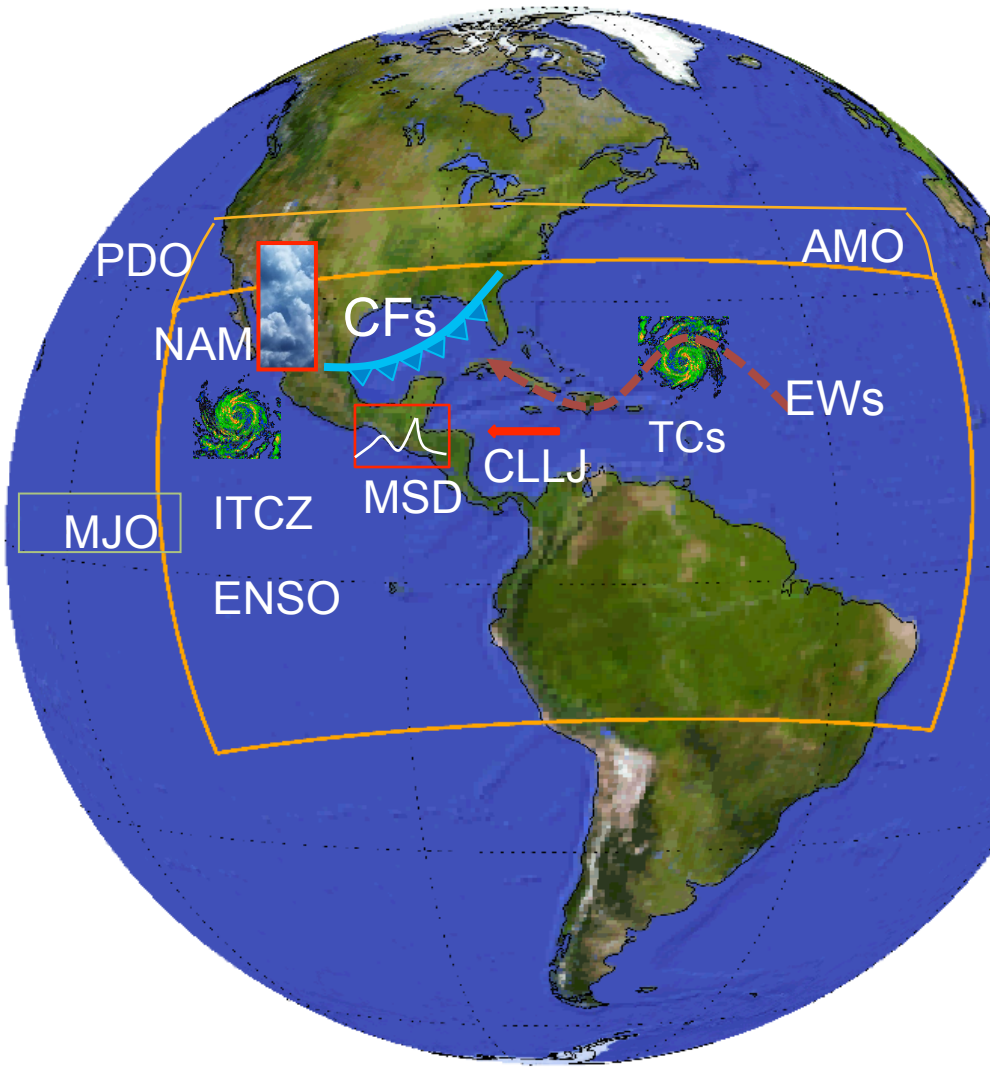
Outline

- Motivation
- Objective
- Domain
- Model description and experimental set up
- Preliminary results
- Summary

Motivation

- This region is characterized by complex climatic features (Diro et al. 2012; Fuentes Franco et al. 2014).
- It is a region identified as one of the most prominent climate change hot-spots (Giorgi 2006).
- It is therefore critical to evaluate RCMs over this domain to understand different processes.

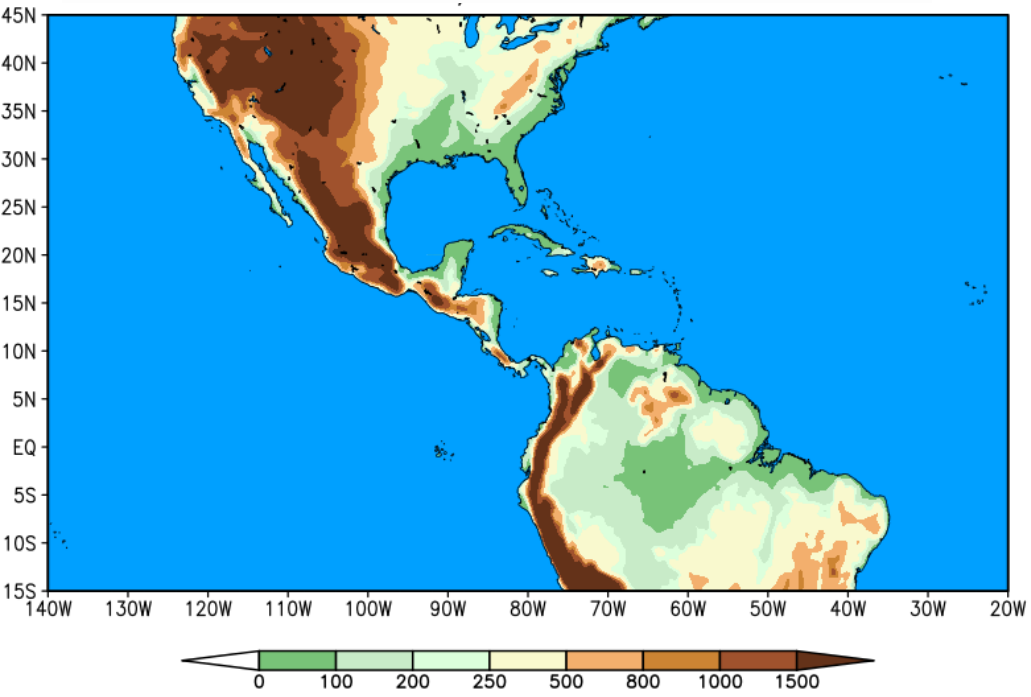


From Tereza Cavazos

Objective

- To evaluate the new version of RegCM (4.7) over the Central America/Mexico CORDEX domain.

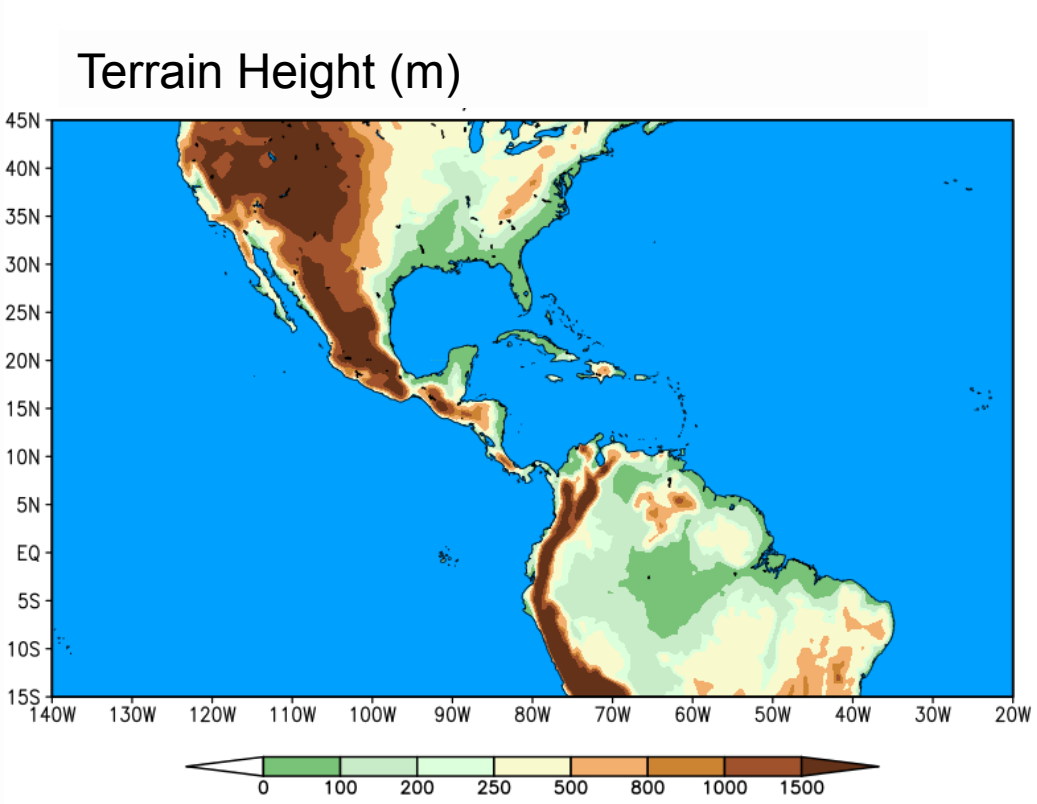
Domain set up



- RegCM 4.7
- Domain size: 576 x 346
- Resolution: 25 km
- Vertical levels: 23
- Initial and boundary conditions: ERA-Interim
- Period: 1997-2002
- Spin up: 1997

RegCM 4.7 configuration

- ✓ Hydrostatic dynamic core
- ✓ LSM: Community Land Model (CLM4.5).
- ✓ Radiation: CCM3
- ✓ PBL: Holtslag
- ✓ Microphysics: SUBEX
- ✓ Mixed convection scheme:
  - Kain-Fritsch (over ocean)
  - Emanuel (over land)



Observational data set

Four observational dataset are used to evaluate the model precipitation:

- ✓ Climate Research Unit (CRU; ~50 km [Mitchell & Jones 2005])
- ✓ Tropical Rainfall Measuring Mision (TRMM; ~25 km [Huffman et al. 2007])
- ✓ Livneh (~6 km [Livneh et al. 2015])
- ✓ Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS; ~ 5 km [Funk et al. 2015])

Tropical cyclone number and tracks:

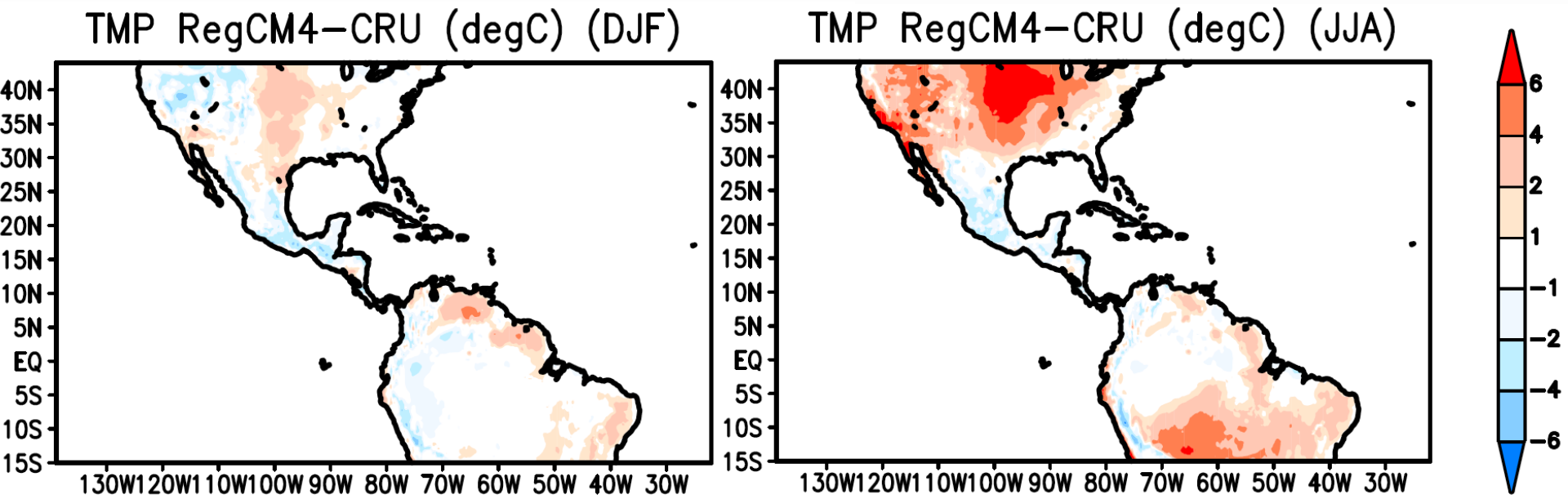
- ✓ HURDAT (NHC)

Wind fields from:

- ✓ ERA-Interim (~75 km [Dee et al. 2011])

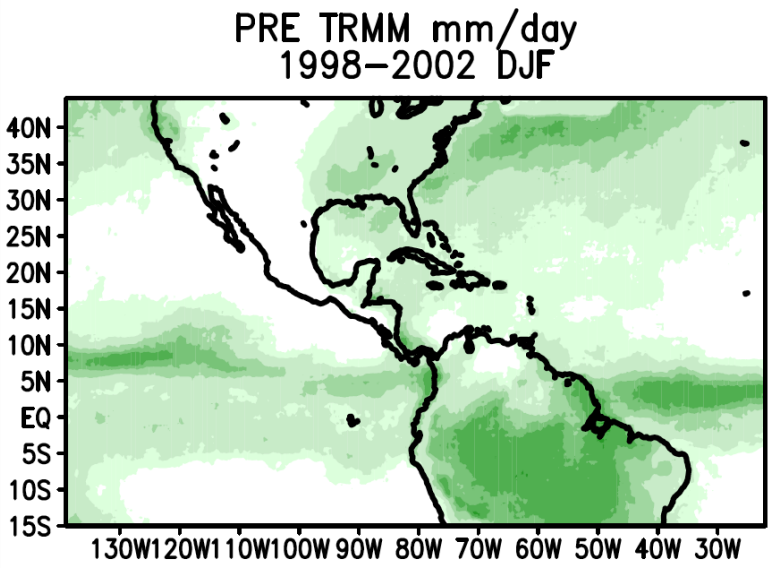
Results

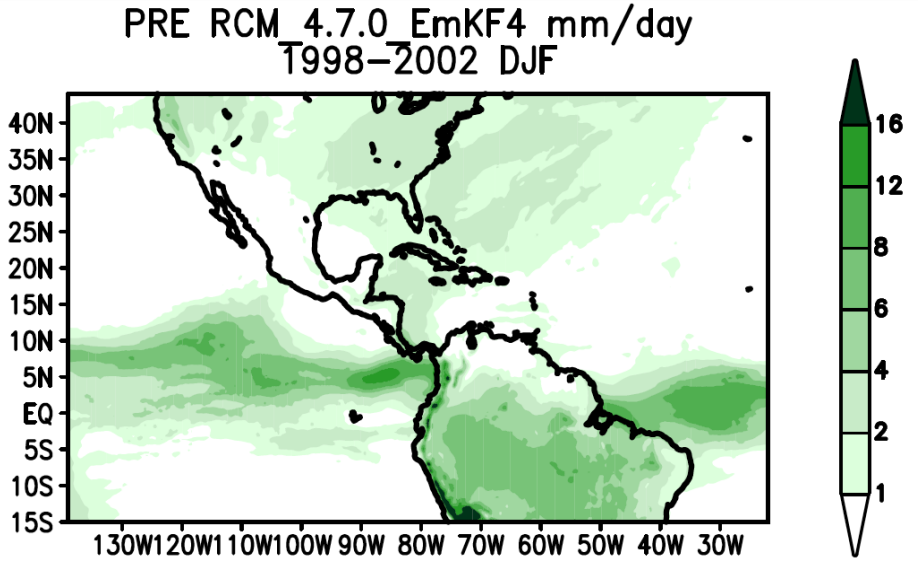
Seasonal bias of air temperature (°C)

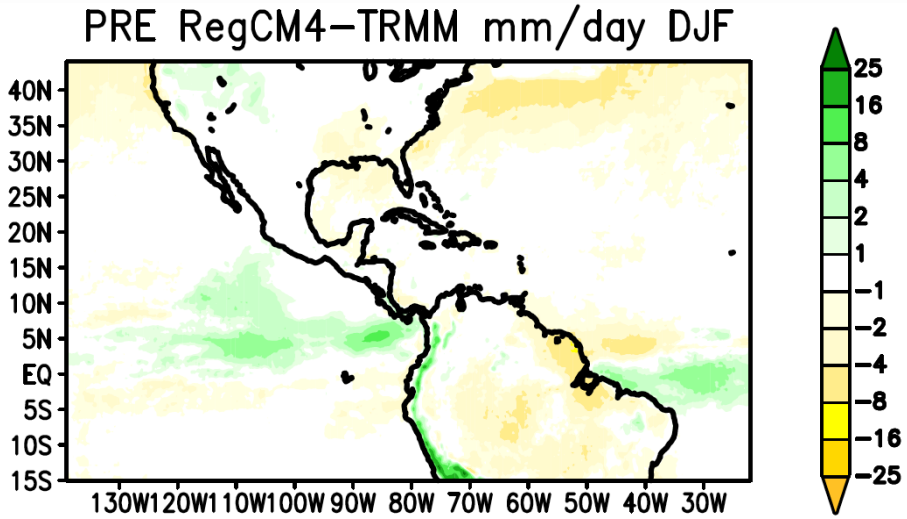


- Cold bias over Mexico, Central America and the Caribbean in winter (DJF) and summer (JJA).
- Warm bias over the US, especially during the summer.

DJF precipitation bias (mm/d)

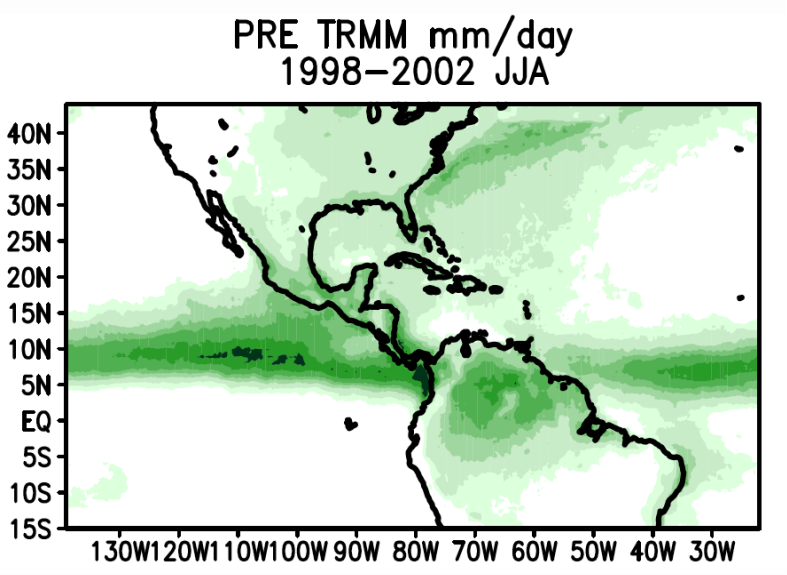


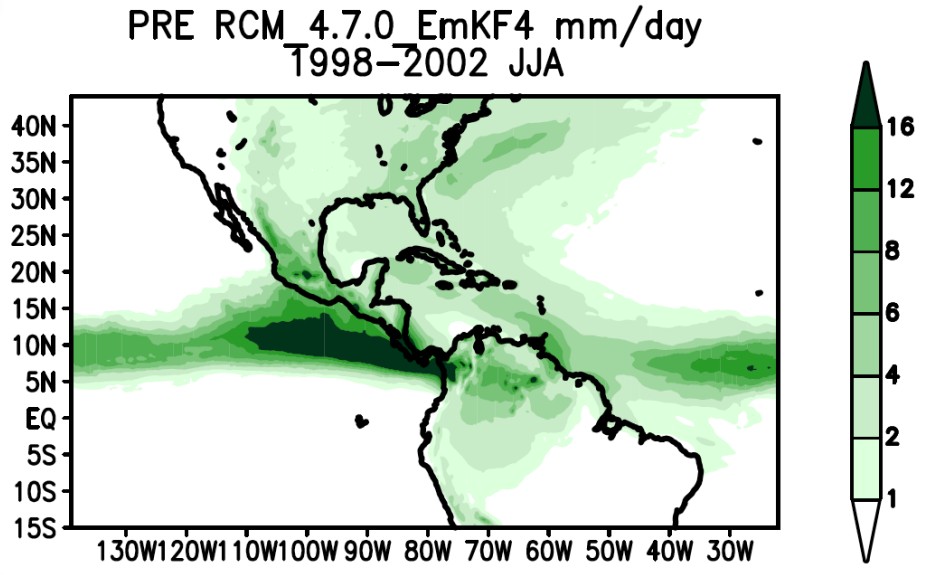


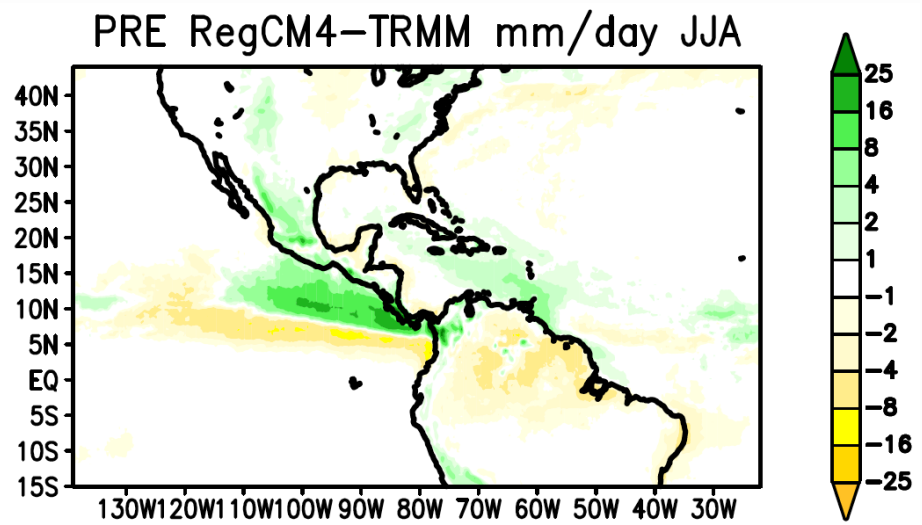


- **RegCM4.7 reproduces well the continental precipitation and the intensity and position of the eastern Pacific and Atlantic ITCZ.**

JJA precipitation bias (mm/d)

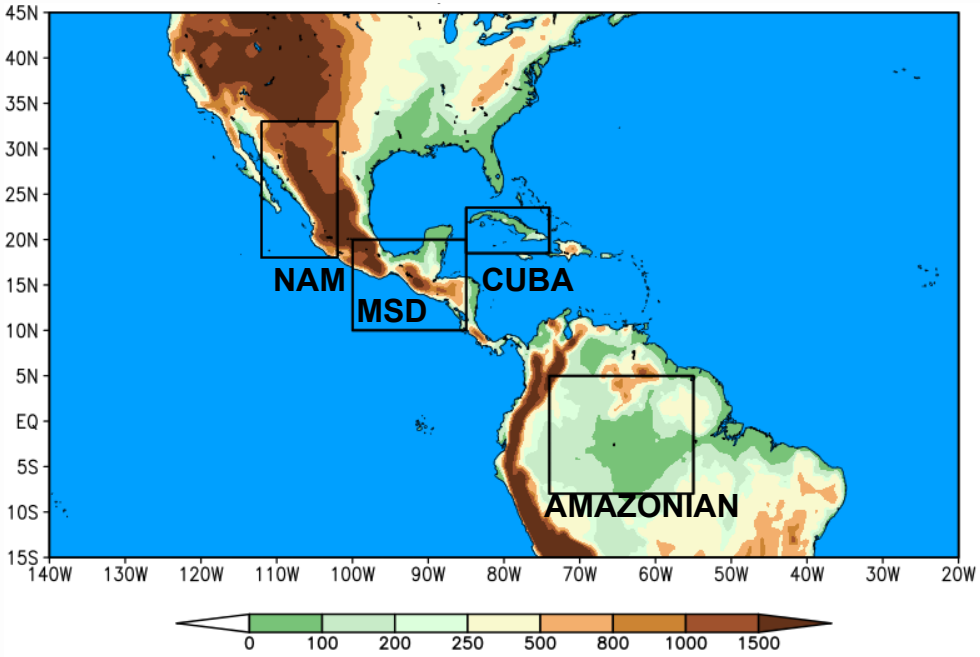






- The model reproduces the northward migration of the ITCZ, but with wet bias near Central America.
- The spatial pattern of North America monsoon is captured but with a wet bias.

Sub-regions of the domain



- **North American monsoon (NAM)**

18° - 33° N, 112° - 102° W

- **Midsummer drought (MSD) region**

20° - 10° N, 100° - 85° W

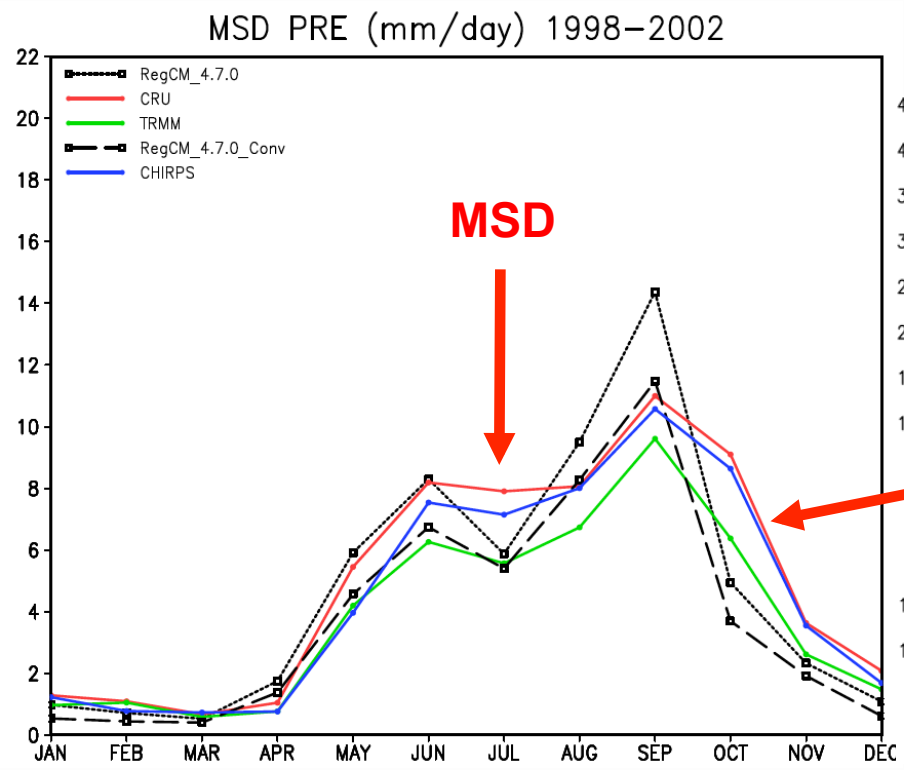
- **Cuba**

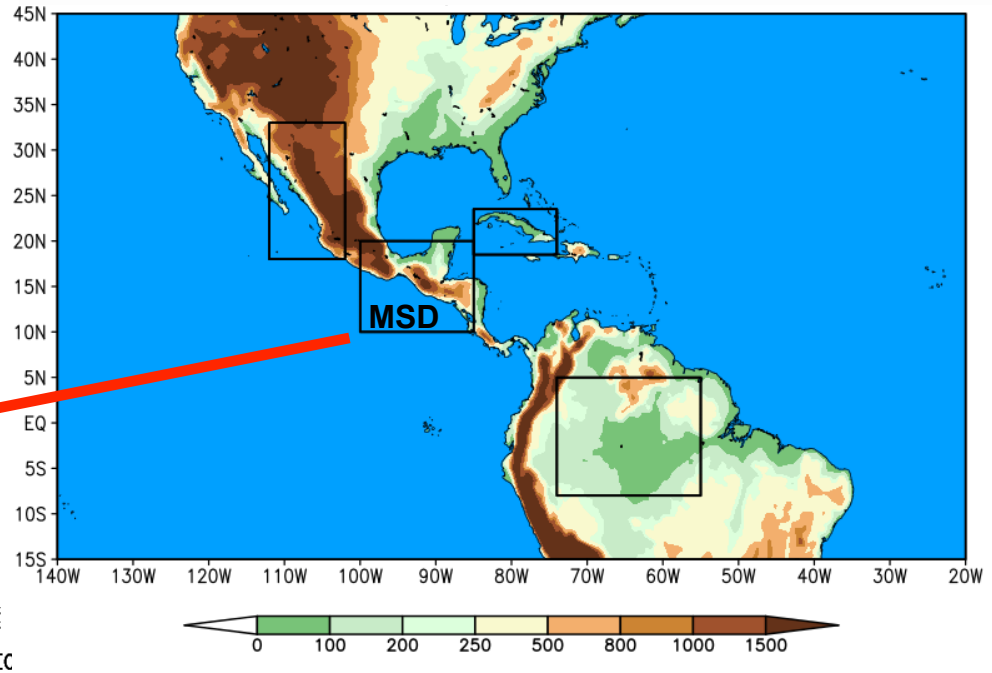
18.5° - 23.5° N, 85° - 74° W

- **Amazonian**

15° - 5° S, 68° - 48° W

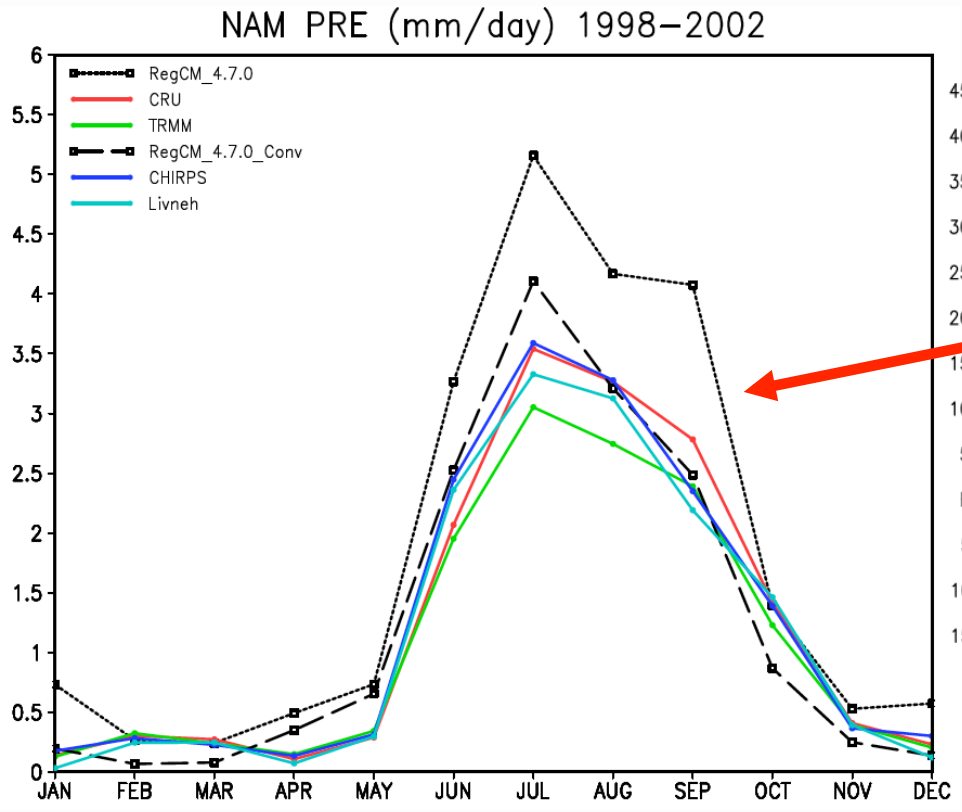
Annual cycle of precipitation in the MSD (1998-2002)

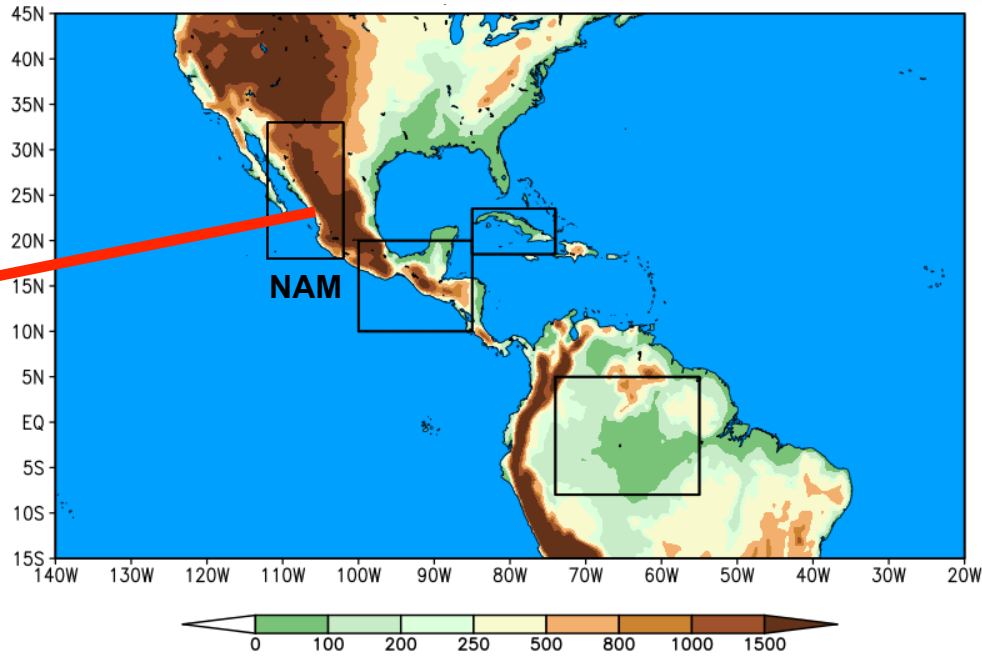




RegCM4.7 captures the observed bimodal pattern with peaks of precipitation in June and September.

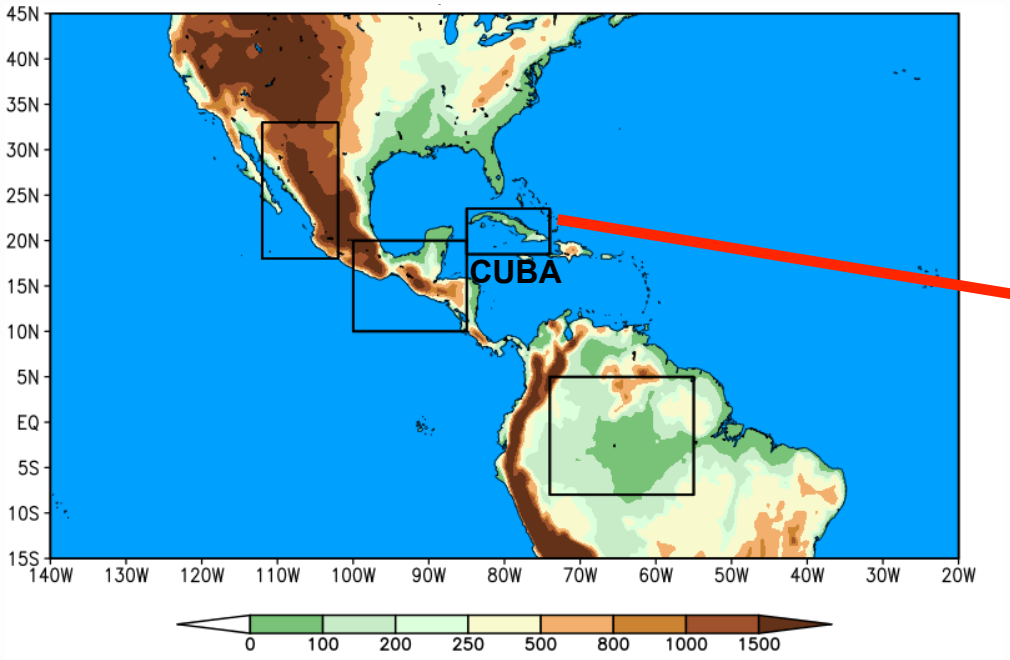
Annual cycle of precipitation in the NAM

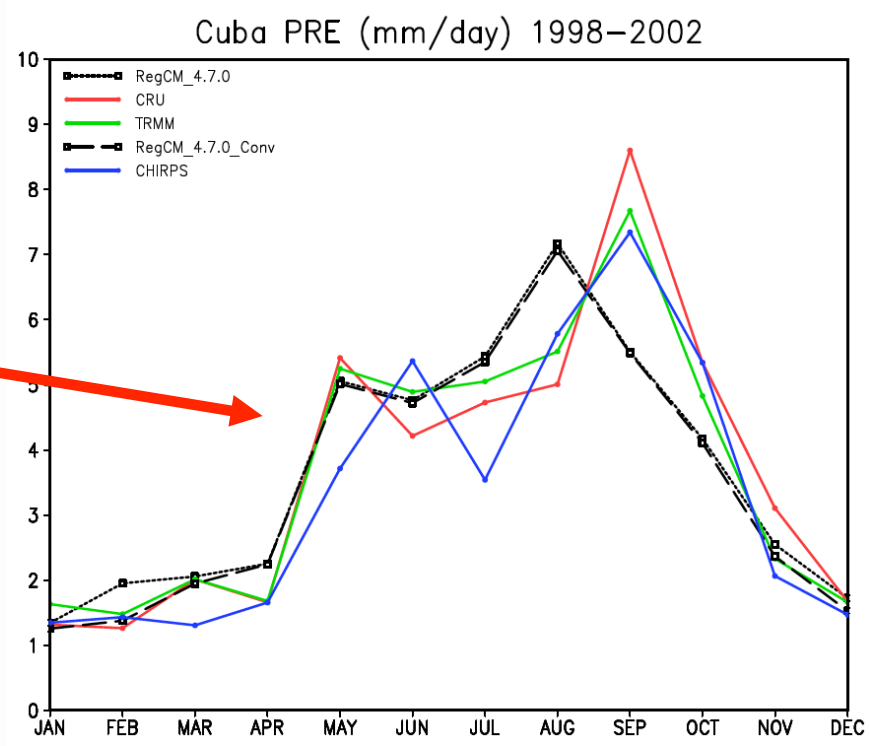




The model is able to reproduce the peak of precipitation in July with a wet bias.

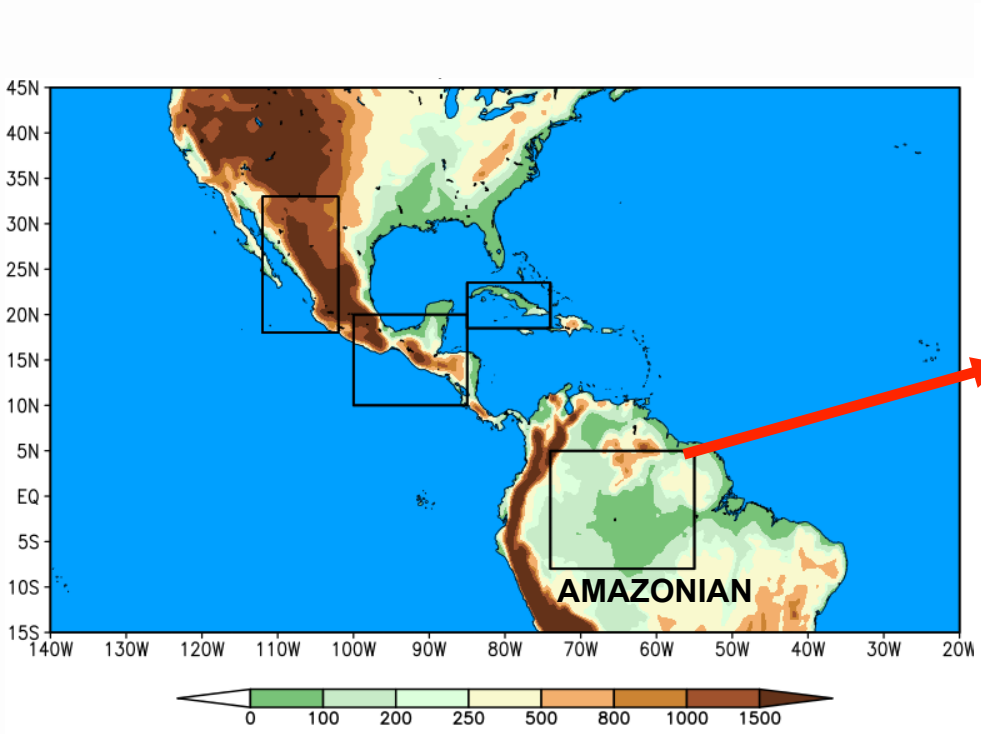
Annual cycle of precipitation in Cuba

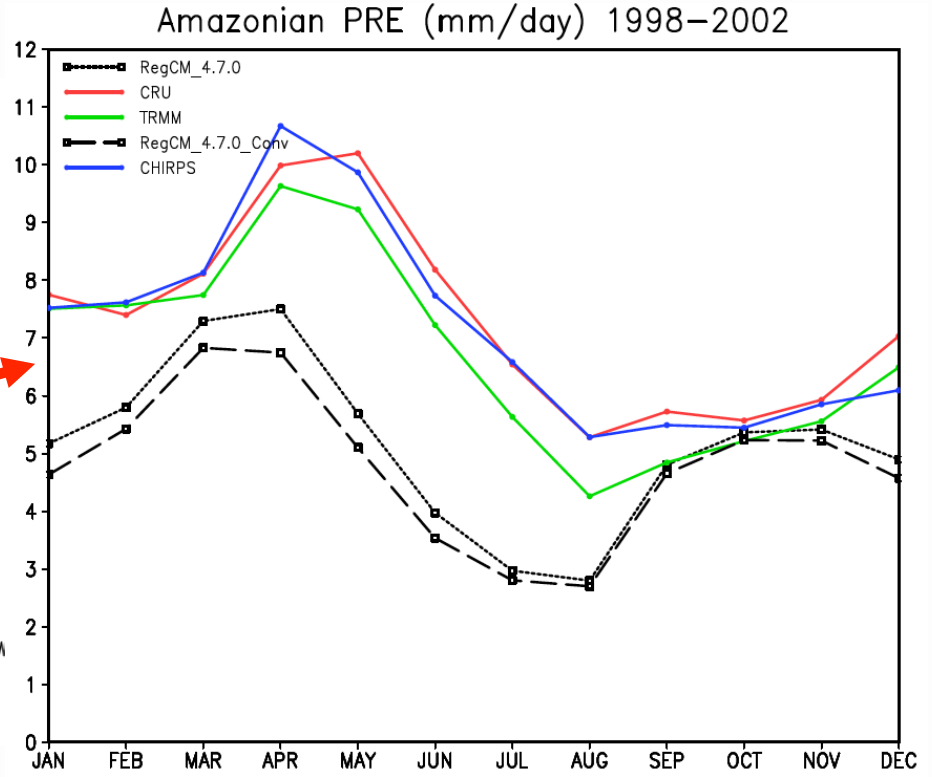




The model partially reproduces the annual cycle and the bimodal pattern.

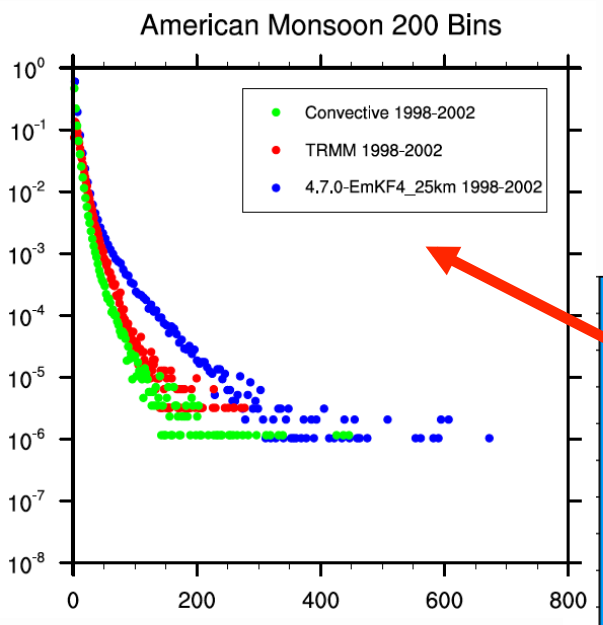
Annual cycle of precipitation in Amazonian

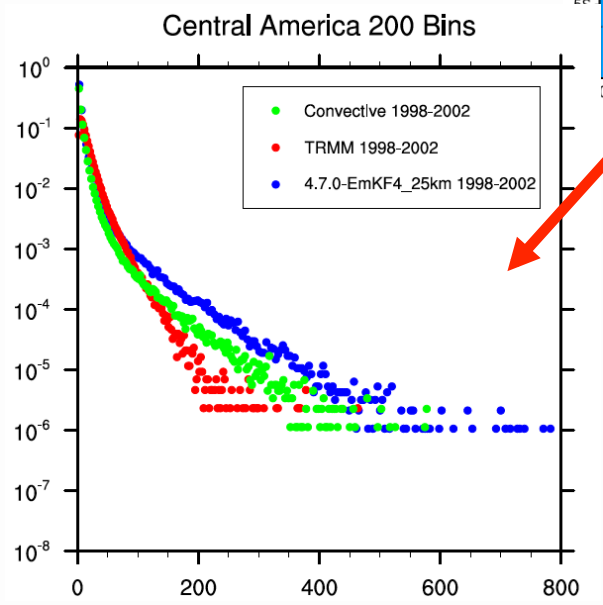


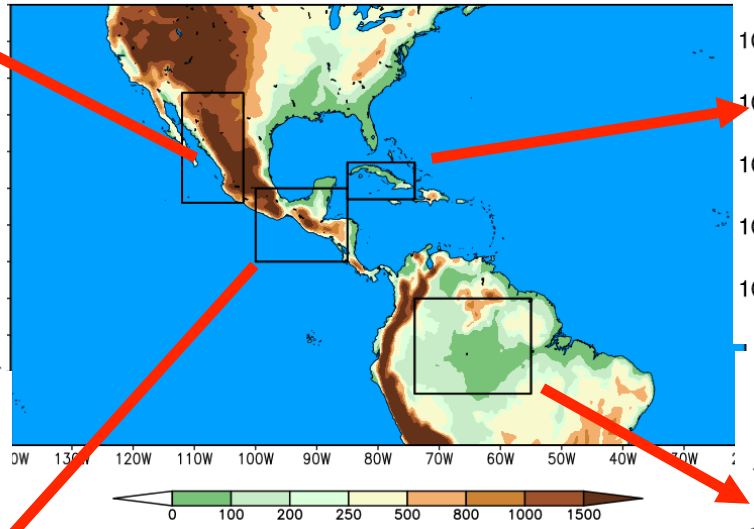


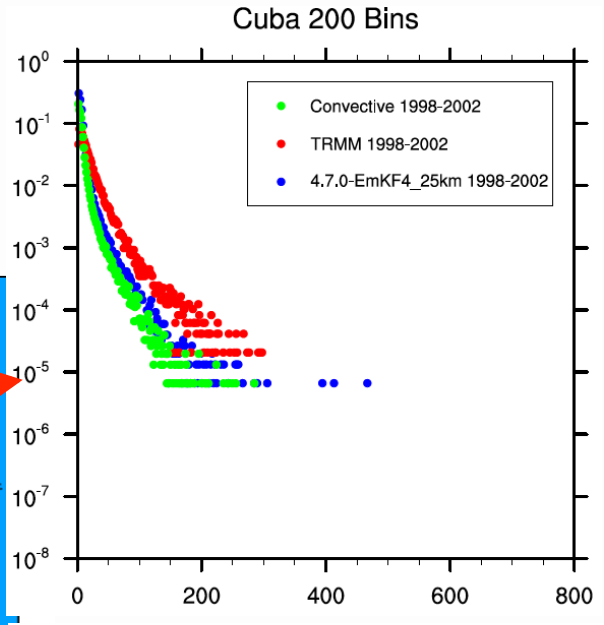
TRMM and CRU have maximum precipitation in April-May, while the RegCM shows it in March–April➔ phase problem

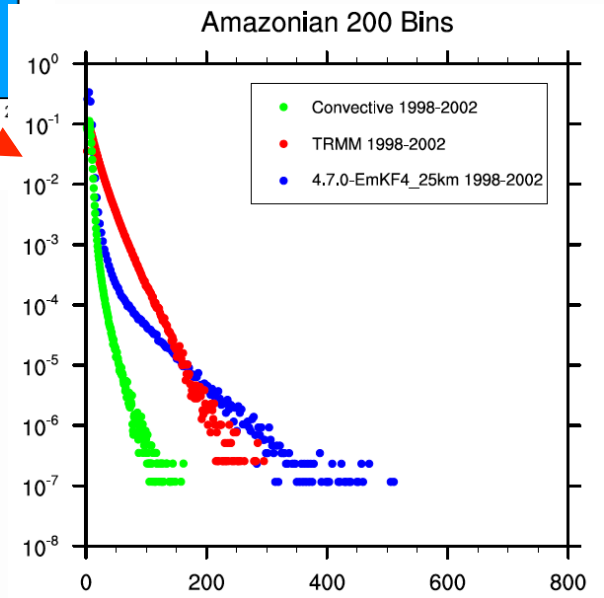
Daily precipitation intensity probability density functions











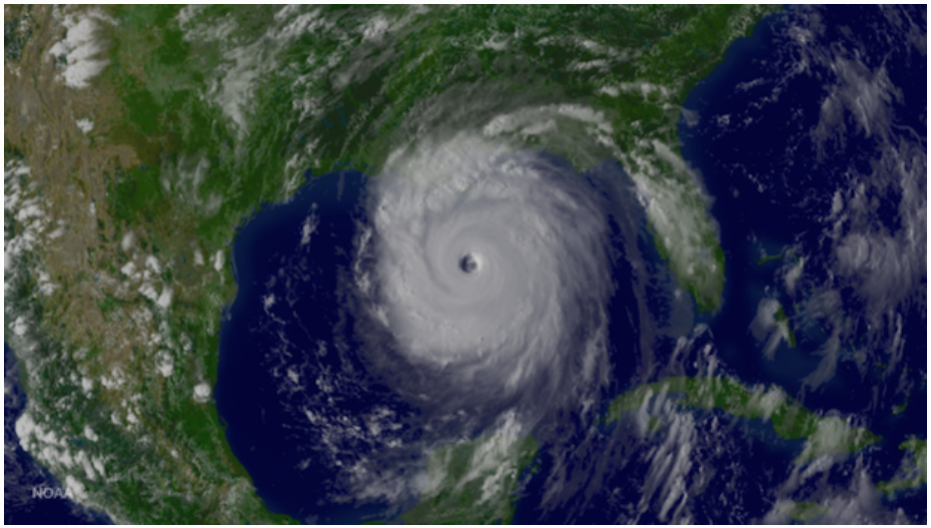
- **Convective precipitation captures very well the frequency distribution of TRMM.**
- **There is a problem with non convective precipitation (wet).**

Tropical cyclone detection and tracking method

Kyklop, Fuentes-Franco et al. (2017)

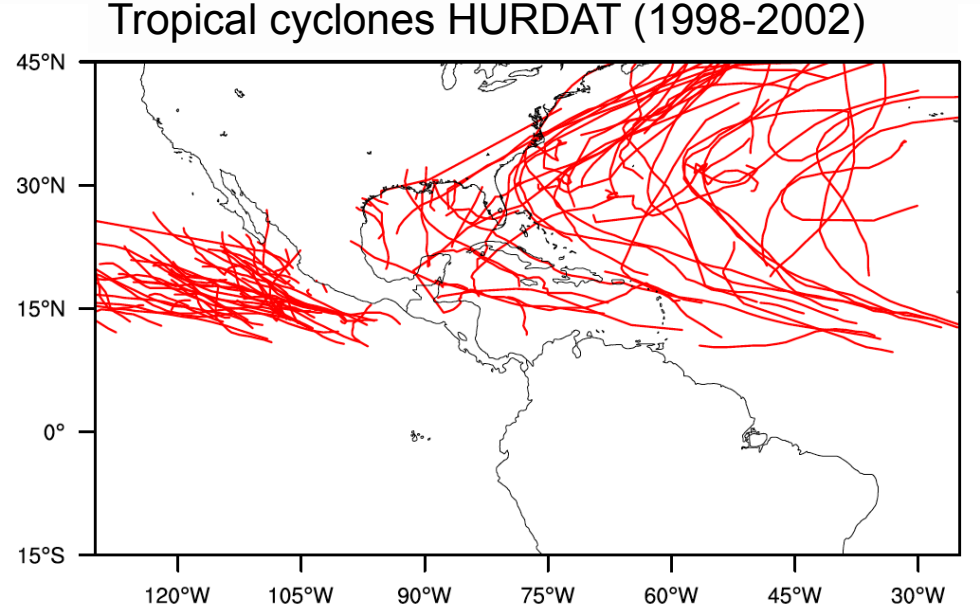
Detection criteria:

- Wind speed > 20 m/s
- Sea level pressure < 1005 hPa
- Sea Surface Temperature ≥ 25 ºC



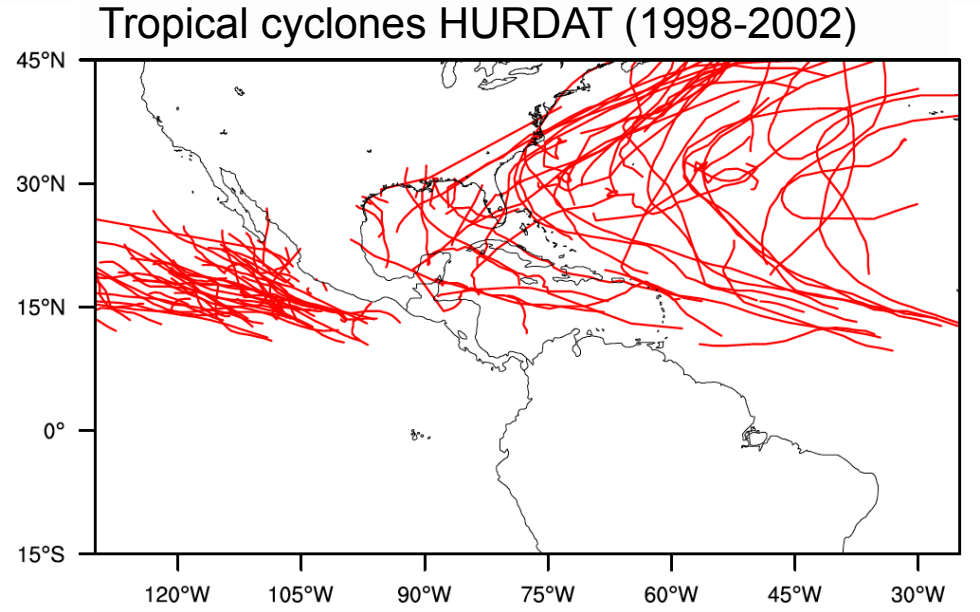
This satellite image was taken by GOES East at 2015Z on August 28, 2005 when Hurricane Katrina was at its maximum intensity of Category 5.

Tracks observed by HURDAT

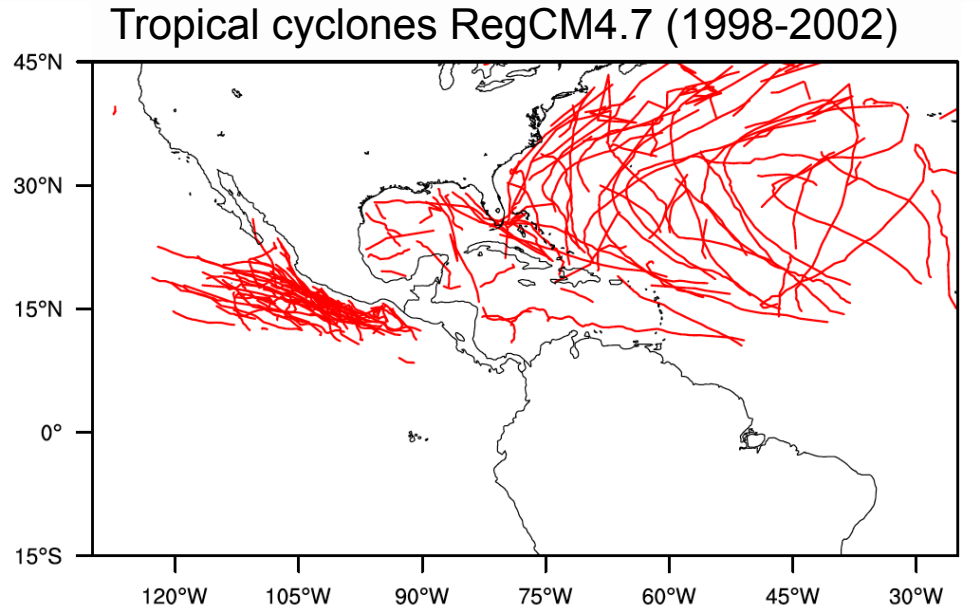


Total tropical cyclones observed: **159**

Tracks observed by HURDAT and simulated cyclones

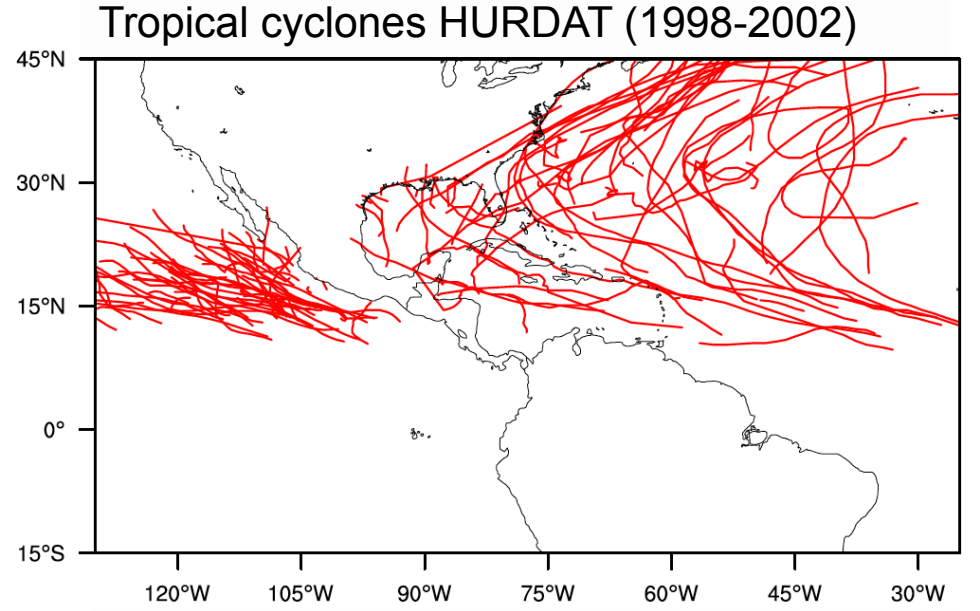


Total tropical cyclones observed: **159**



Total tropical cyclones simulated: **160**

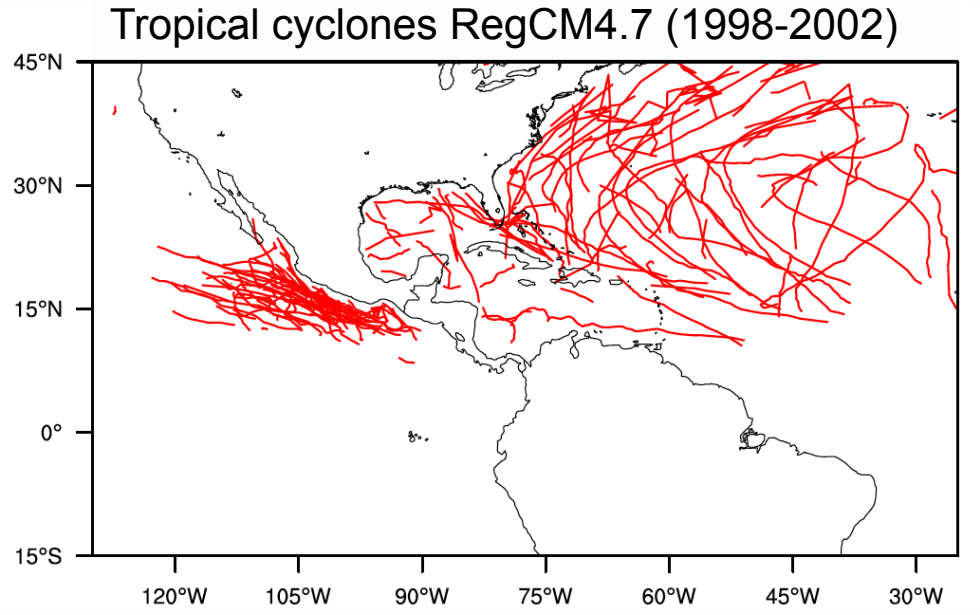
Tracks observed by HURDAT and simulated cyclones



Total tropical cyclones observed: **159**

Atlantic basin: **78**

Pacific basin: **81**



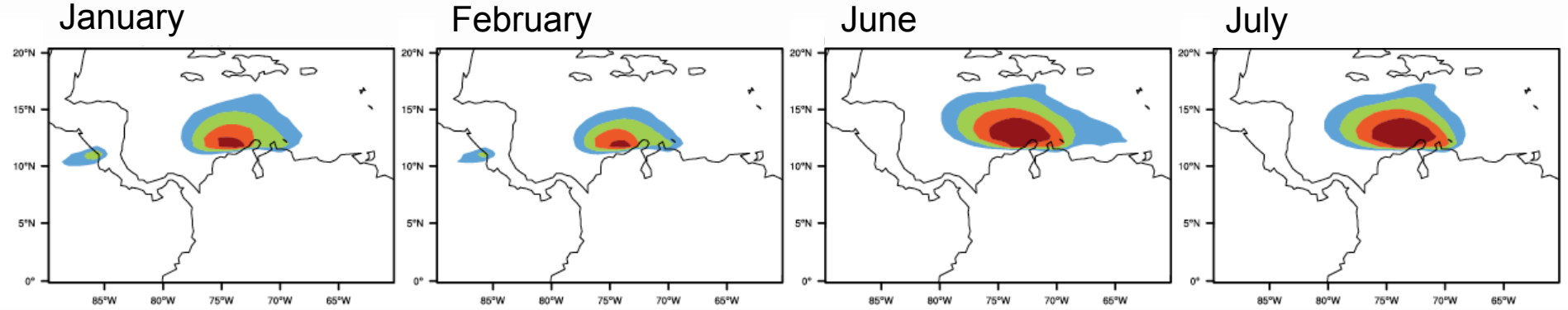
Total tropical cyclones simulated: **160**

Atlantic basin: **84**

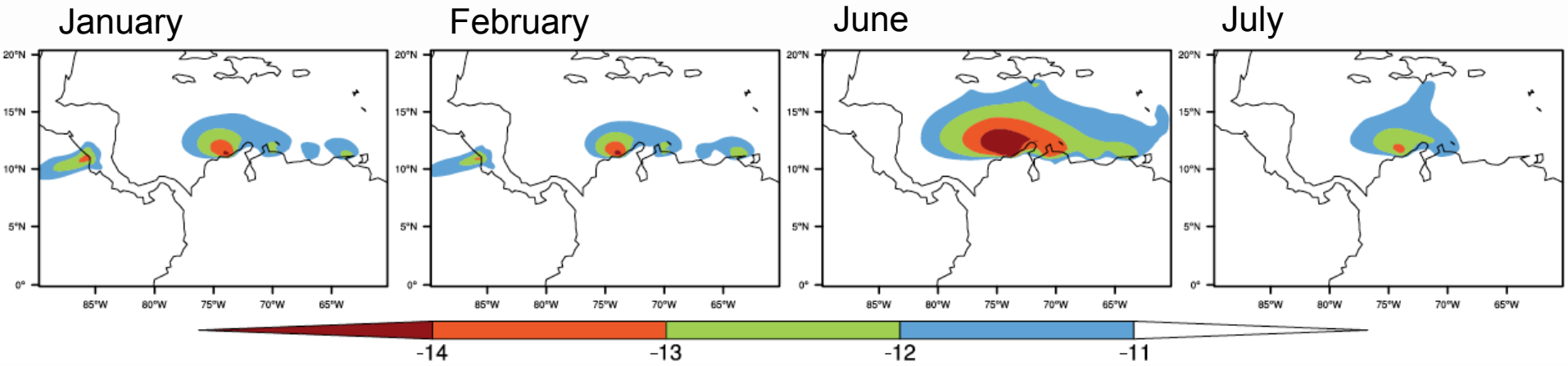
Pacific basin: **76**

Low level circulation

U925 (m/s) ERA-Interim



U925 (m/s) ReqCM4.7

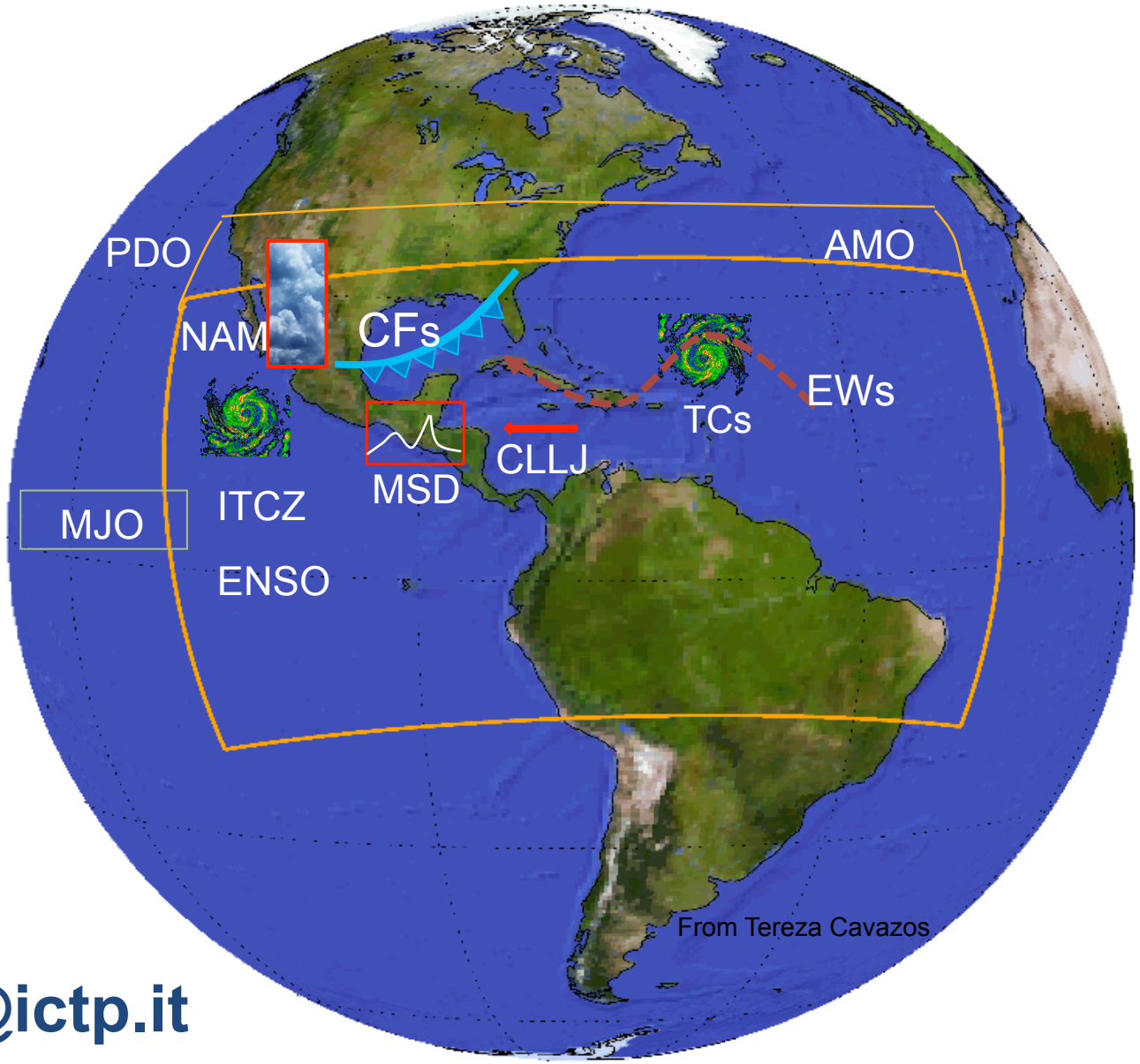


The location and intensity of CLLJ is well simulated .

Summary

- Overall, the model reproduces the spatial and seasonal patterns of temperature and precipitation over the region.
- Both count and spatial distribution of TC tracks in the RegCM4.7 simulation are well matched with observations.
- The location and intensity of CLLJ is well simulated.
- Additional test is needed to reduce the non-convective precipitation.

Thank You!



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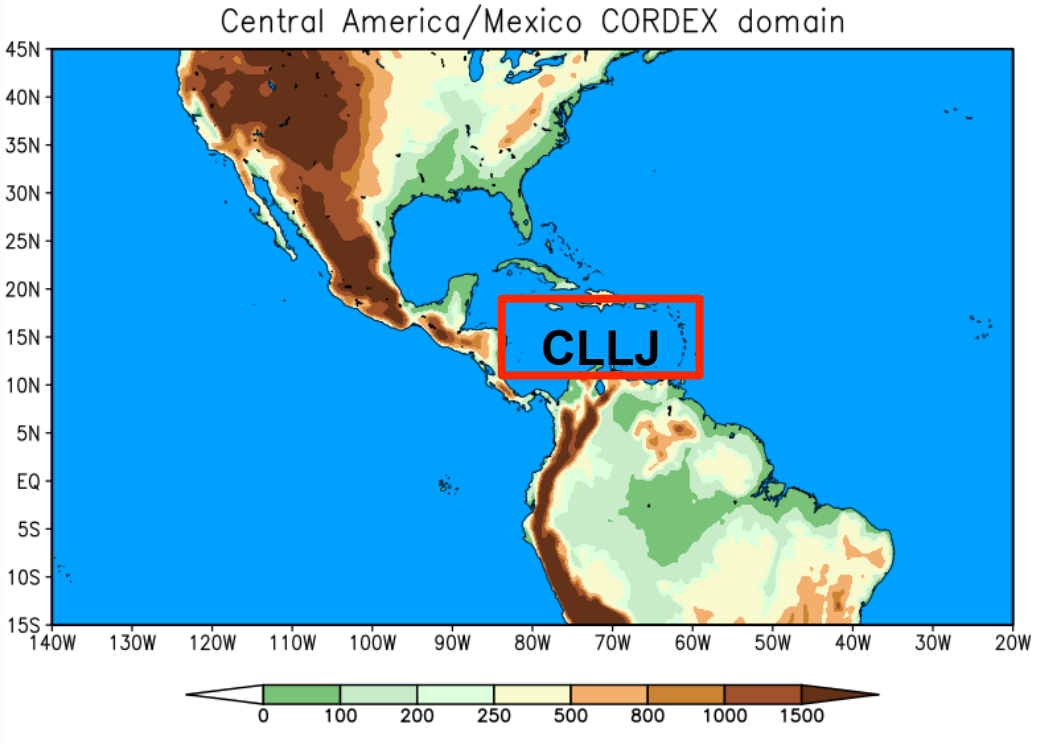
Low level circulation



The easterly Caribbean low-level jet (CLLJ) is a prominent climate feature over the Intra-America Seas.

A strong (weak) CLLJ is associated with reduced (enhanced) rainfall over the Caribbean Sea throughout the year (Cook and Vizy, 2010).