The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Ninth ICTP Workshop on the Theory and Use of Regional Climate Models

Added Value of RegCM4 simulations over Central America and the Caribbean.

Authors :

Alejandro Vichot Llano
Dr. Daniel Martinez Castro
Dr. Filippo Giorgi

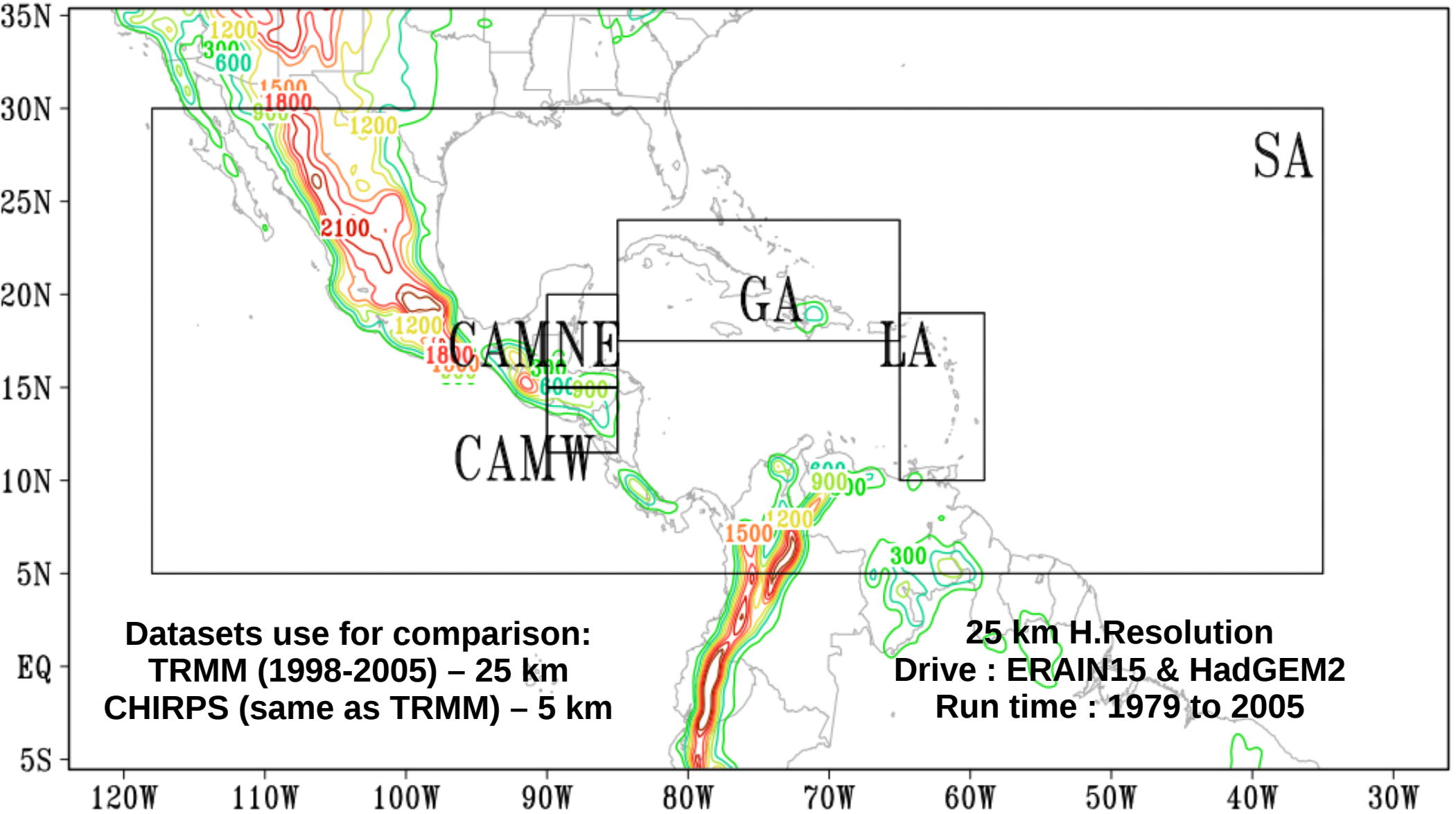
The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Domain & Data & Numerical Experiments



Datasets use for comparison:
TRMM (1998-2005) – 25 km
CHIRPS (same as TRMM) – 5 km

25 km H.Resolution
Drive : ERAIN15 & HadGEM2
Run time : 1979 to 2005

Set of Configurations

Cumulus parameterizations Schemes :

Tiedtke **(Tk)** & Kain-Fritsch **(Kf)** over Land

Emanuel **(Em)** over Ocean

Tunning parameters

Martínez-Castro, D., Vichot-Llano, A., Bezanilla-Morlot, A. et al. Clim Dyn (2018) 50: 4103. https://doi.org/10.1007/s00382-017-3863-y **(Tk)**

Entrainment & Convective rate & CAPE **(Kf)**

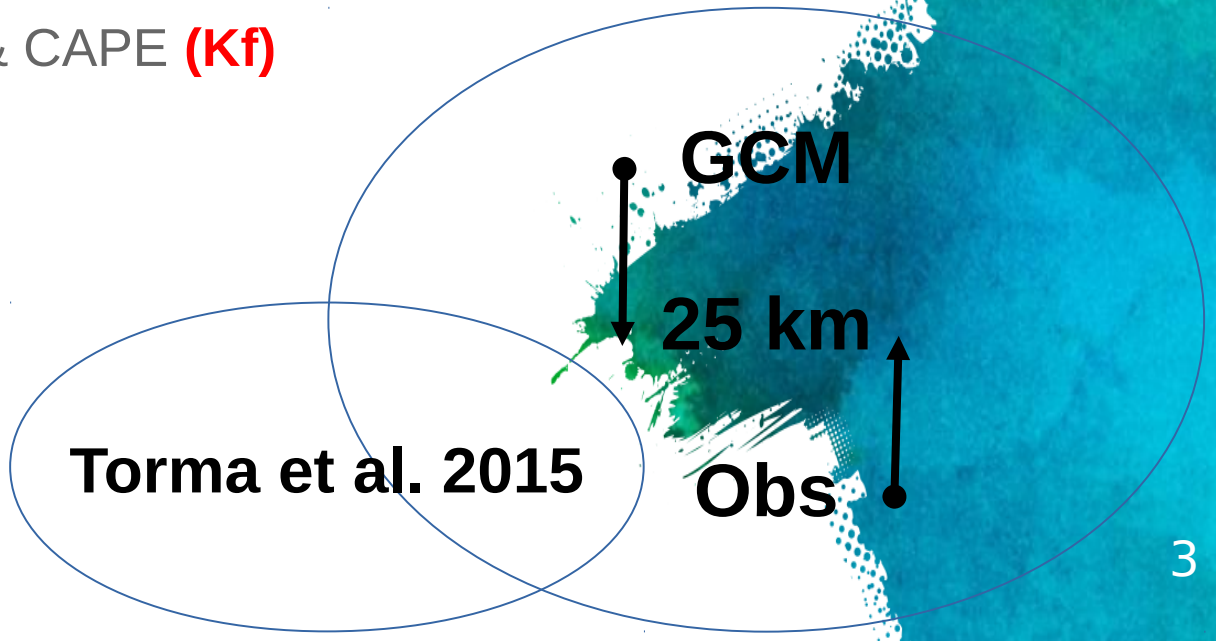
Precipitation efficiency **(Em)**

Creating two combinations:

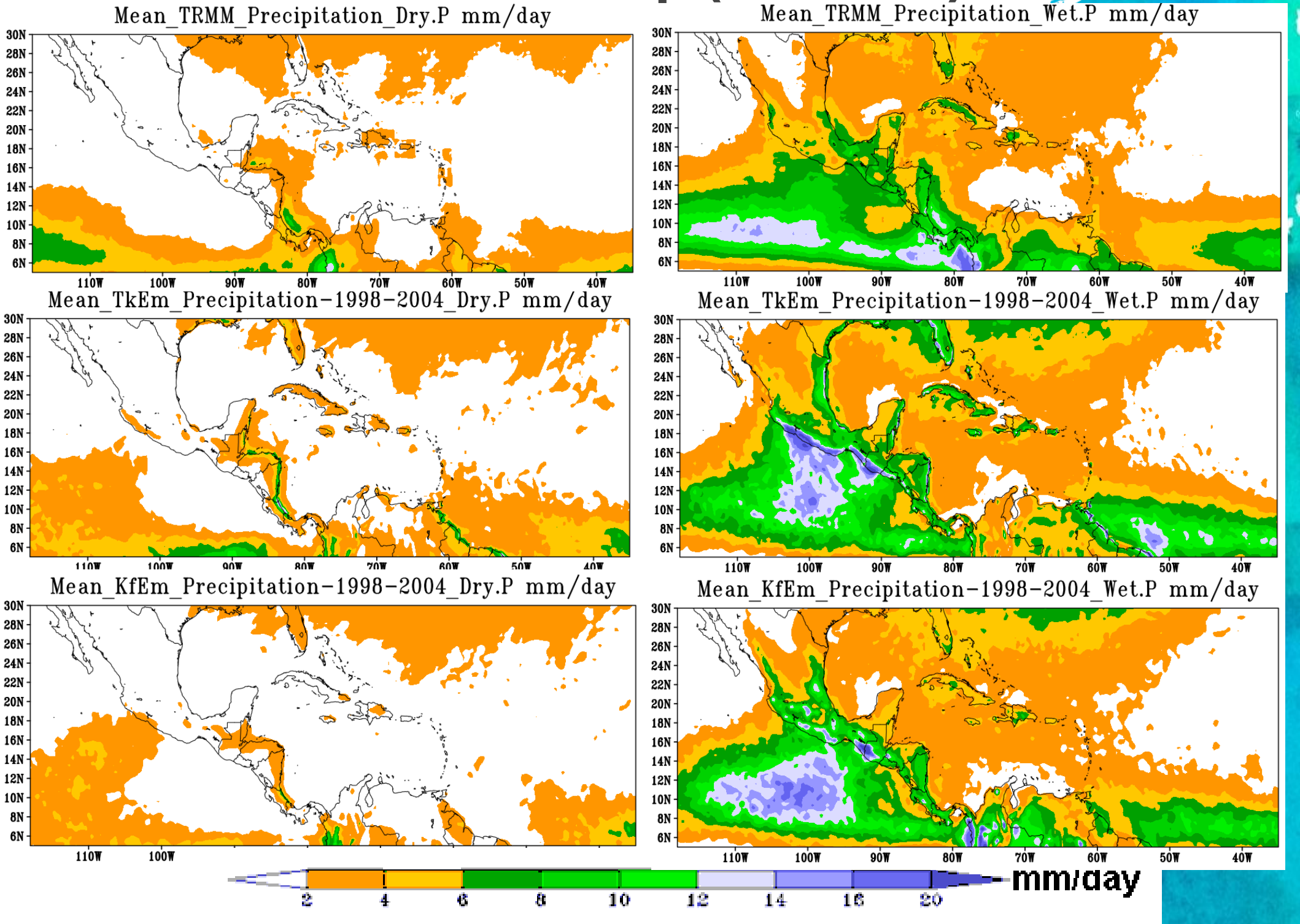
TkEm & **KfEm**

Final Analysis

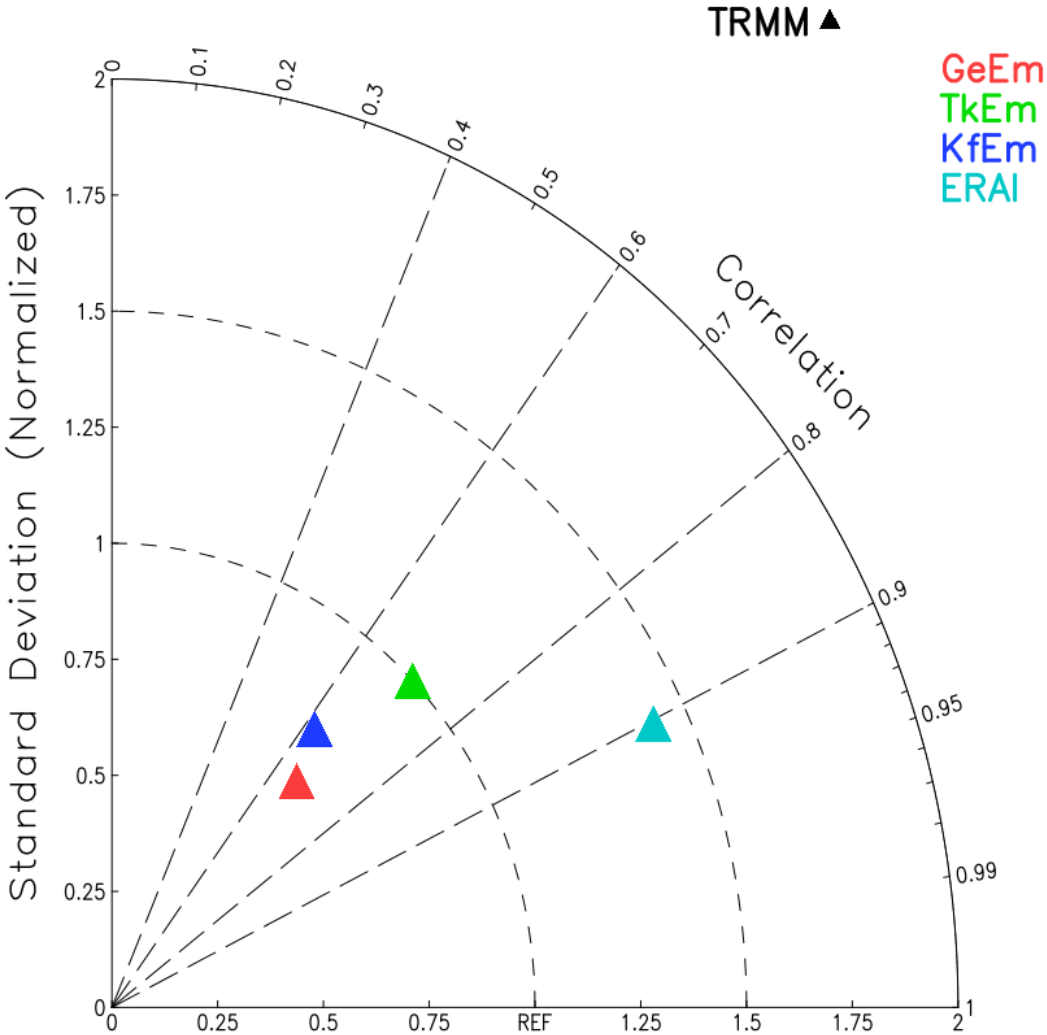
Dry & Wet periods

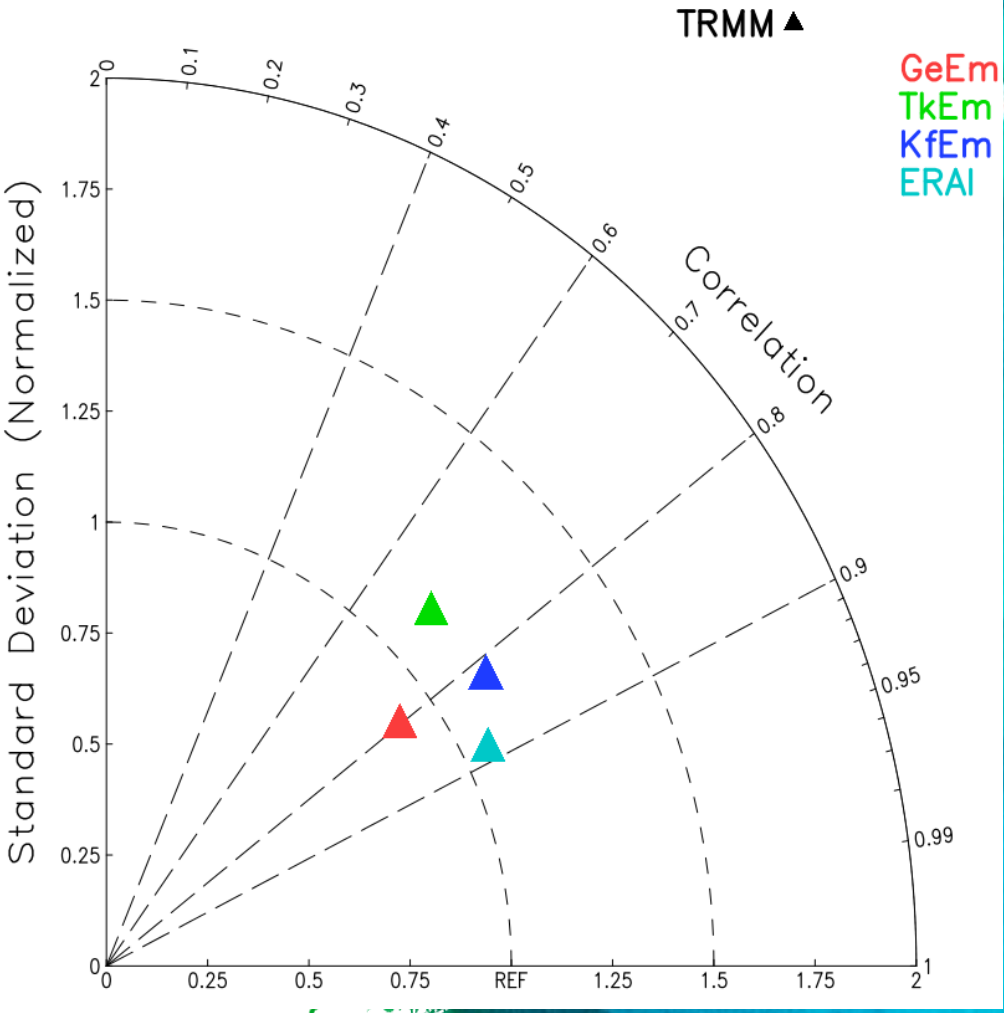


Mean Precip (ERAIN15)

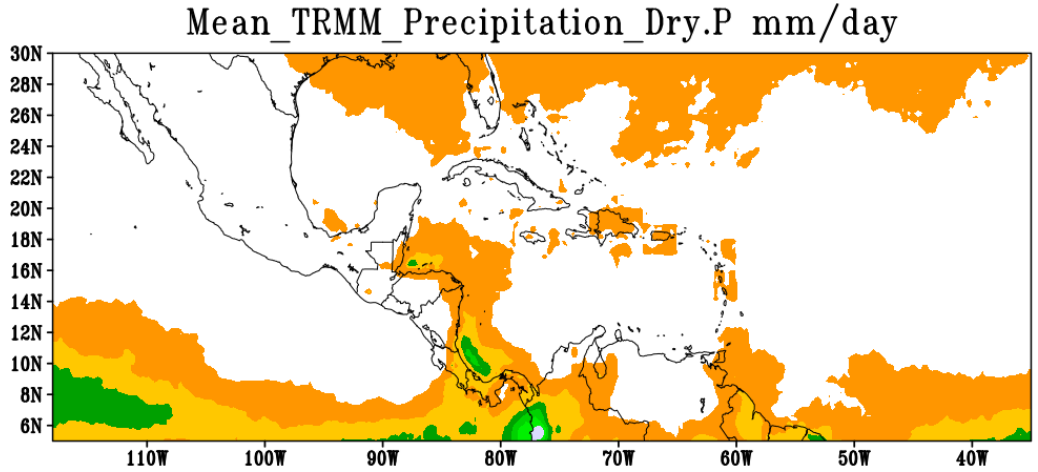


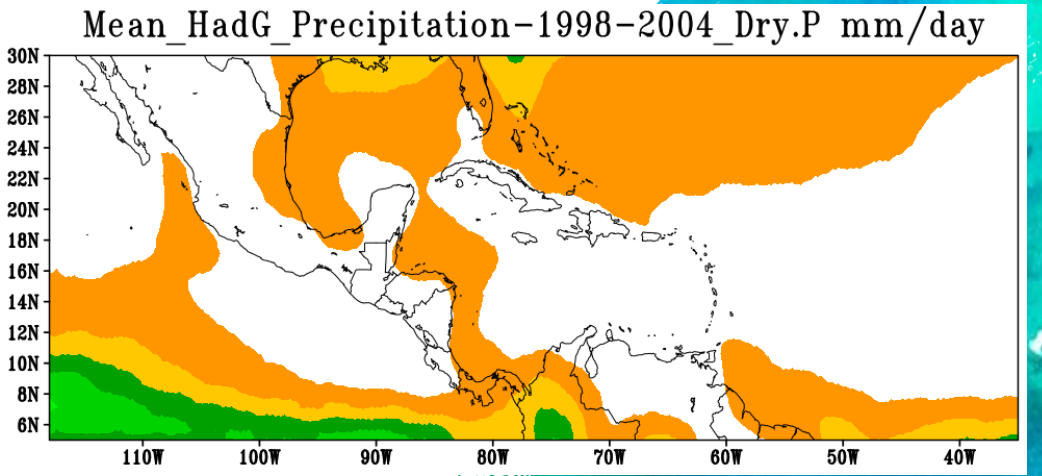
Taylor Diagram (ERAIN15)

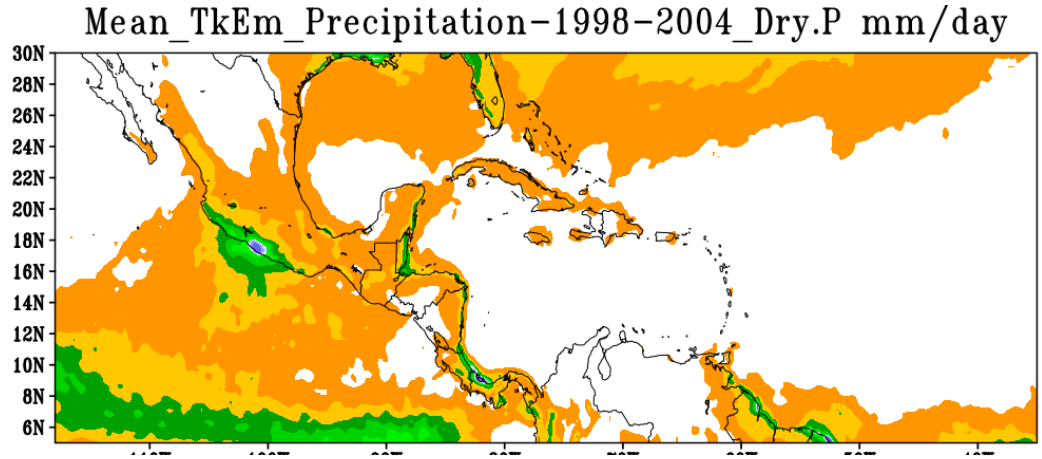


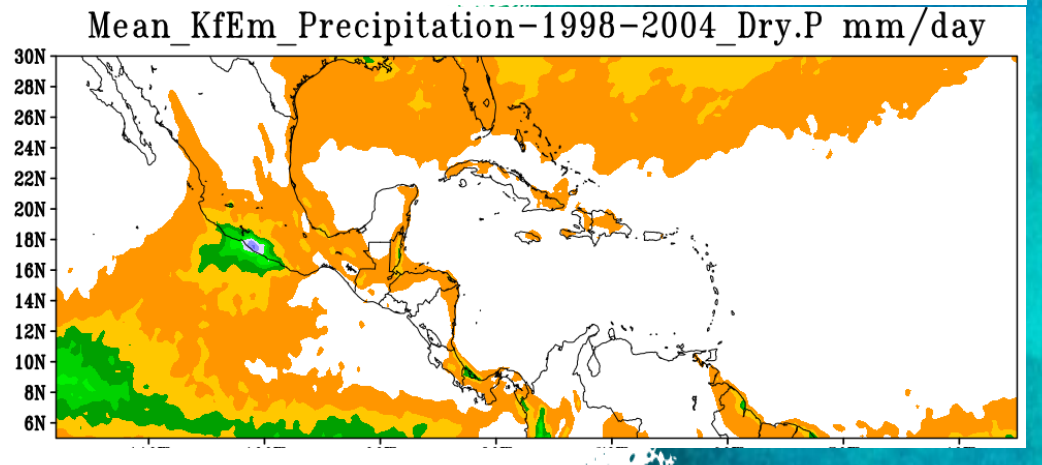


Mean Precip (GCM Dry P.)

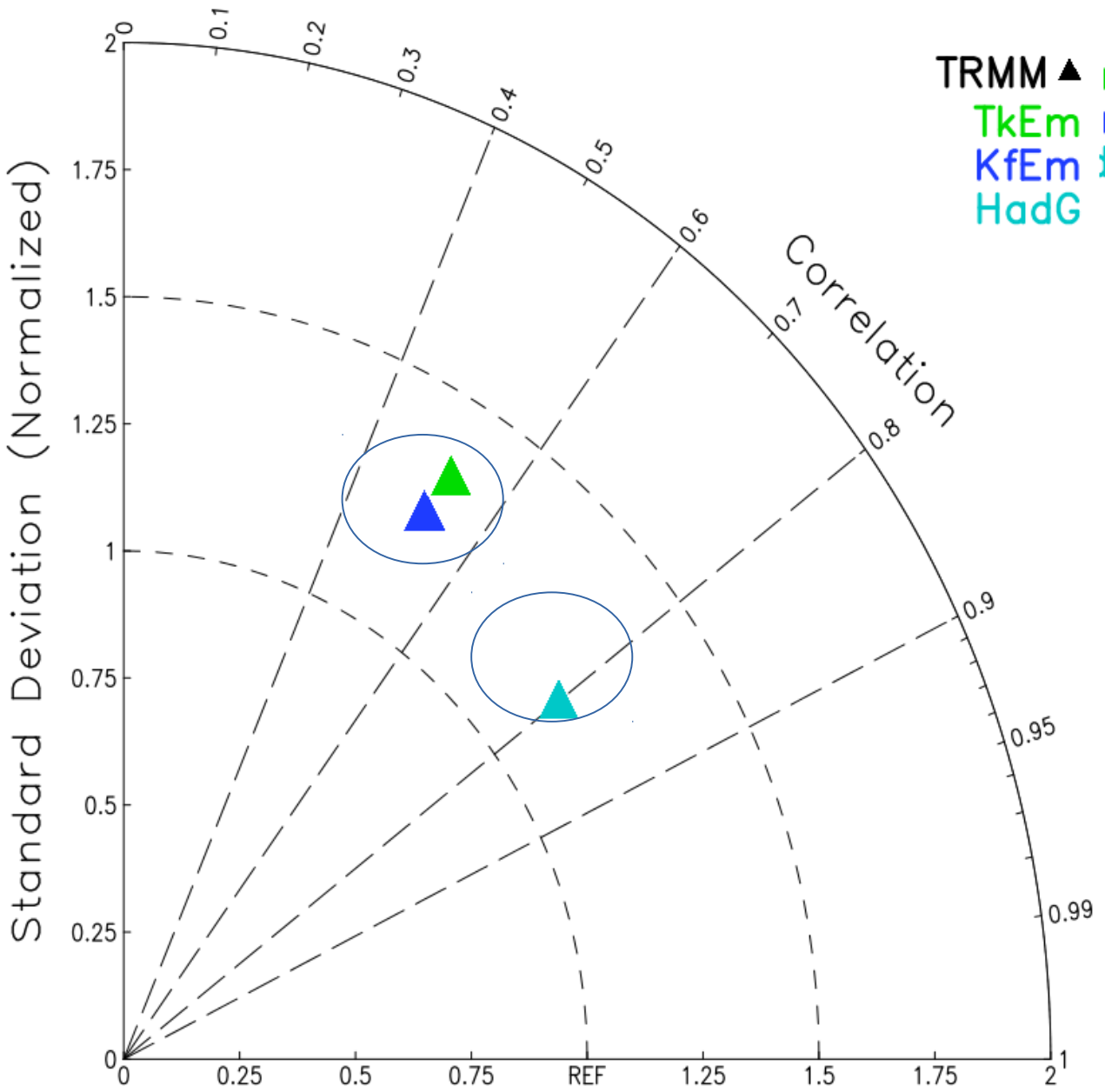




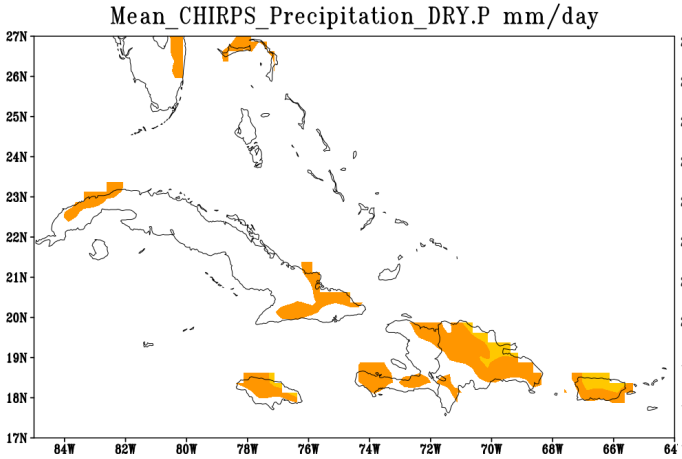


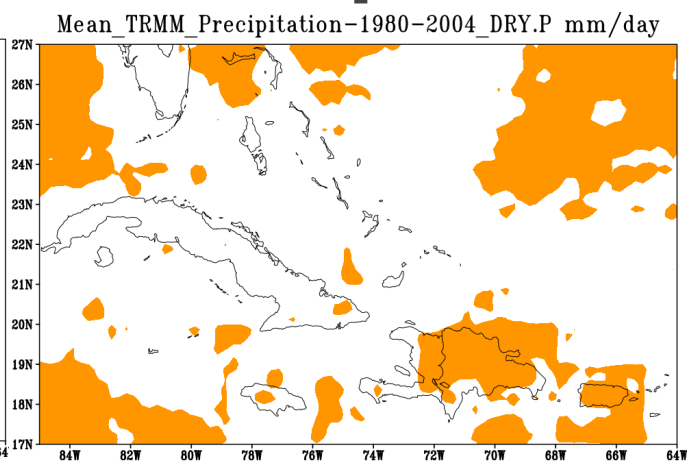


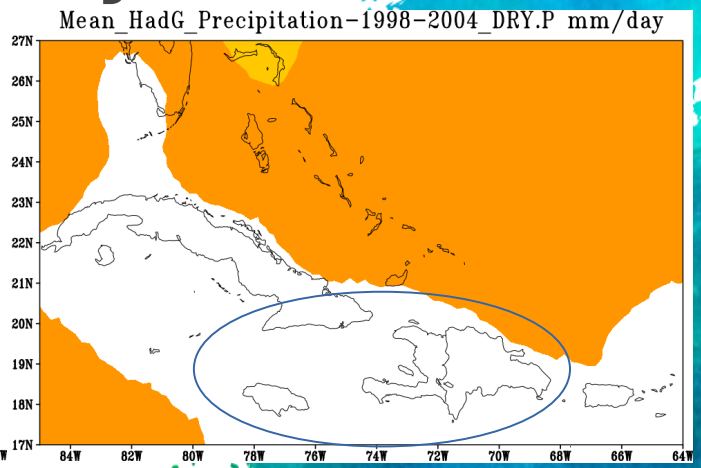
Taylor Diagram (GCM Dry P.)

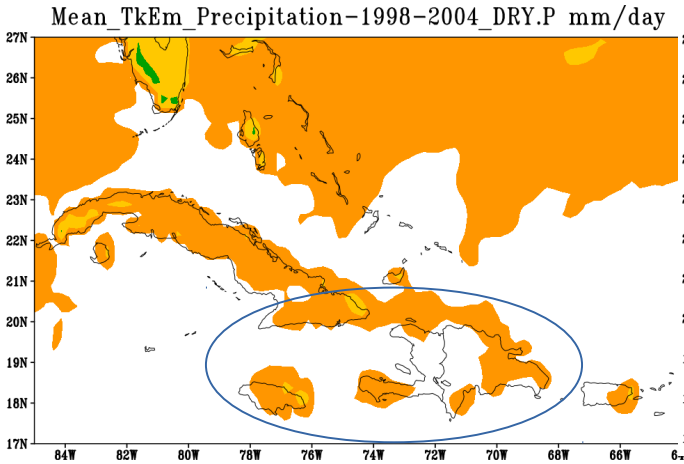


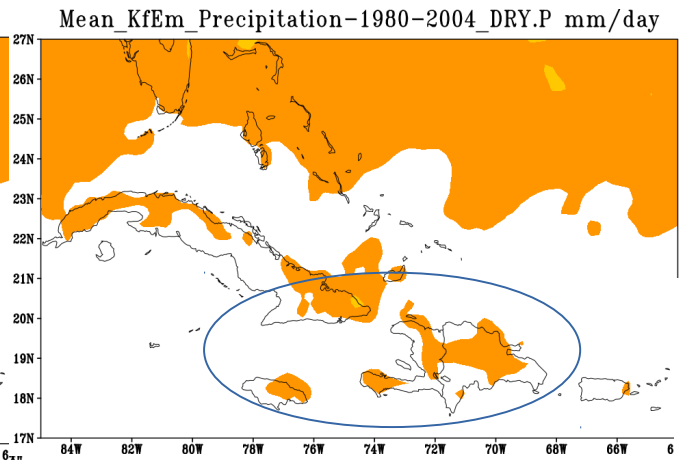
Mean Precip (GCM Dry P.)

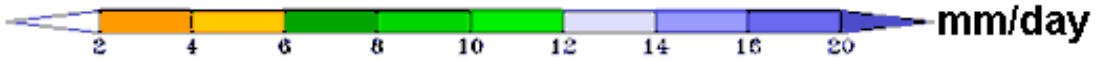


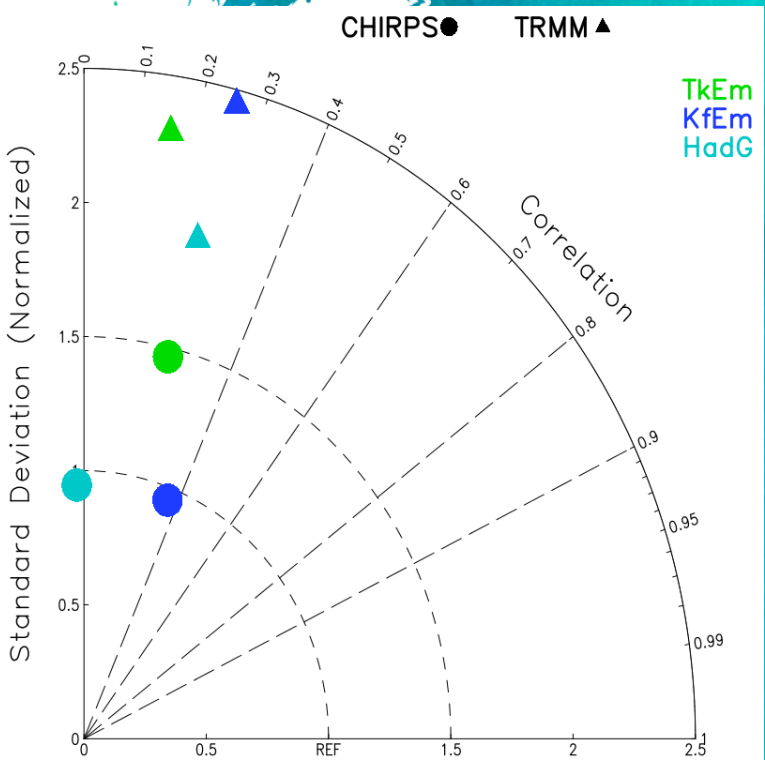






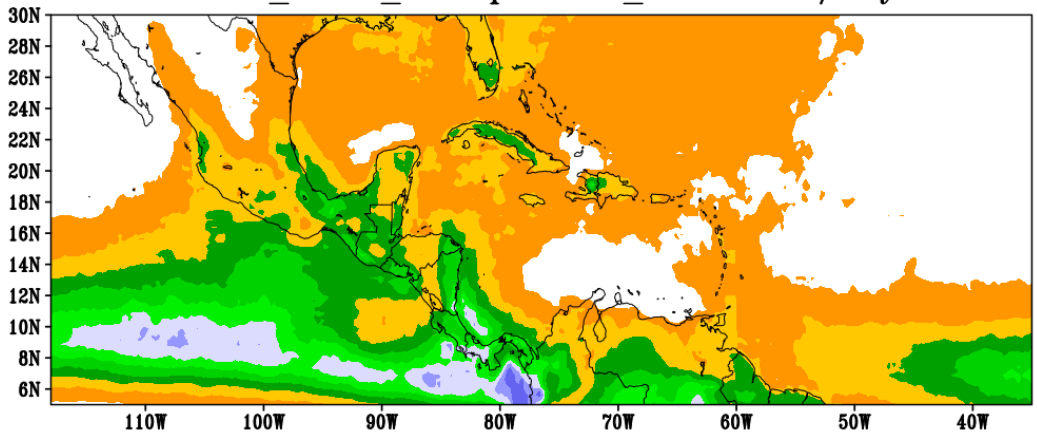




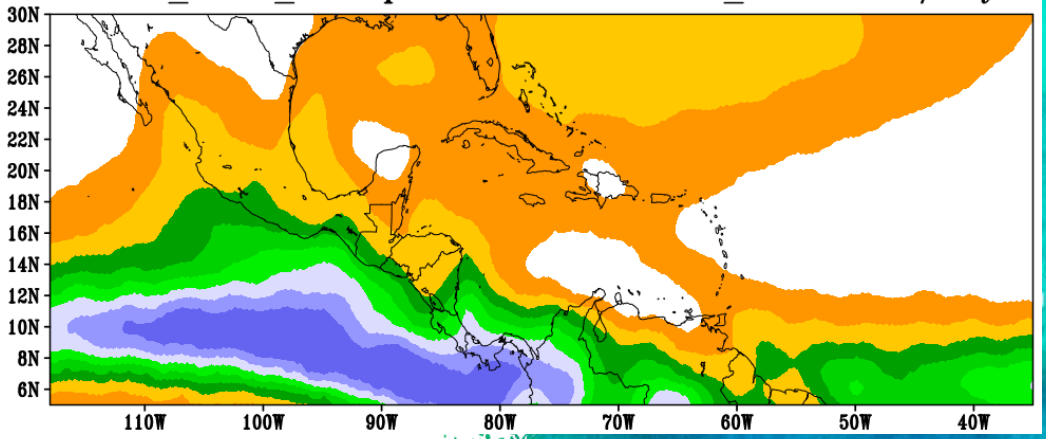


Mean Precip (GCM Wet P.)

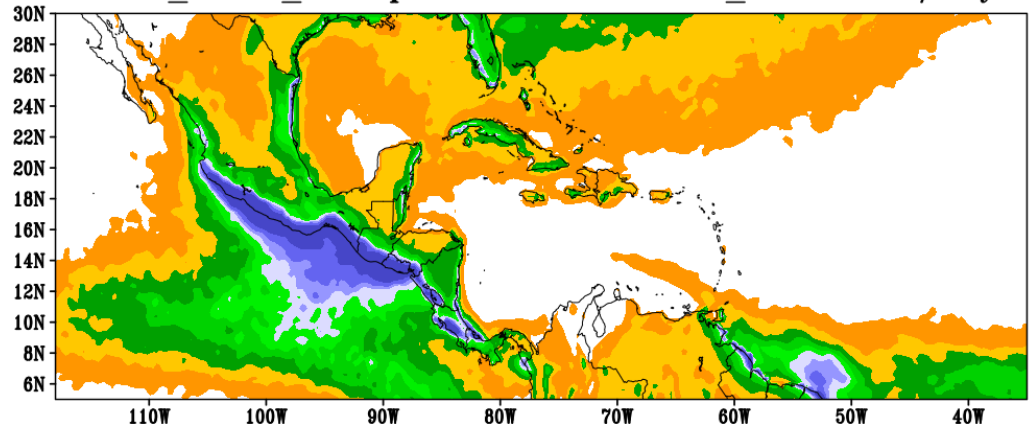
Mean_TRMM_Precipitation_Wet.P mm/day



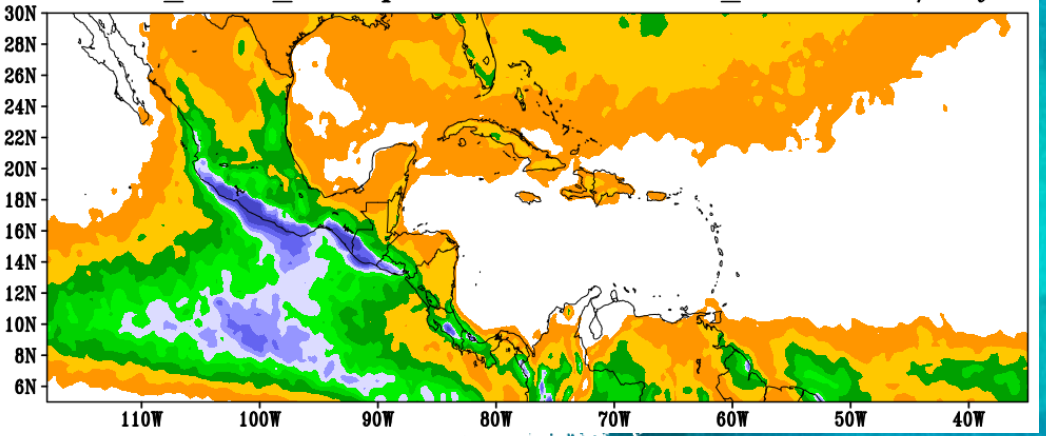
Mean_HadG_Precipitation-1998-2004_Wet.P mm/day



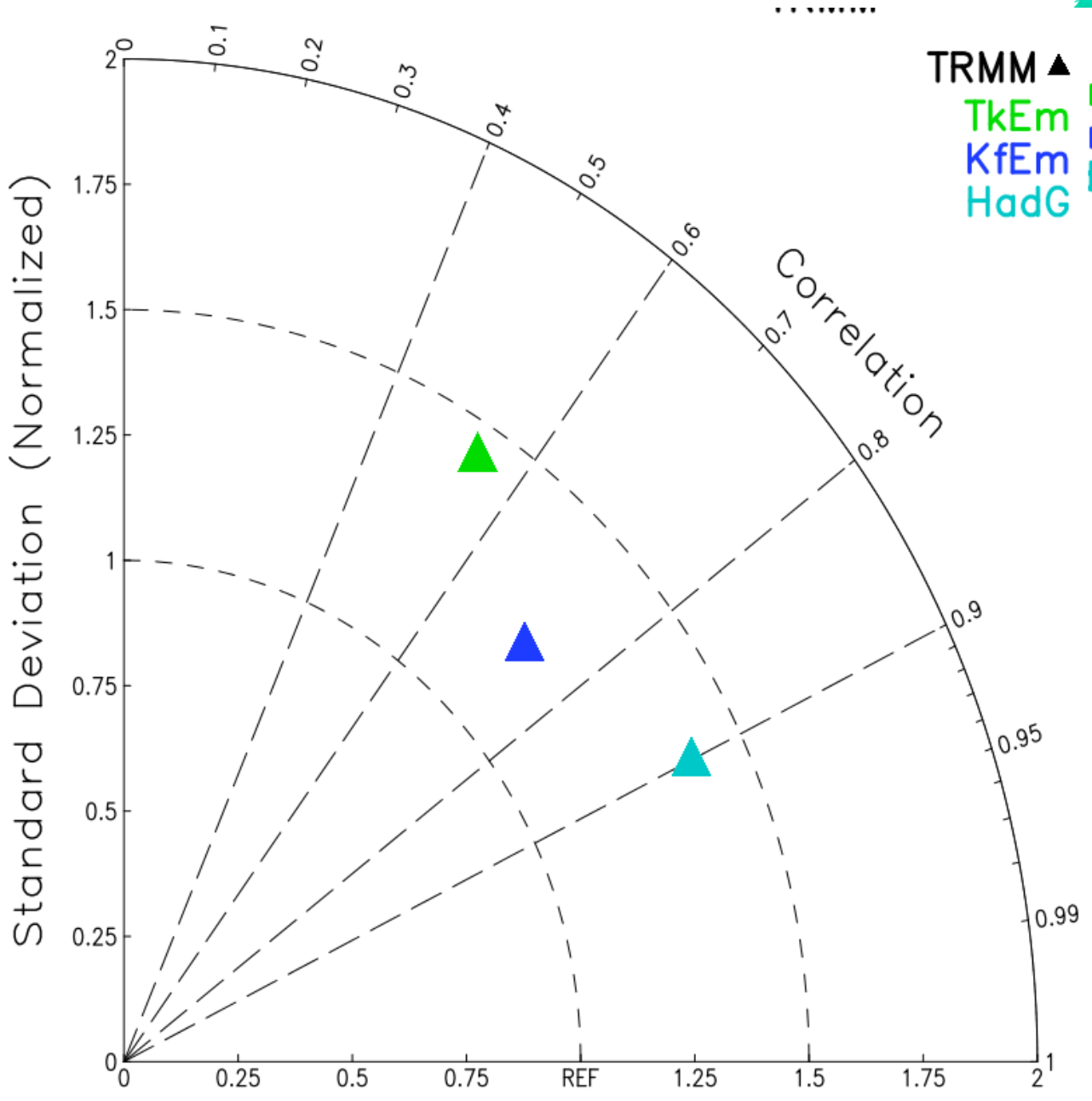
Mean_TkEm_Precipitation-1998-2004_Wet.P mm/day



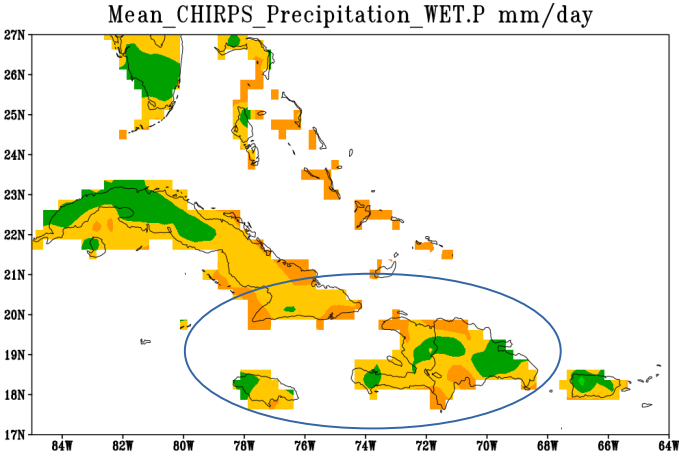
Mean_KfEm_Precipitation-1998-2004_Wet.P mm/day

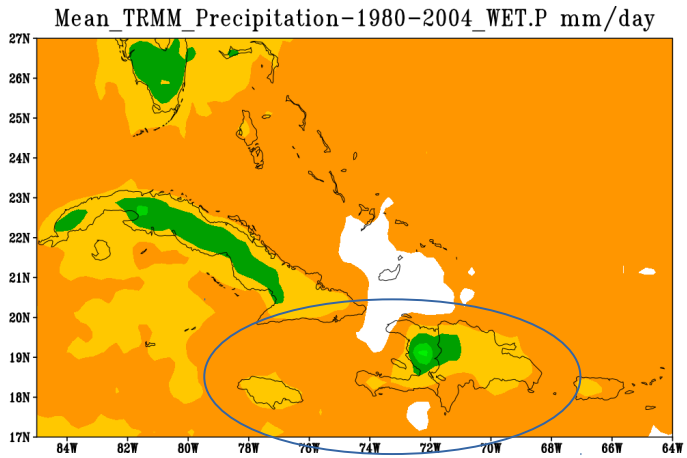


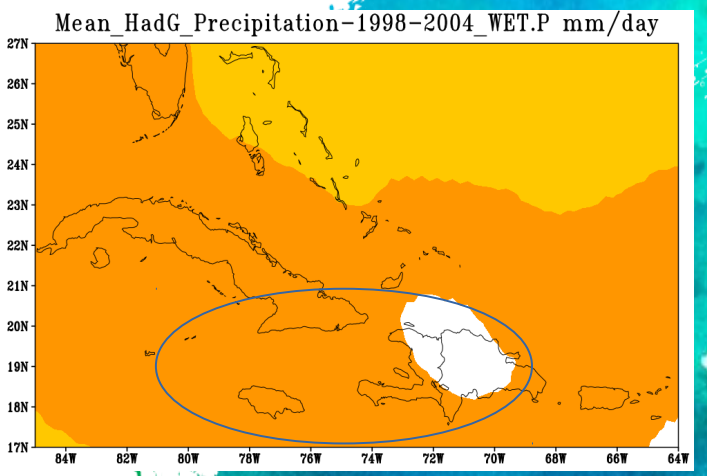
Taylor Diagram (GCM Wet P.)

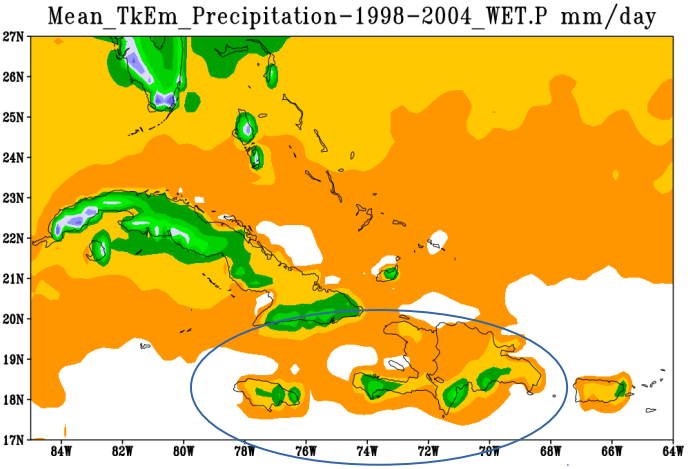


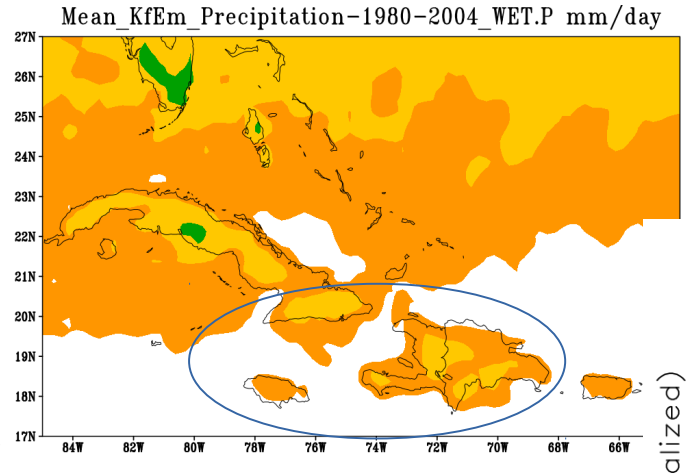
Mean Precip (GCM Wet P.)

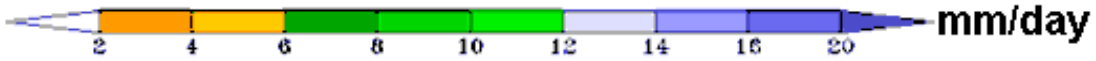


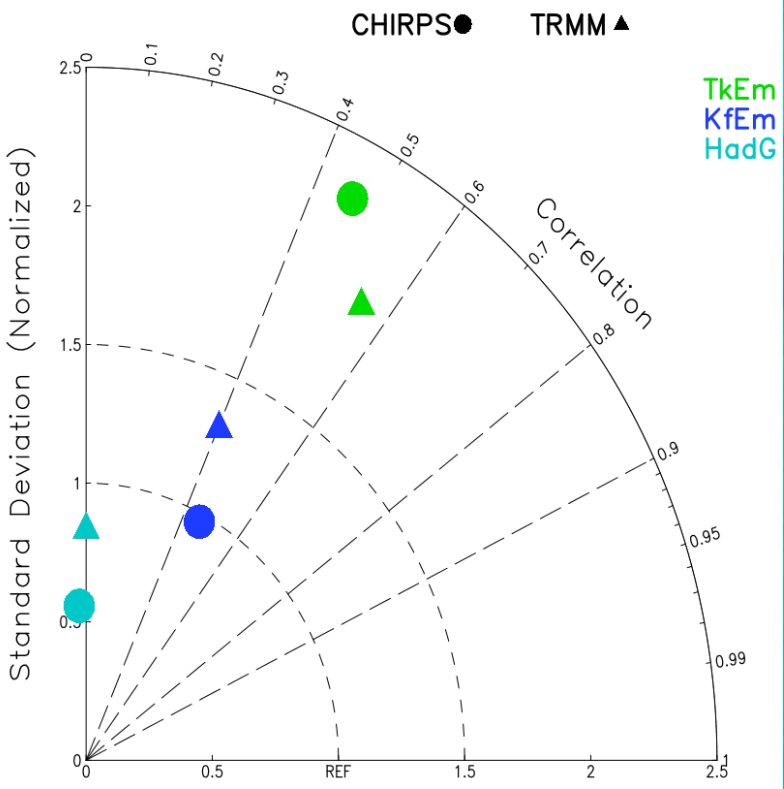




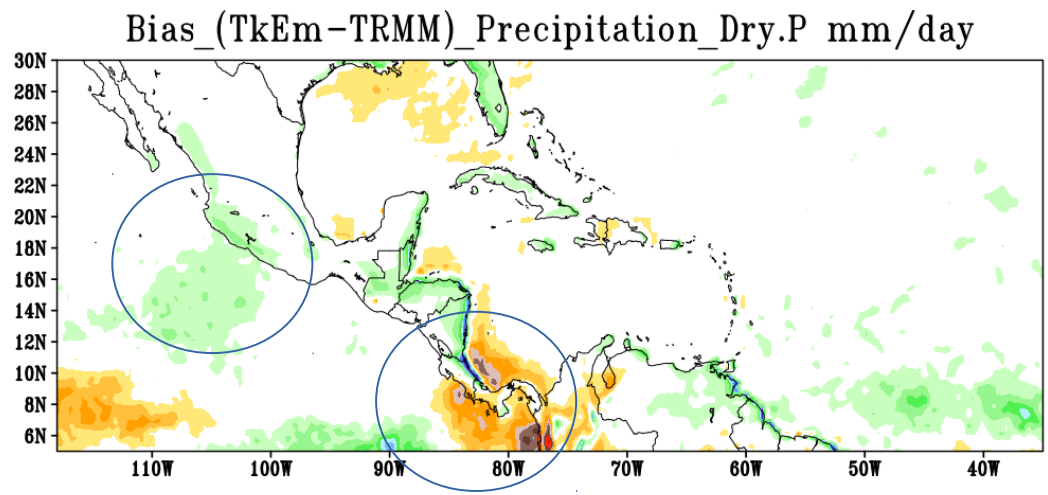


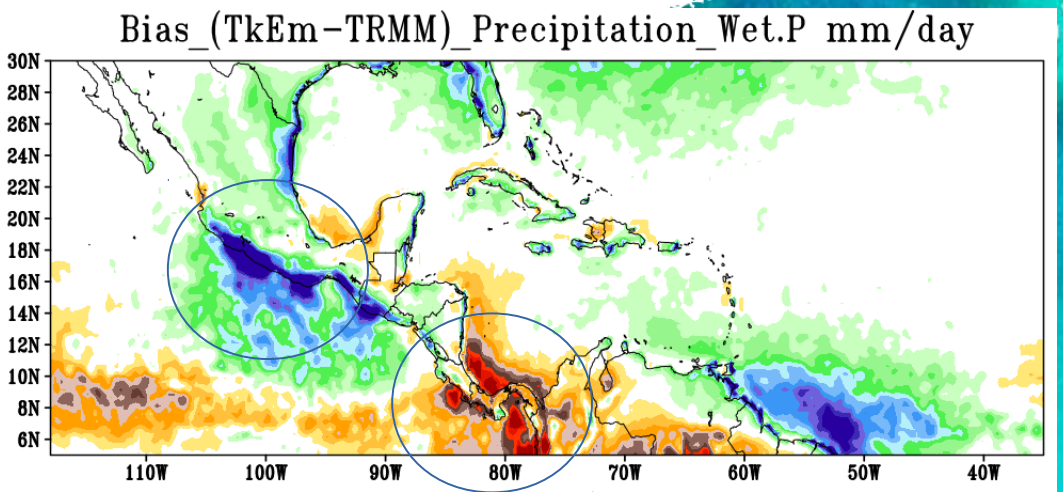


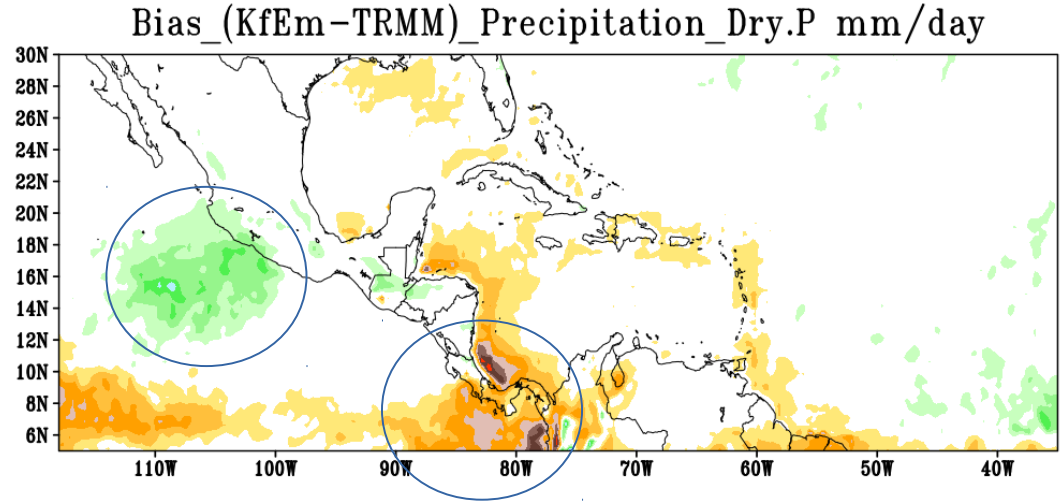


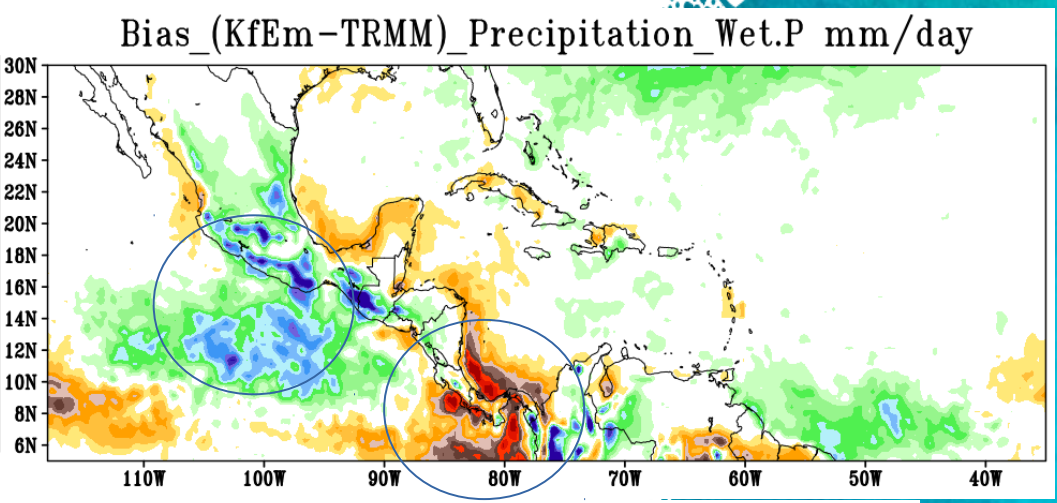


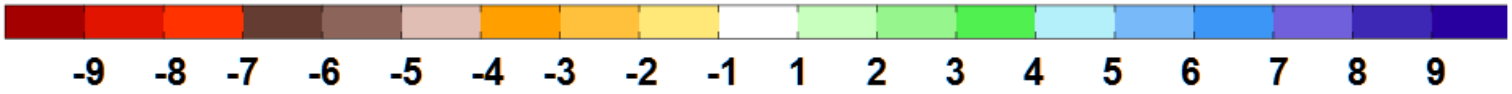
Bias Dry & Wet P. (ERAIN15)











The Abdus Salam International Centre for Theoretical Physics

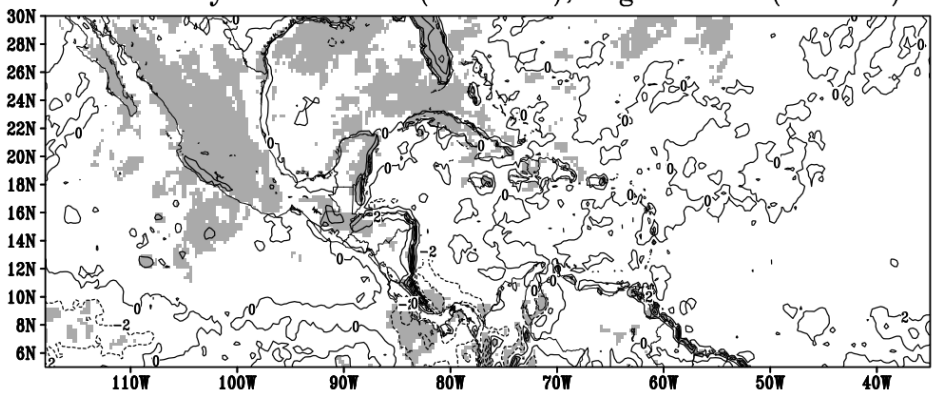
IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

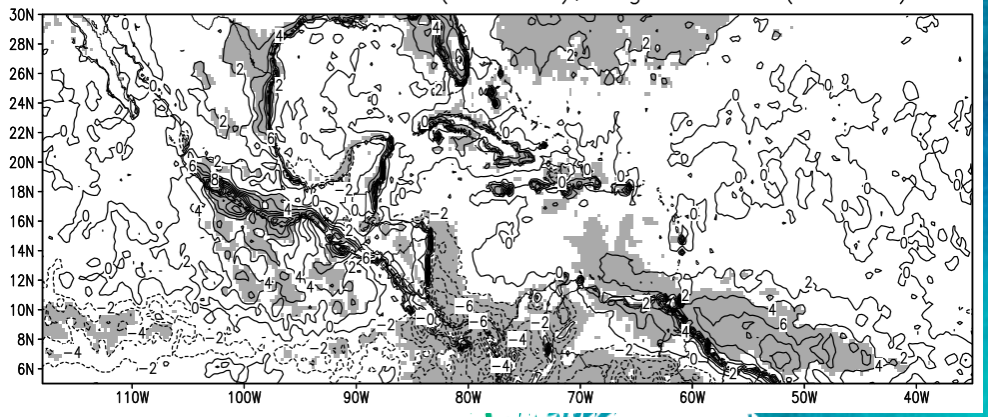
INSMET INSTITUTO DE METEOROLOGIA

T test of the Bias. Sig at 95%

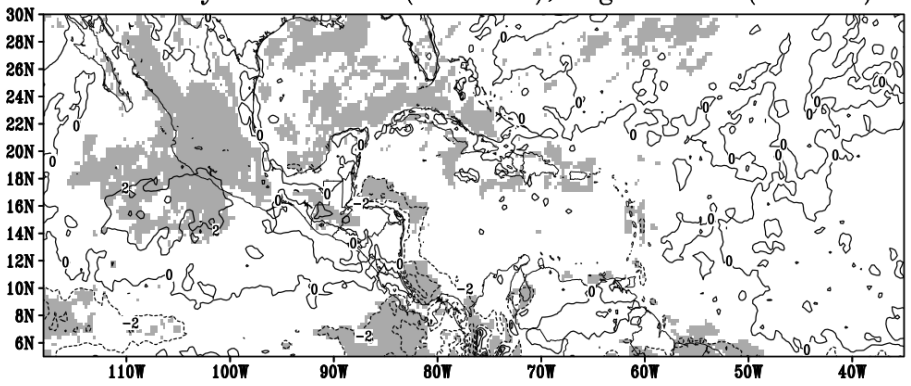
TkEm Dry.P vs TRMM (contour), Sig at 95% (shaded)



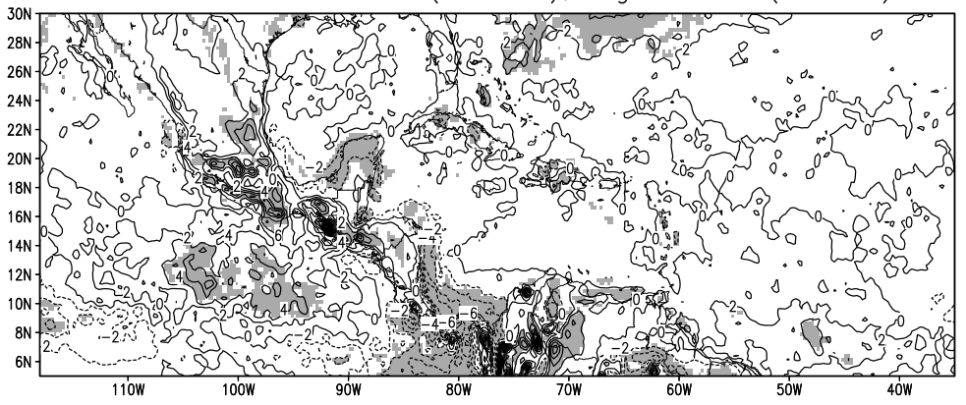
TkEm Wet.P vs TRMM (contour), Sig at 95% (shaded)

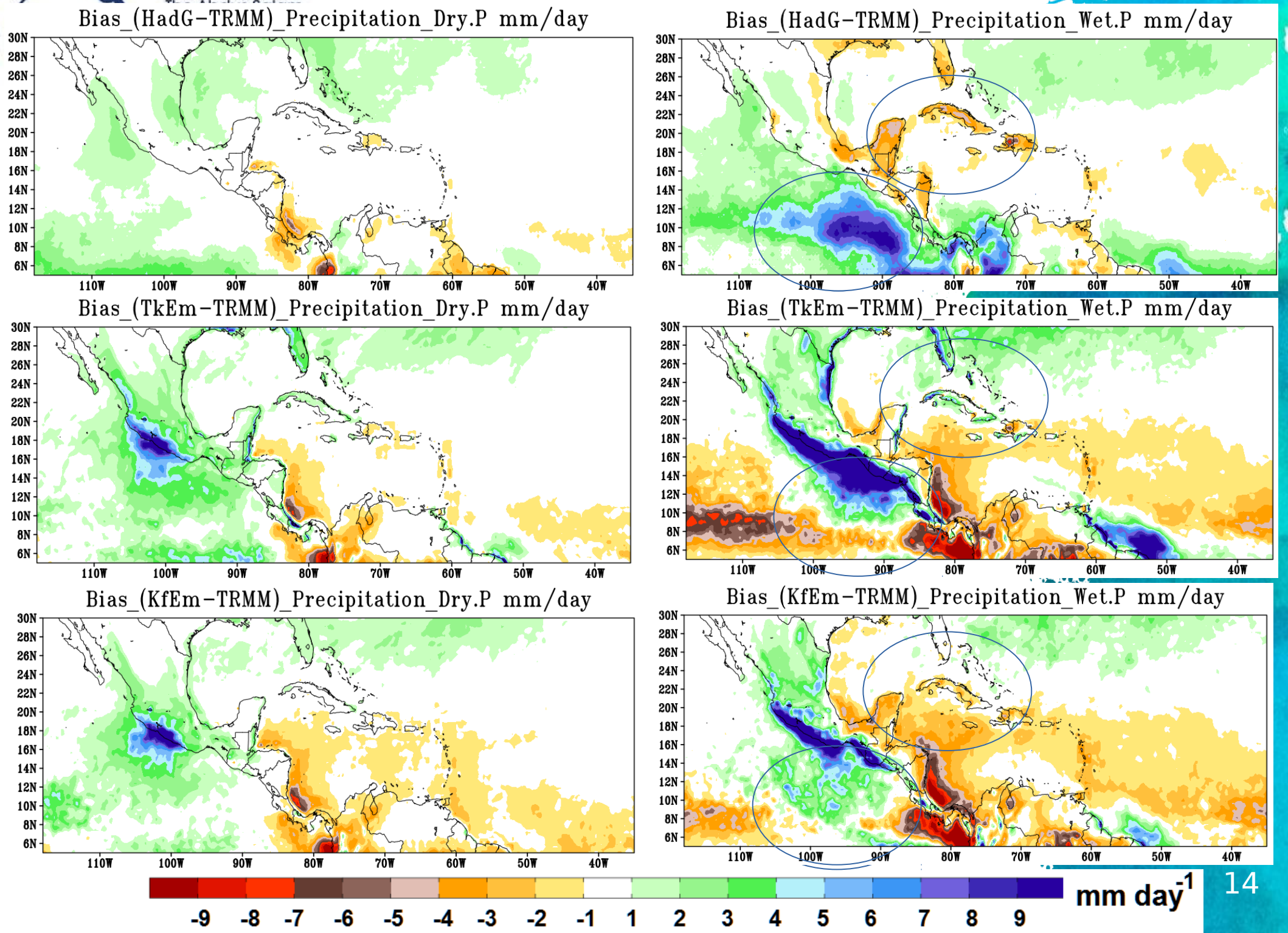


KfEm Dry.P vs TRMM (contour), Sig at 95% (shaded)



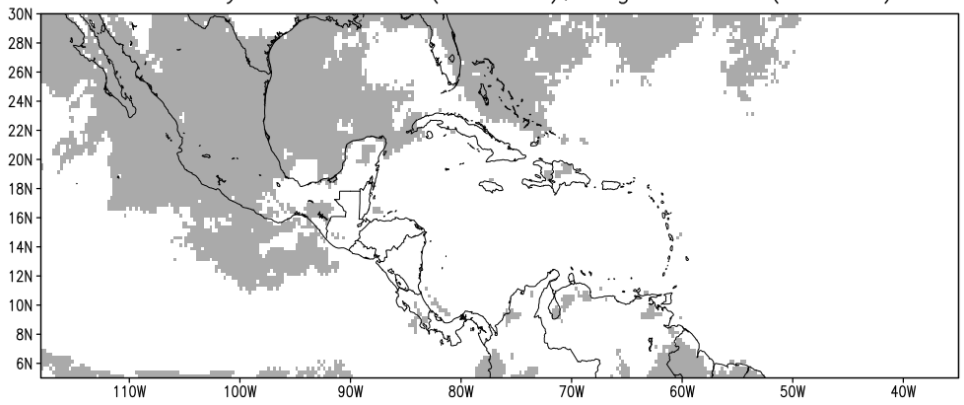
KfEm Wet.P vs TRMM (contour), Sig at 95% (shaded)



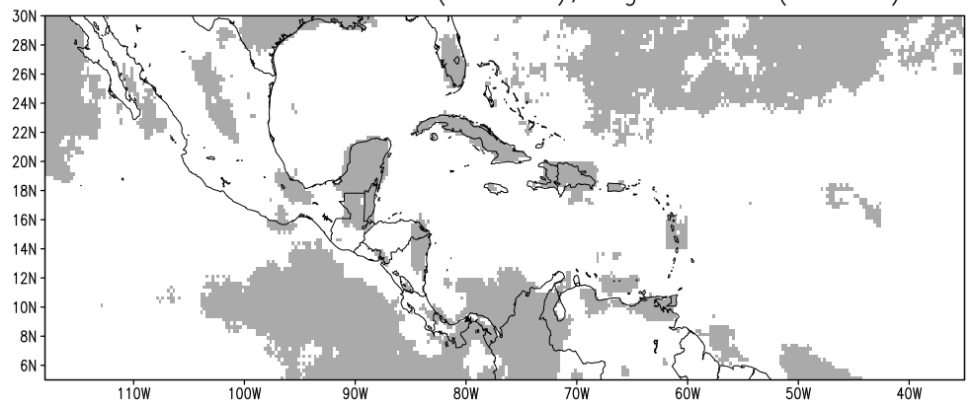

Bias_(HadG-TRMM)_Precipitation_Dry.P mm/day
Bias_(HadG-TRMM)_Precipitation_Wet.P mm/day
Bias_(TkEm-TRMM)_Precipitation_Dry.P mm/day
Bias_(TkEm-TRMM)_Precipitation_Wet.P mm/day
Bias_(KfEm-TRMM)_Precipitation_Dry.P mm/day
Bias_(KfEm-TRMM)_Precipitation_Wet.P mm/day
30N 28N 26N 24N 22N 20N 18N 16N 14N 12N 10N 8N 6N
110W 100W 90W 80W 70W 60W 50W 40W
-9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9
mm day-1

T test of the Bias. Sig at 95%

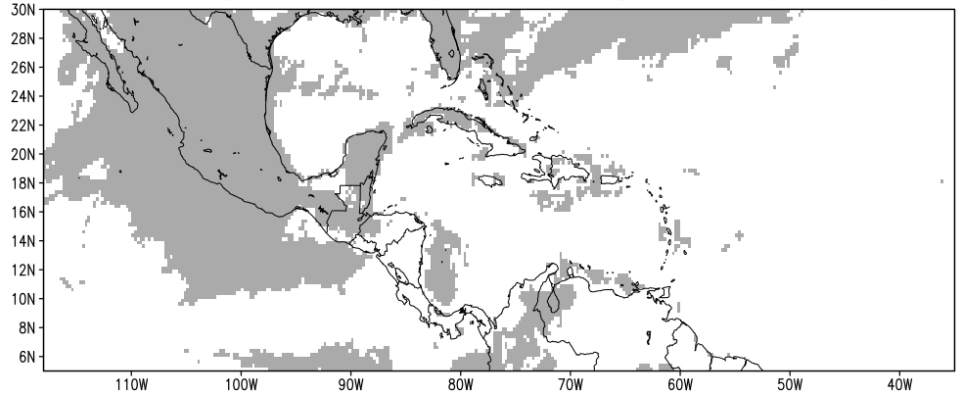
HadG Dry.P vs TRMM (contour), Sig at 95% (shaded)



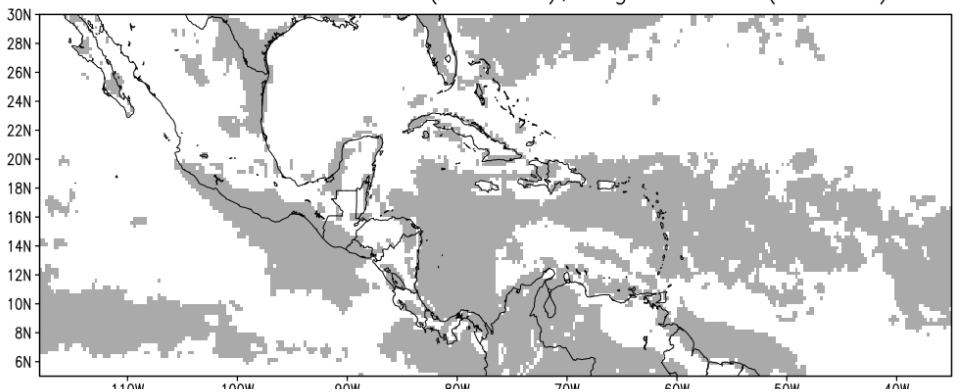
HadG Wet.P vs TRMM (contour), Sig at 95% (shaded)



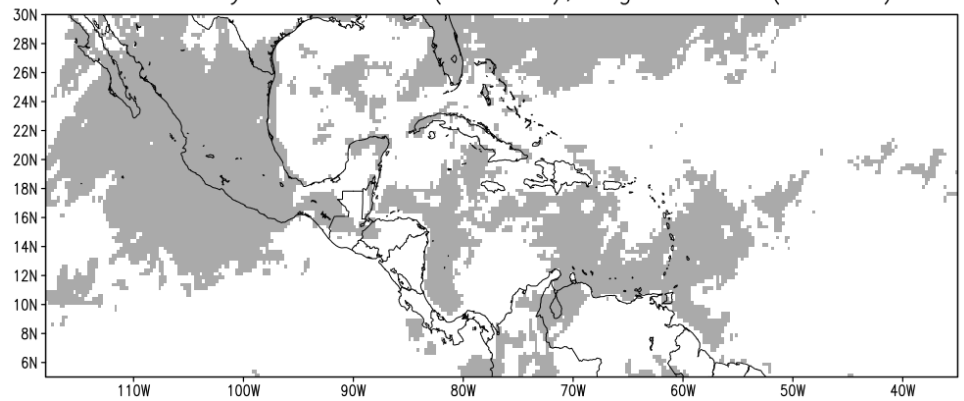
TkEm Dry.P vs TRMM (contour), Sig at 95% (shaded)



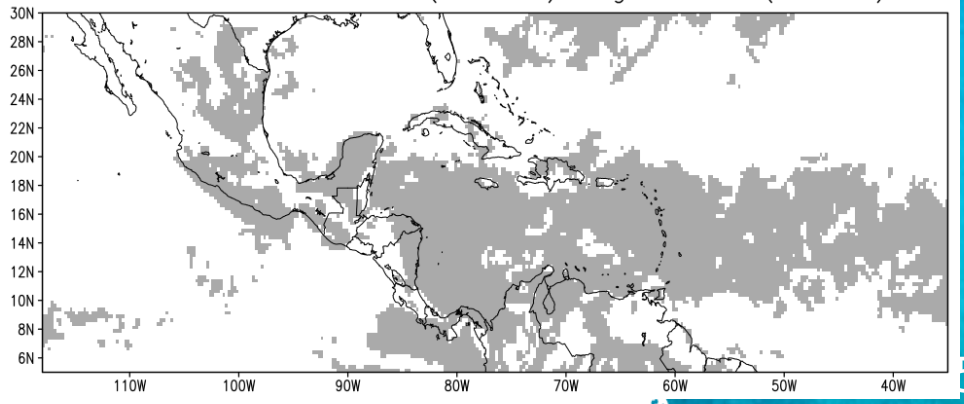
TkEm Wet.P vs TRMM (contour), Sig at 95% (shaded)



KfEm Dry.P vs TRMM (contour), Sig at 95% (shaded)



KfEm Wet.P vs TRMM (contour), Sig at 95% (shaded)



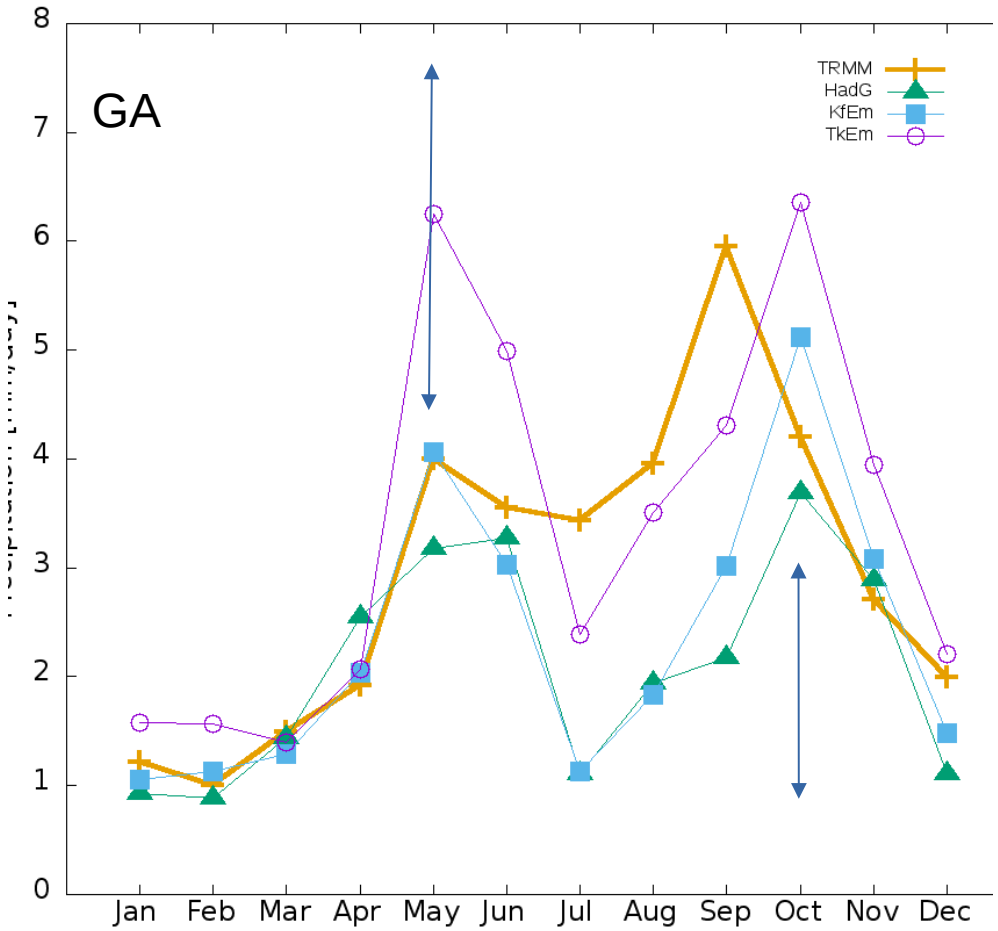
The Abdus Salam International Centre for Theoretical Physics

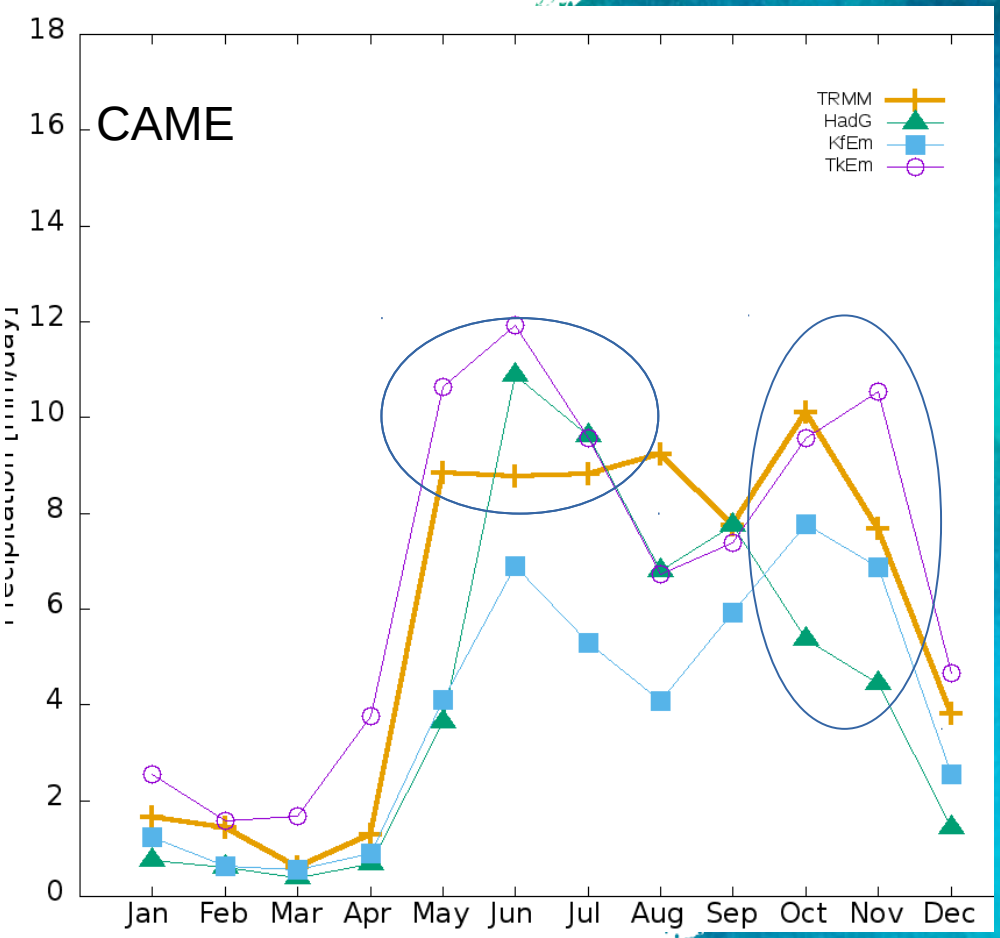
IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Annual Cycle of Precipitation (Driving with GCM)





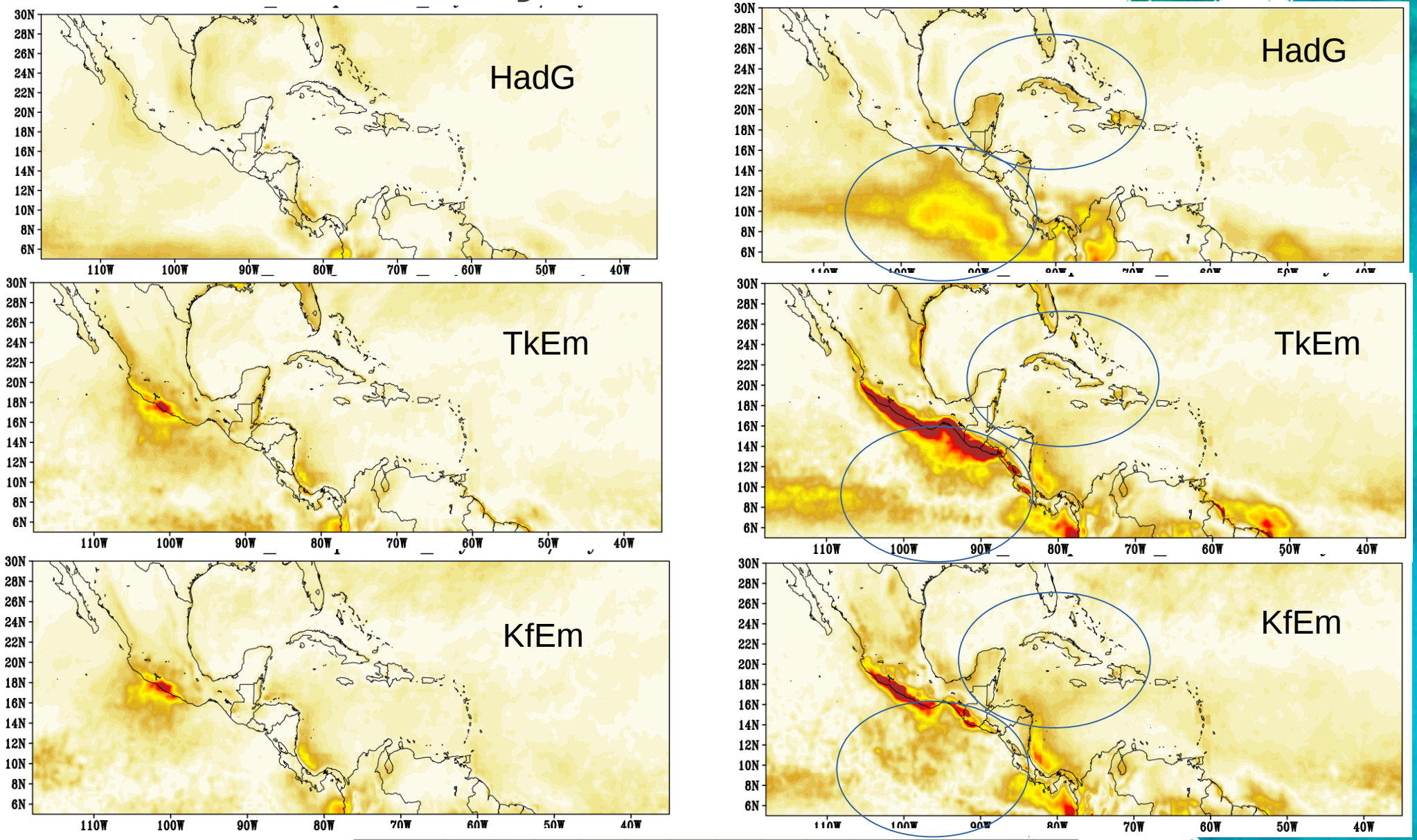
The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

RMSE Dry & Wet P.



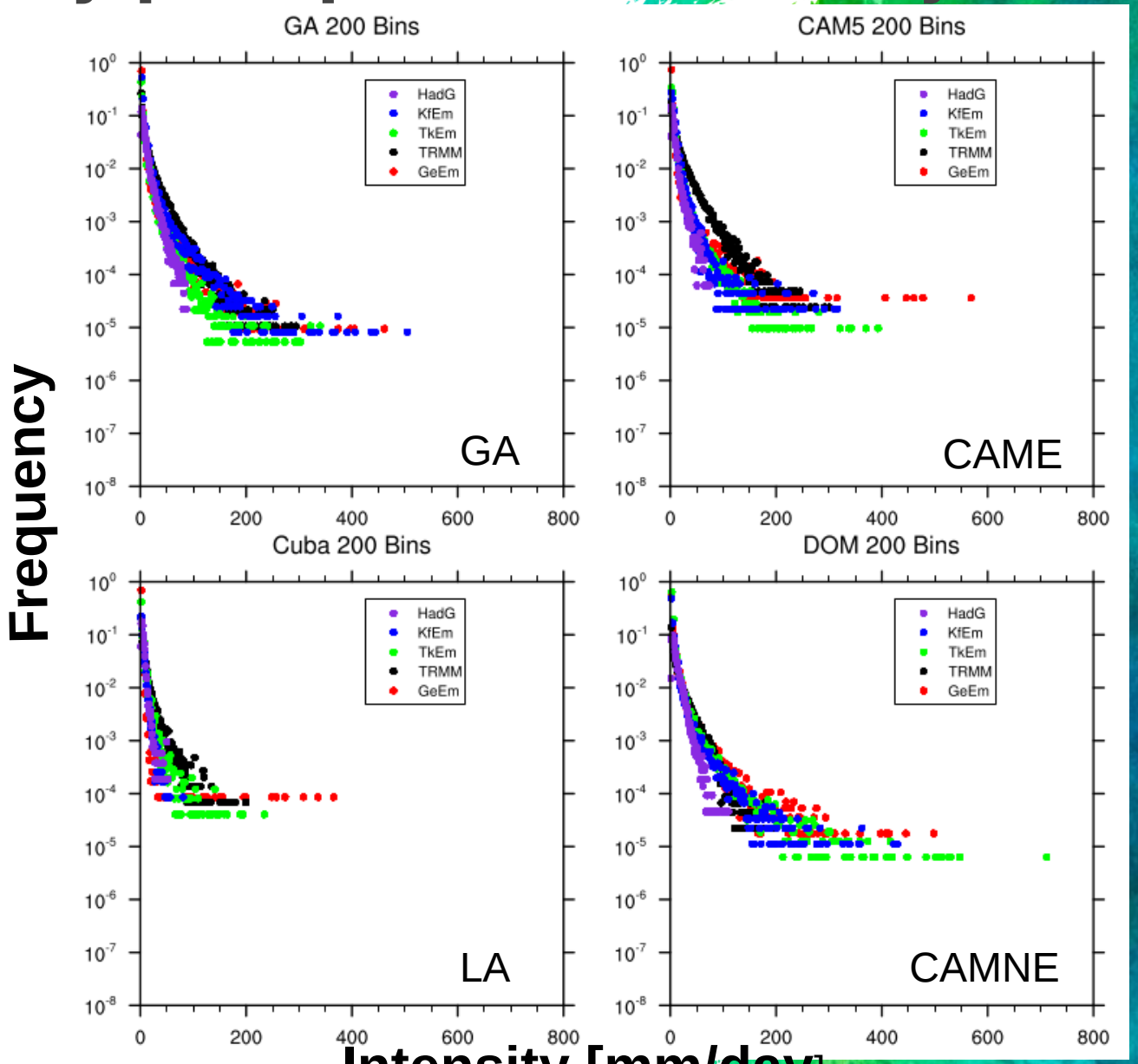
The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Daily precipitation PDFs Dry P.



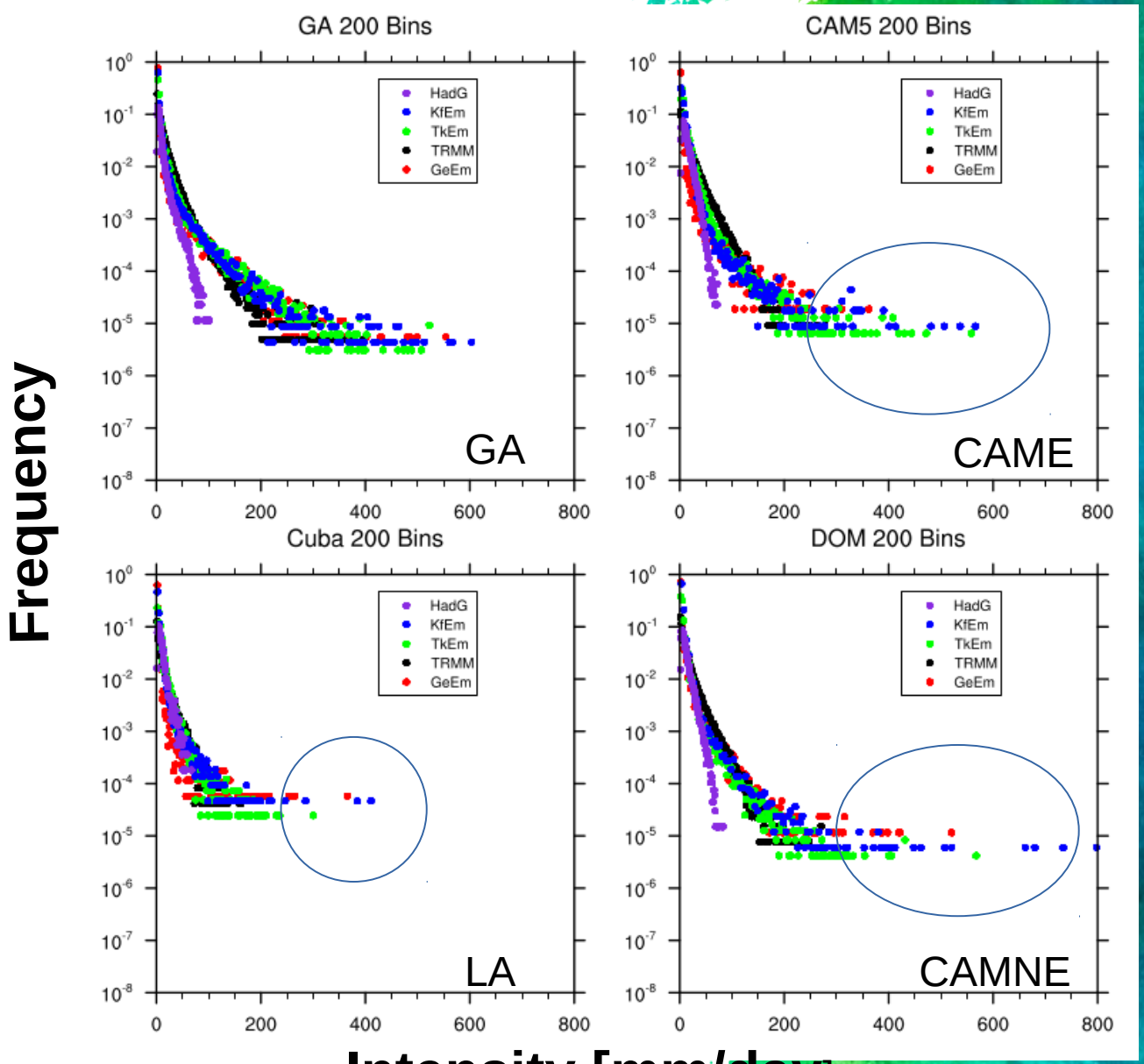
The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Daily precipitation PDFs Wet P.



What Added Value (AV) Means?

The AV of dynamical downscaling is a measure of the extend to which the downscaled climate is closer to the observations than the model from which the Boundary Conditions where obtained. **(Di Luca et al. 2015)**

AV = | (GCM – Obs) | - | (RCM - Obs) |

The Abdus Salam International Centre for Theoretical Physics

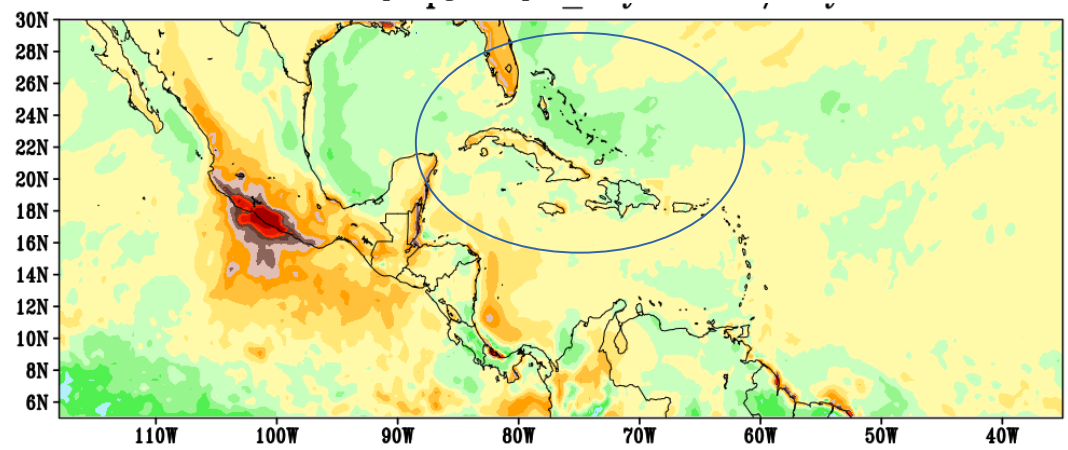
IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

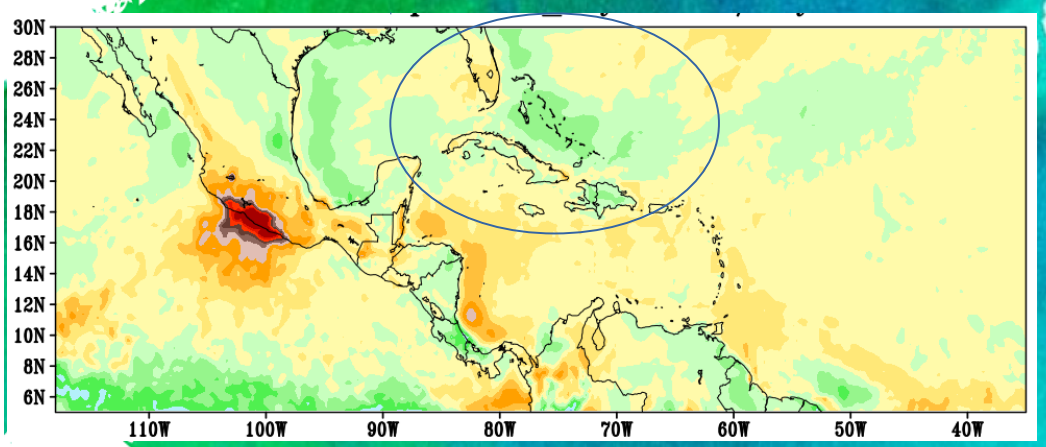
INSMET INSTITUTO DE METEOROLOGIA

AV Dry & Wet P.

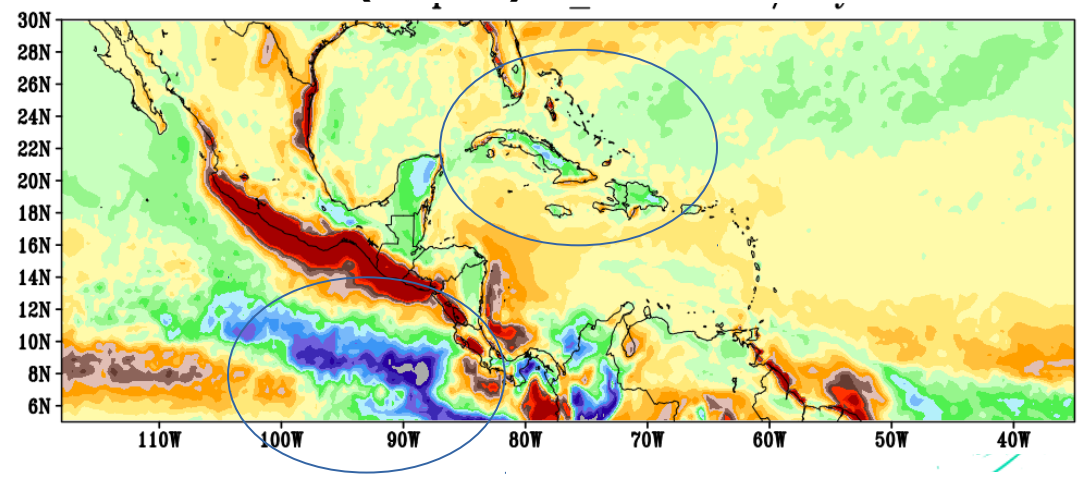
TkEm (Dry P.)



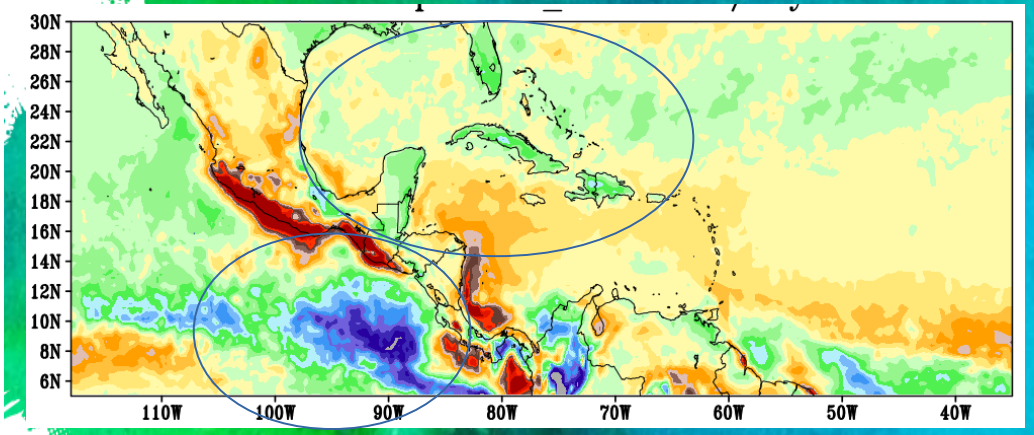
KfEm (Dry P.)

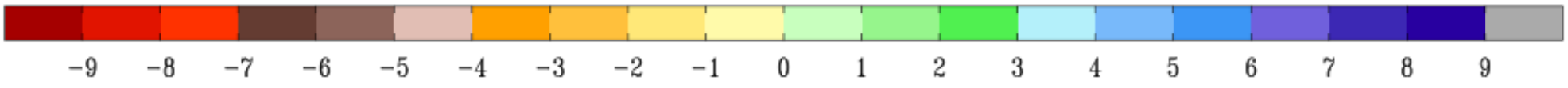


TkEm (Wet P.)



KfEm (Wet P.)





The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

Summary

We know that the AV is related with the horizontal resolution, the domain size, with the boundary conditions, from other researchers. Here after we use different metrics we found substantial AV of RCM downscaling in all precipitation metrics considered related also to the cumulus parameterization. The AV was clearly associated with the cumulus used being the configuration KfEm the most prominent.

The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

INSMET INSTITUTO DE METEOROLOGIA

THANKS GRAZIE GRACIAS!!!!!