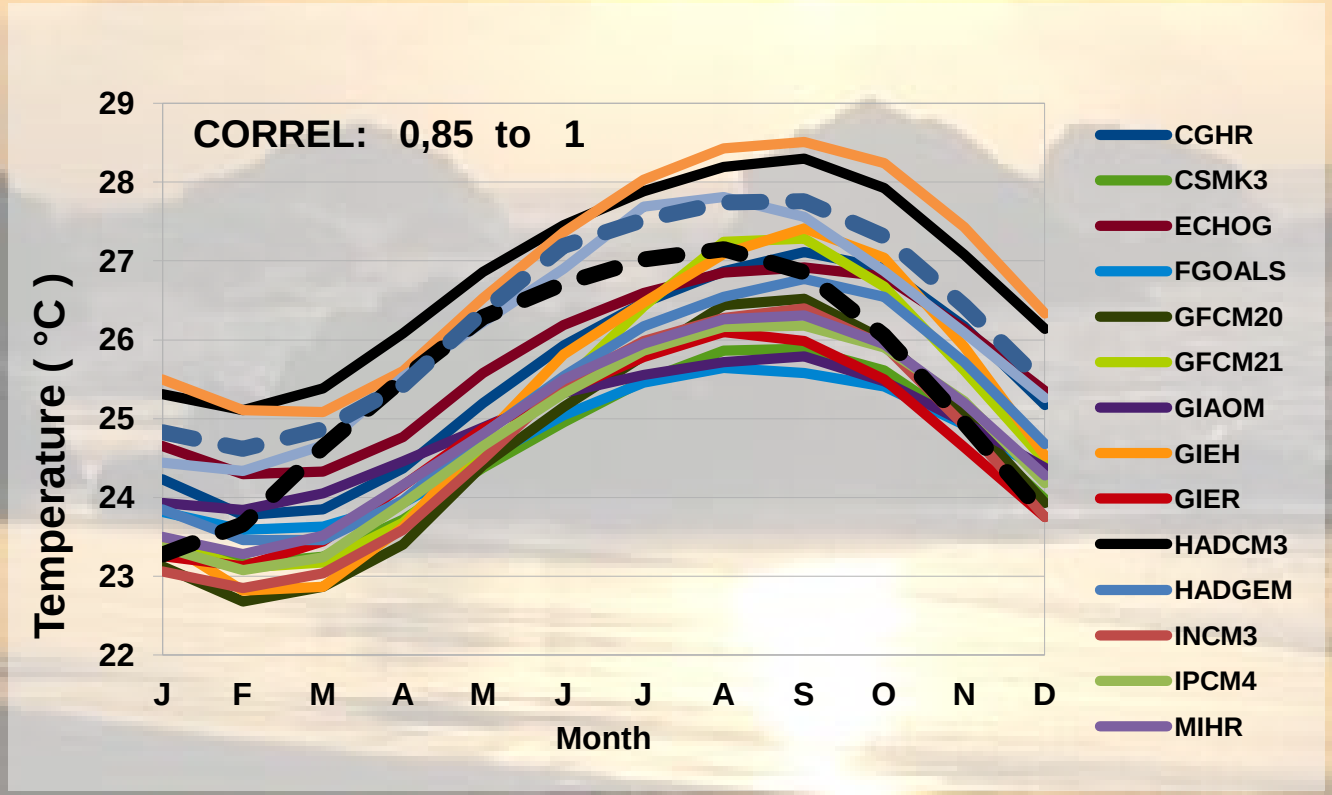
# CMIP3 Temperature

Annual Cycle
Caribbean ( 1961-1990 )

**Correlation analysis**

| |
|---|
| GIER ( 0,967 ) |
| MRCGCM ( 0,962 ) |
| GIAOM ( 0,955 ) |
| INCM3 ( 0,935 ) |
| MIHR ( 0,934 ) |
| NCCCSM ( 0,925 ) |
| IPCM4 ( 0,919 ) |
| CSMK3 ( 0,910 ) |
| GFCM20 ( 0,905 ) |
| FGOALS ( 0,902 ) |
| ECHOG ( 0,889 ) |
| BCM2 ( 0,887 ) |
| MPEH5 ( 0,882 ) |
| GFCM21 ( 0,879 ) |
| GIEH ( 0,875 ) |
| HADGEM ( 0,87 ) |
| NCPCM ( 0,869 ) |
| CGHR ( 0,862 ) |
| MIMR ( 0,843 ) |
| CGMR ( 0,829 ) |
| CNCM3 ( 0,822 ) |



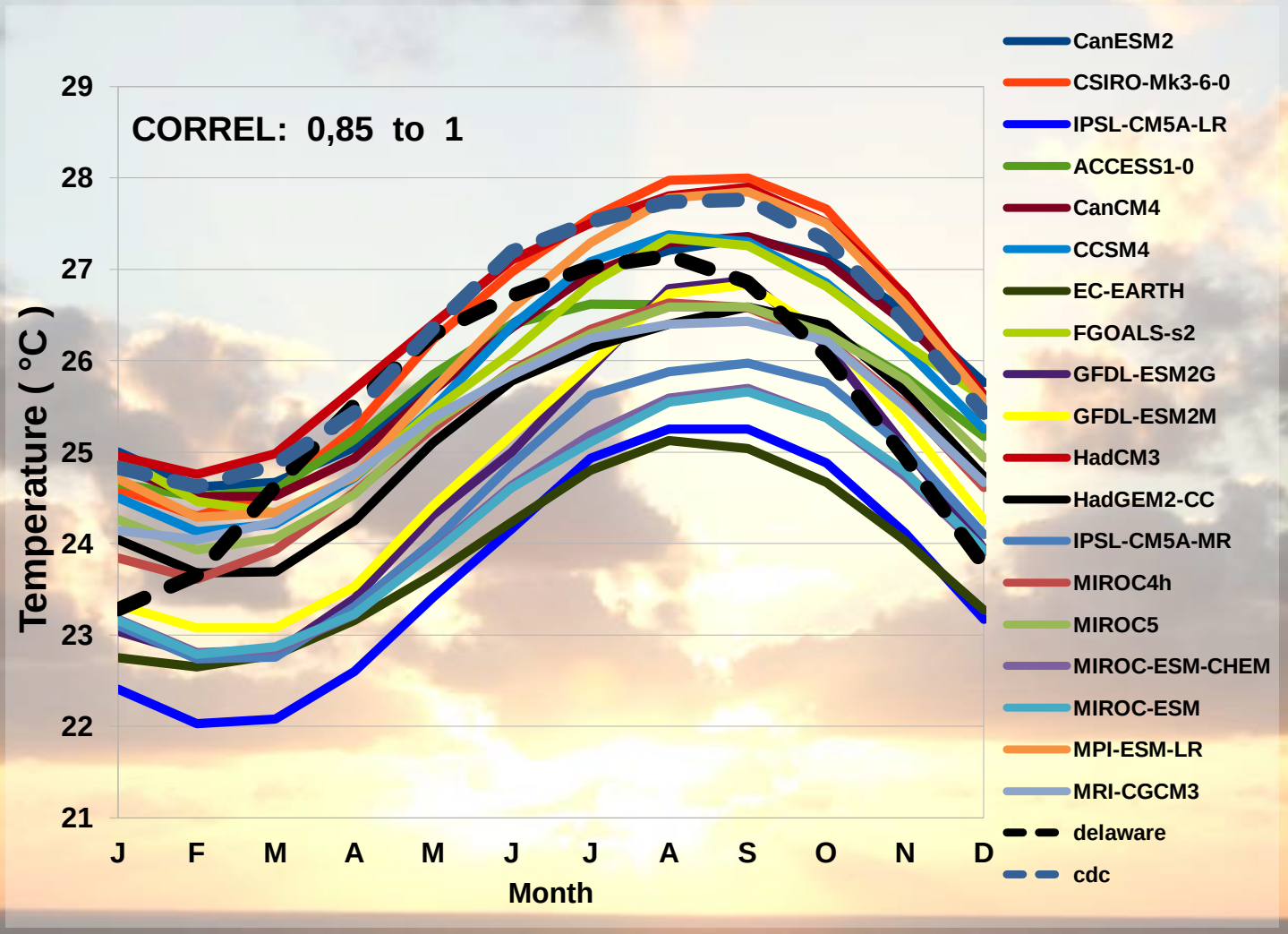



# CMIP5 Temperature

## Annual Cycle of Daily Temperature - Caribbean ( 1961-1990 )

**Correlation analysis**

| |
|---|
| ACCESS1-0 ( 0,951 ) |
| MRI-CGCM3 ( 0,950 ) |
| MIROC4h ( 0,944 ) |
| HadCM3 ( 0,943 ) |
| EC-EARTH ( 0,929 ) |
| CSIRO-Mk3-6-0 ( 0,928 ) |
| MIROC5 ( 0,911 ) |
| CCSM4 ( 0,908 ) |
| IPSL-CM5A-LR ( 0,898 ) |
| HadGEM2-CC ( 0,897 ) |
| GFDL-ESM2G ( 0,892 ) |
| CanCM4 ( 0,881 ) |
| GFDL-ESM2M ( 0,87854 ) |
| MPI-ESM-LR ( 0,87851 ) |
| MIROC-ESM-CHEM ( 0,872 ) |
| IPSL-CM5A-MR ( 0,871 ) |
| CanESM2 ( 0,868 ) |
| MIROC-ESM ( 0,865 ) |
| FGOALS-s2 ( 0,852 ) |



# Conclusions

- Spread among observational datasets in this region. We need better validation data for our models
- Reasonable representation of major characteristics of precipitation and temperature annual cycle over the Caribbean (including MSD)
- Improvement of this representation from CMIP3 to CMIP5 (phase errors diminished)
- No clear relationship between model resolution and model skill for the features we analyzed
- Also, no clear relationship between model complexity and model skill
- Future work will include CORDEX regional models in this analysis along with the other WCRP initiatives
- Based on some of the slide backgrounds, you may think on a good answer for the “key question”…

# Referências


Bueno, R. et al. 2008 The Caribbean and Climate Change: The costs of inaction. Report prepared by Tufts University and the Stockholm Environment Institute.

IPCC - Special Report on Managing the Risks of Extreme Events
and Disasters to Advance Climate Change Adaptation