environmental sciences proceedings

MDPI

The 5th International Electronic Conference on Atmospheric Sciences

Analysis of SisPI performance to represent the North Atlantic subtropical anticyclone

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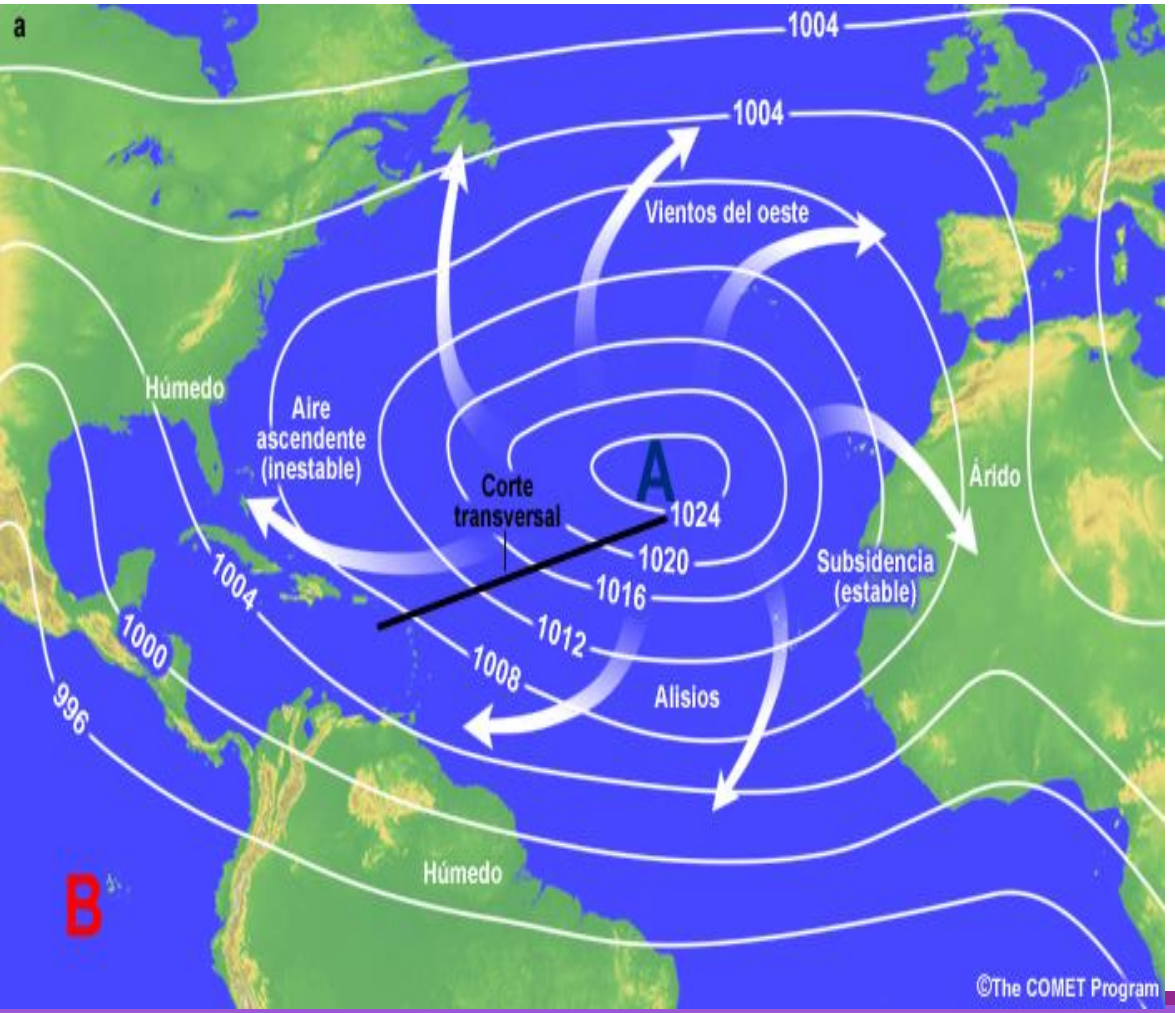
North Atlantic subtropical anticyclone

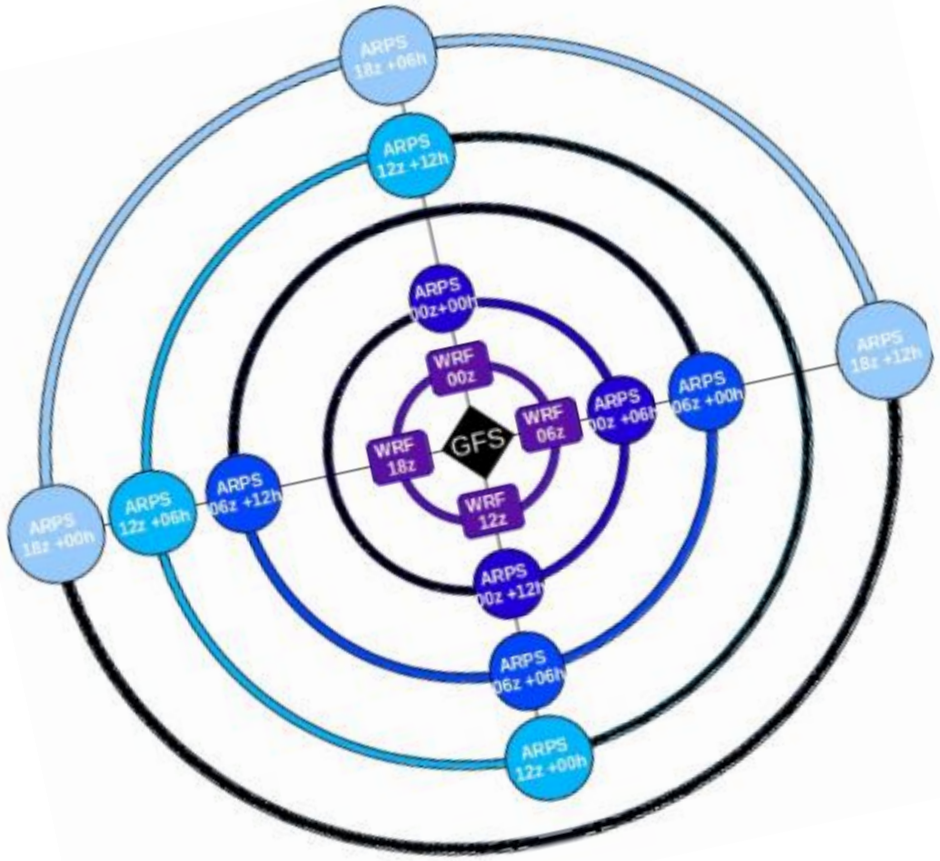


Last changes:

- **Laings & Evans (2016)**
  - **Yang et al. (2020)**
  - **Fernández et al.(2021)**

- An expansion of the Hadley cell from 2 to 4° latitude grades since 1979.
- Global warming may have already significantly contributed to the ongoing tropical expansion.
- An expansion of the subtropical ridge in all months of the year, especially in troposphere lower and middle levels.

SisPI

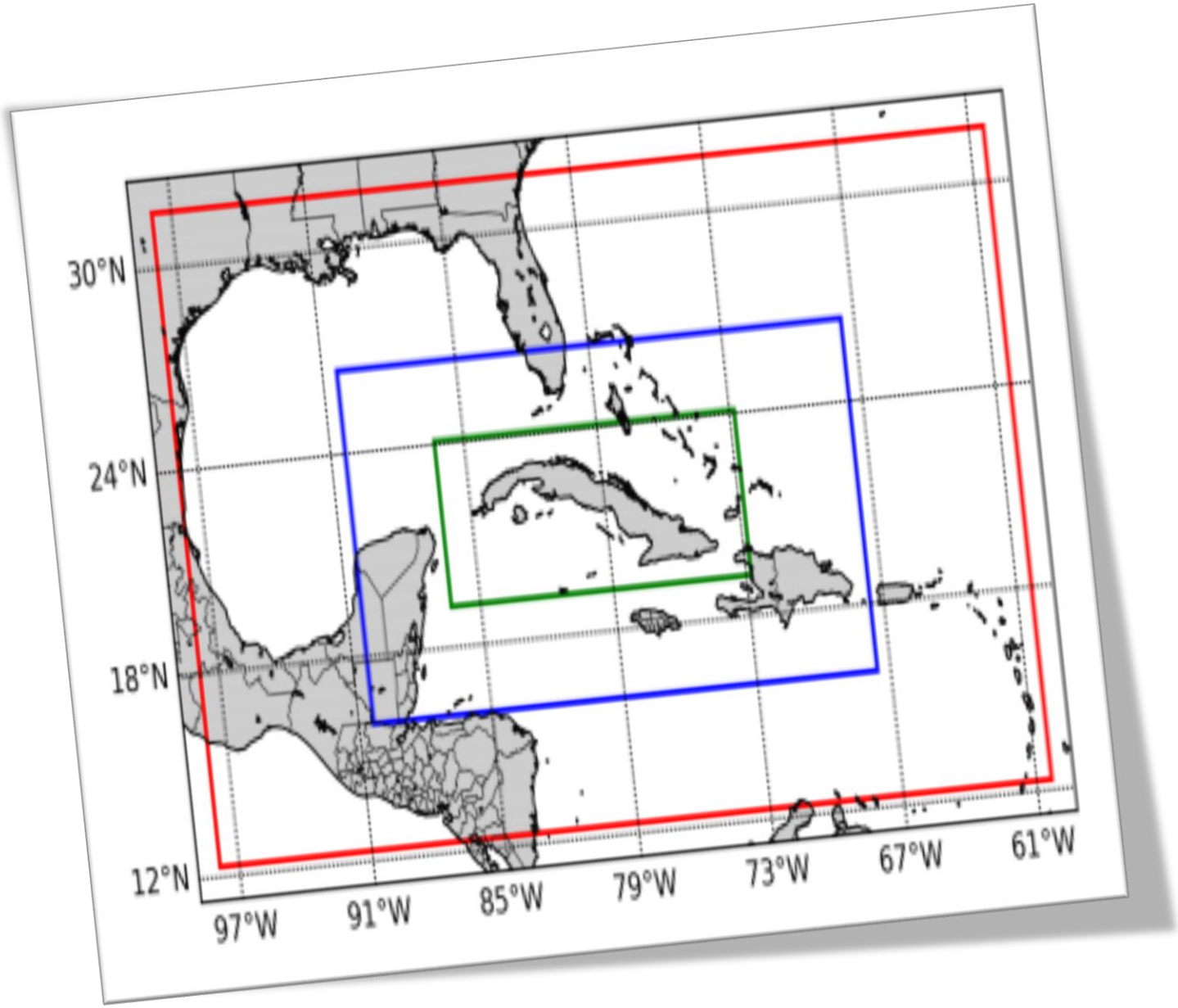


- **Sierra et al. (2014) combined three microphysics and three cluster parameterizations for two nested domains of 27 and 9 km spatial resolution.**
- **(Sierra et al. 2017) conducted sensitivity studies of the SisPI to changes in the PBL, the number of vertical levels and the microphysics parameteri-zations and clusters, at very high resolution**

Short-range system based in WRF

It has three domains of 27, 9 and 3 km of resolution

2020 wet season



Materials and Methods

2020 Wet Season

Decadal characterization (2010-2019)

Anomalies

SisPI Errors respect ERA5 results

Analize average synoptic sistem position position

Greatest changes respect decadal average

Determinate if depend of its configuration or anomalous conditions

Variables: geopotential height, relative humidity, wind and temperature at mandatory levels

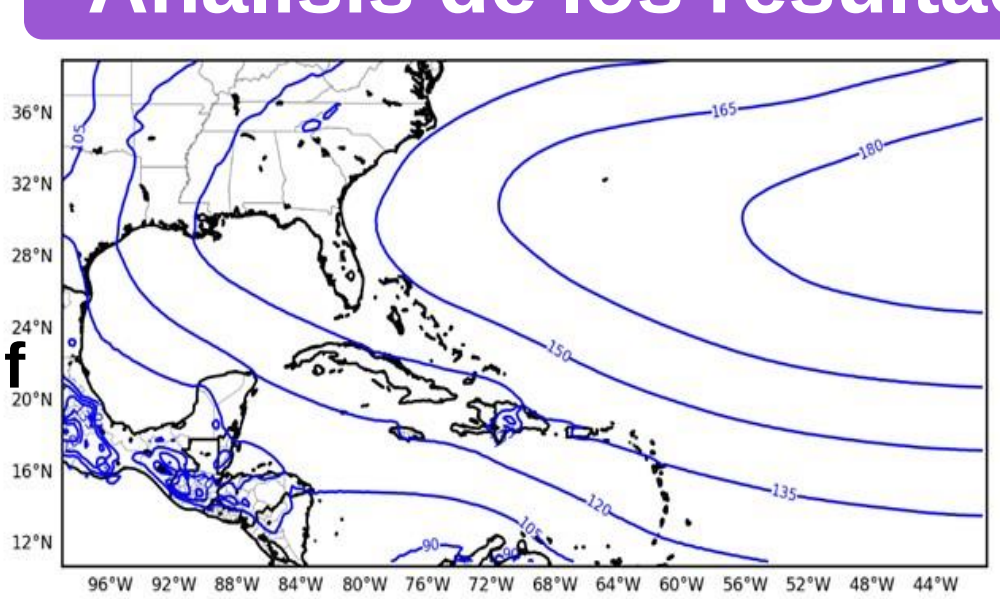
Materials and Methods

Análisis de los resultados

Subtropical ridge extiended until gulf de Mexico

Fluctuations on zonal winds area

East region winds over Cuba



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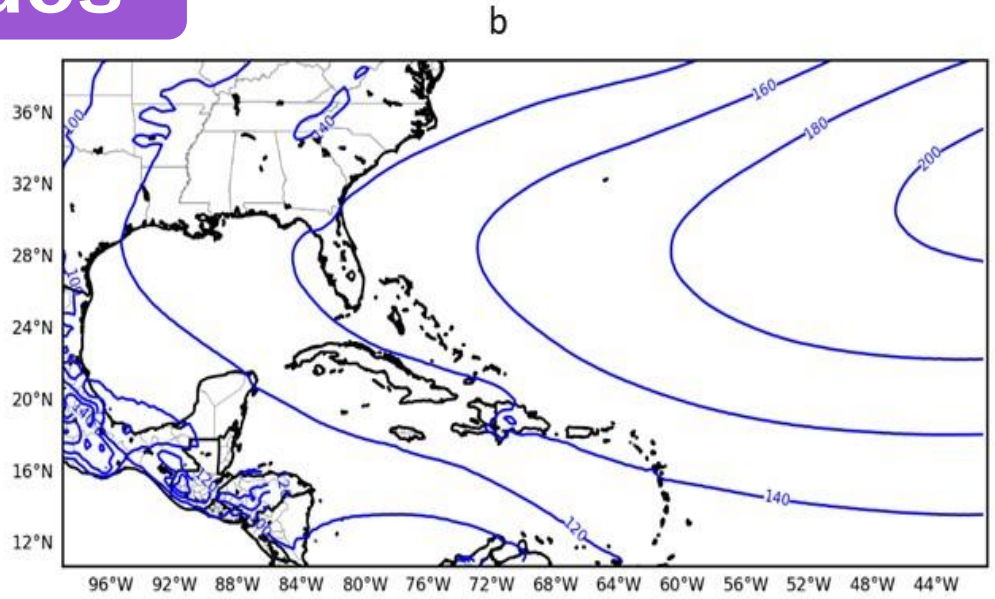

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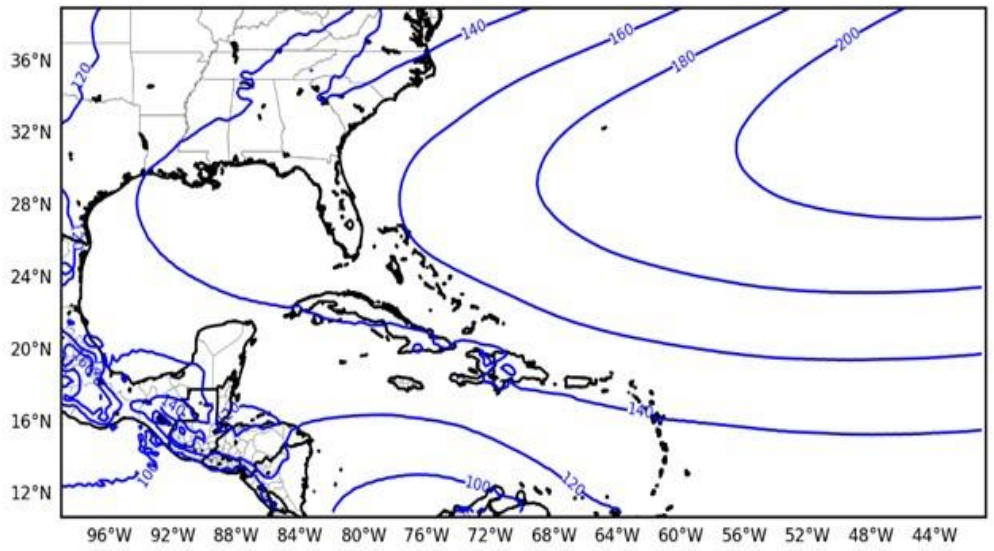

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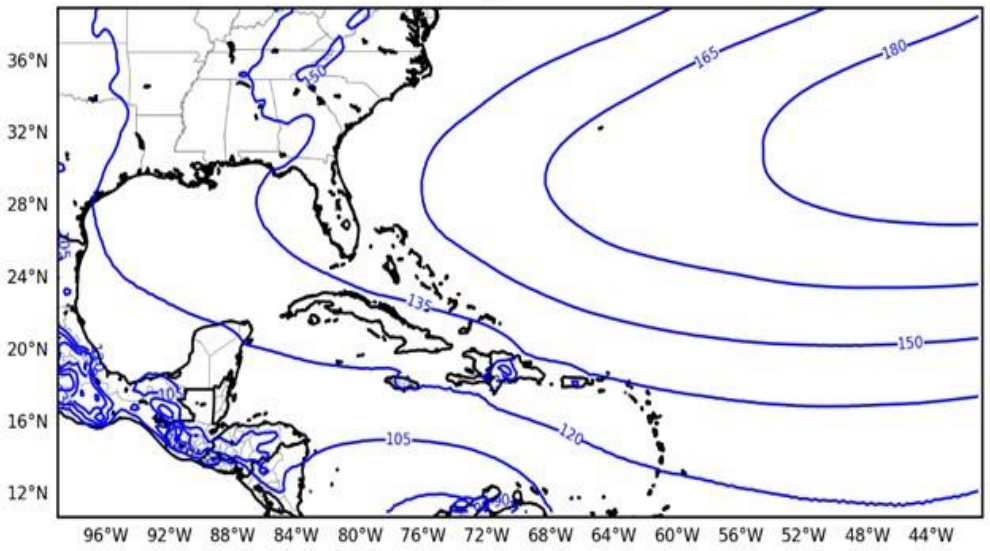


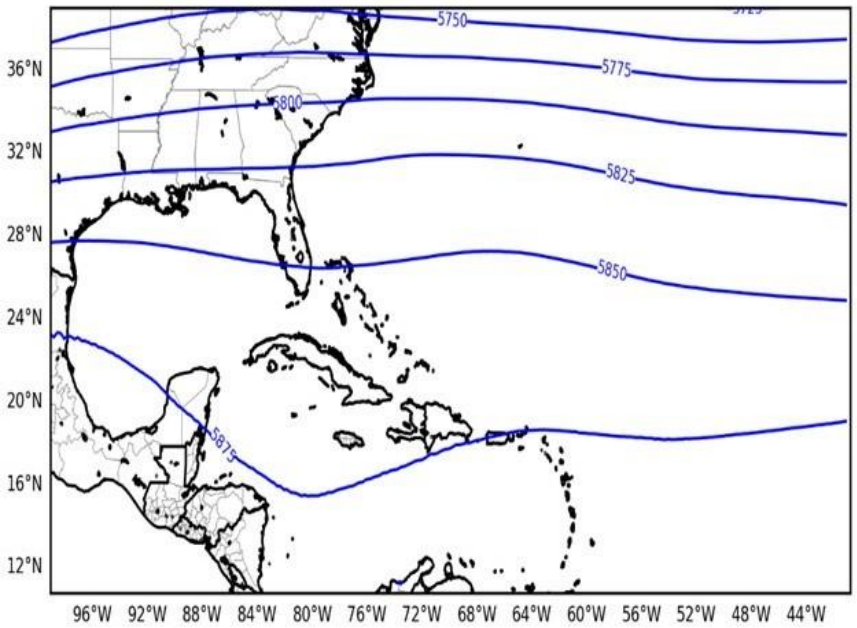
2010-2019 decade

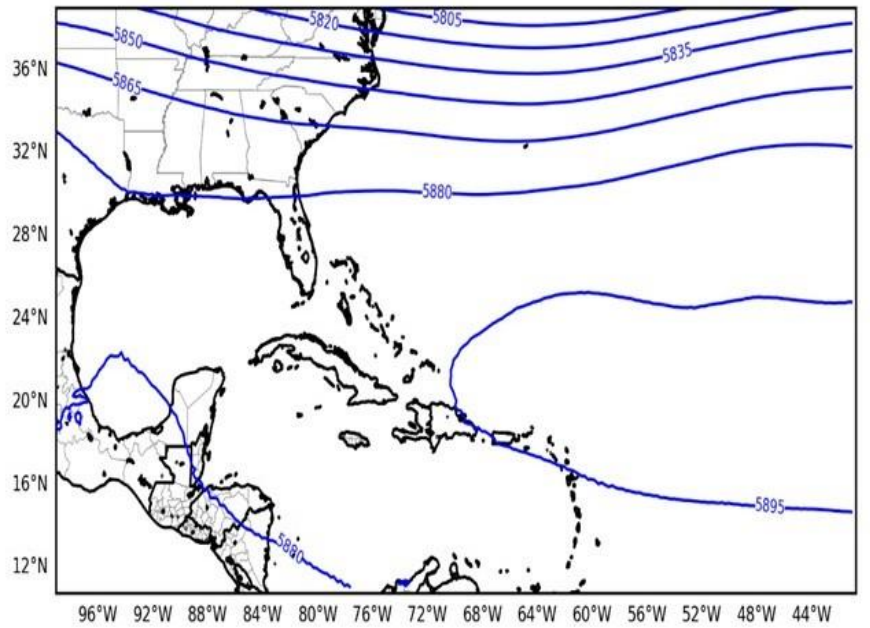
May (a), June (b), July (c) & August (d) at 1000 hPa.

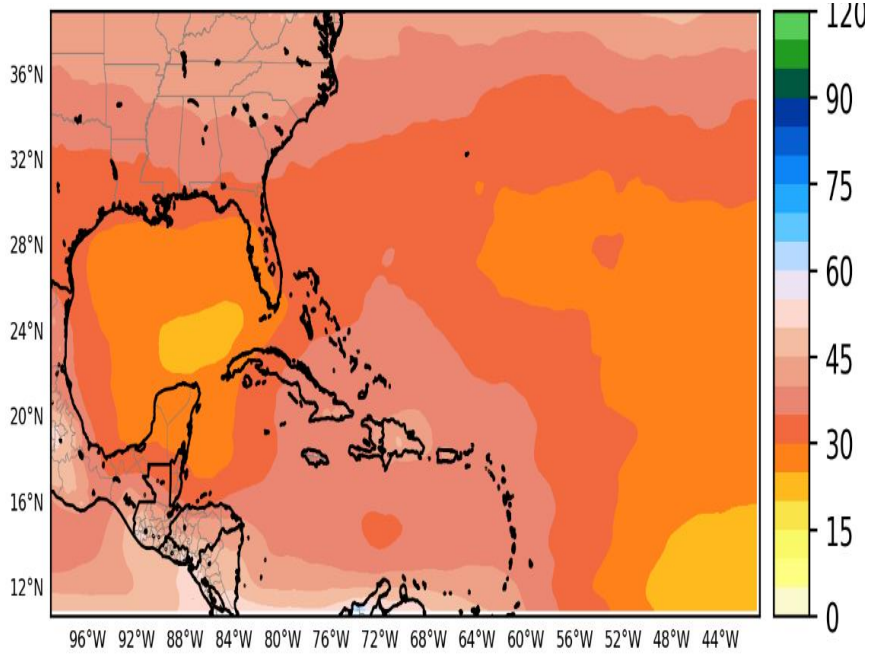
May-June Trough

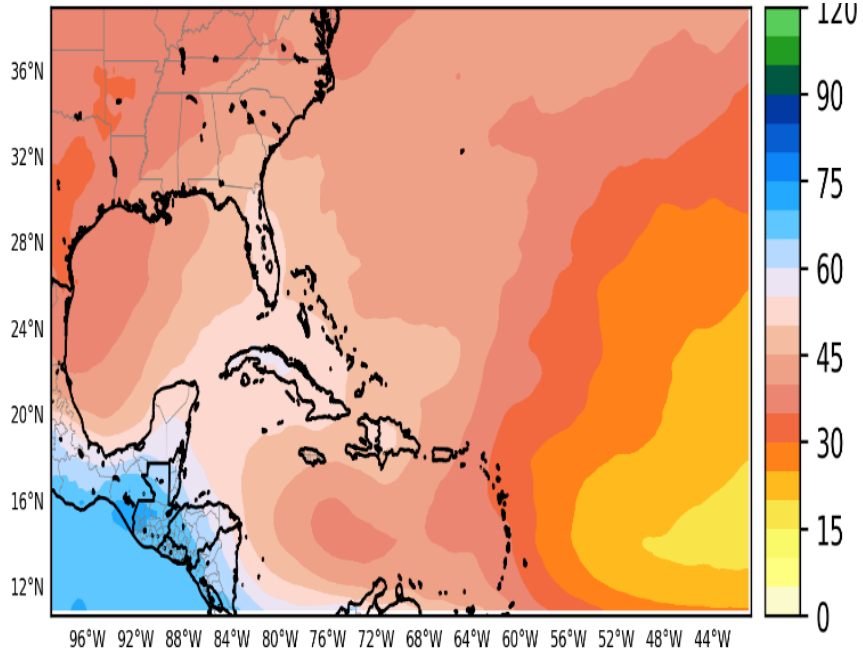
eastern displacement

The area of maximum vorticity advection of the trough was found in the central and eastern regions of the territory, while the driest portion was located in the west









era5

2010-2019 decade

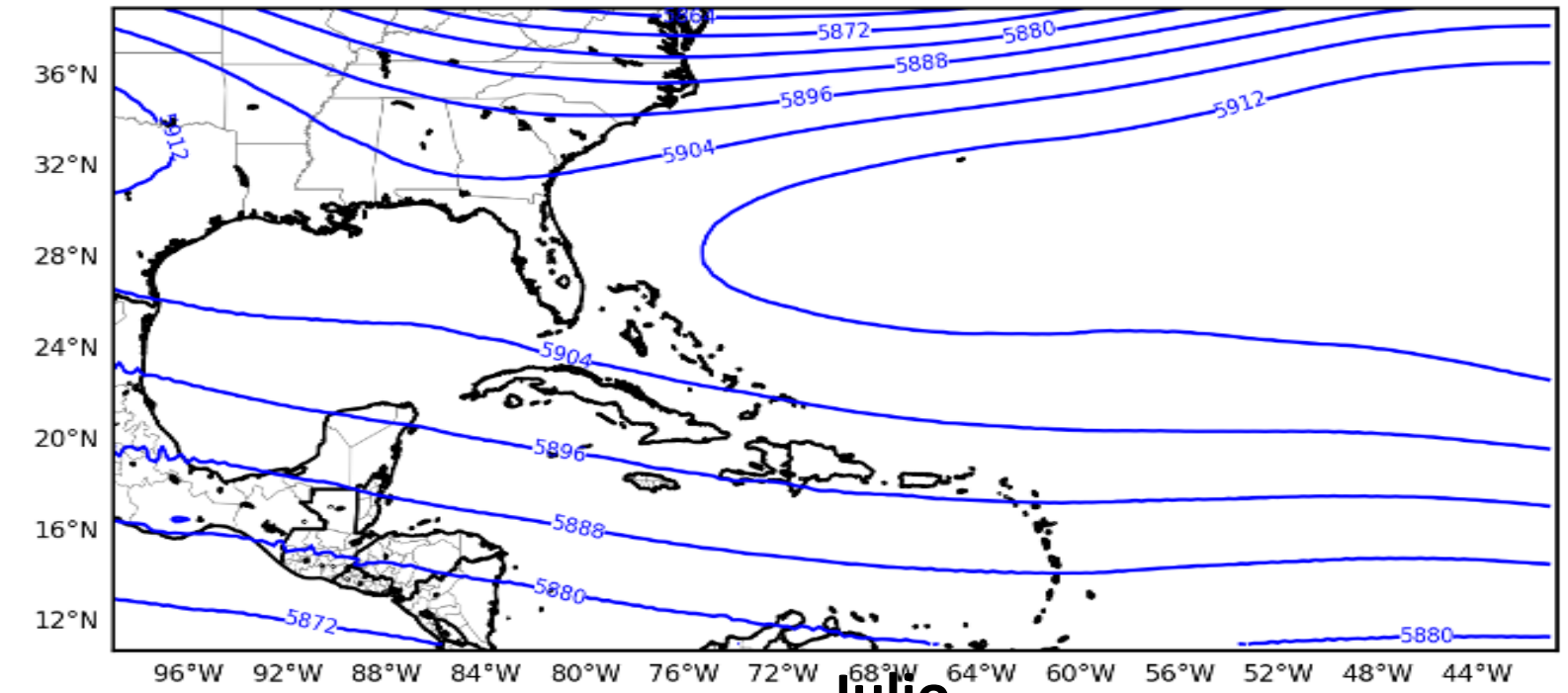
May & June at 500 hPa

500 hPa

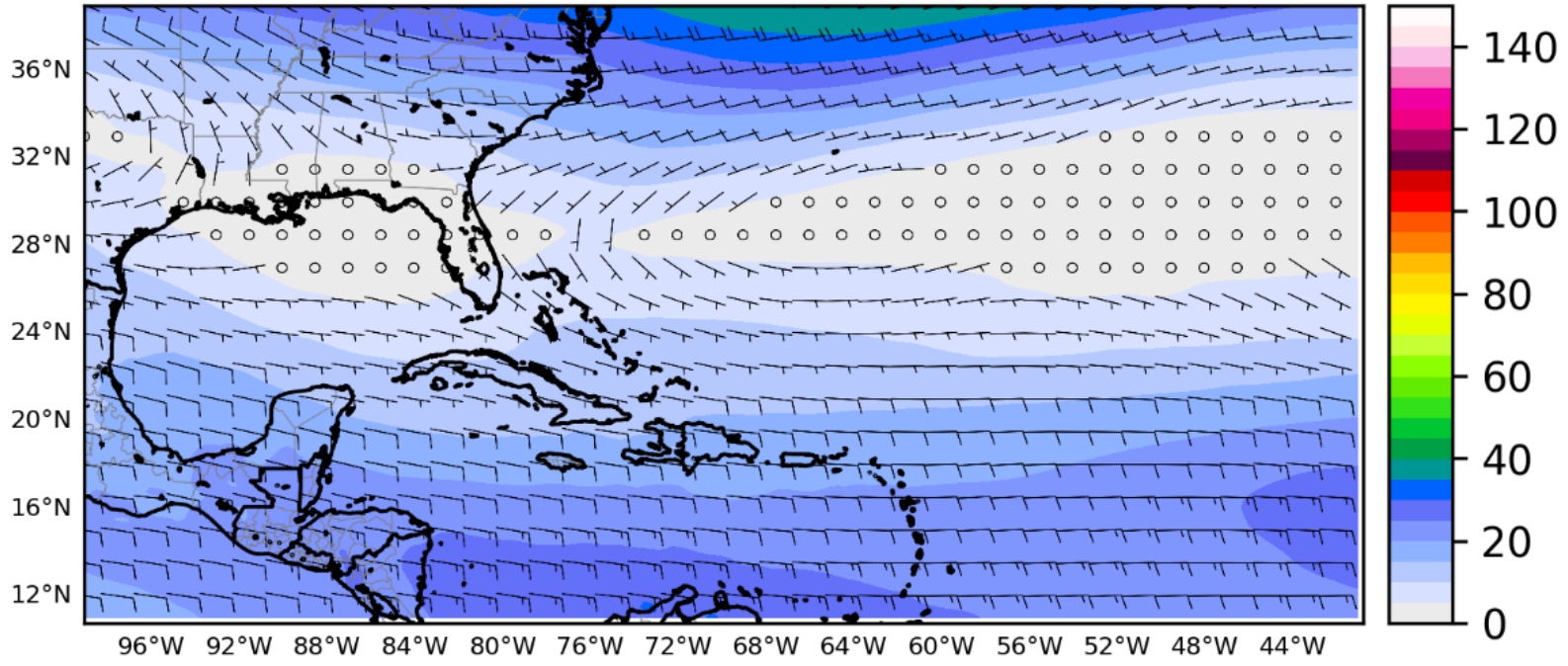
Subtropical & Mexican ridges establish a belt of high geopotential values

could be the cause of limited exchange between tropic and mid latitudes

Weak winds



Julio



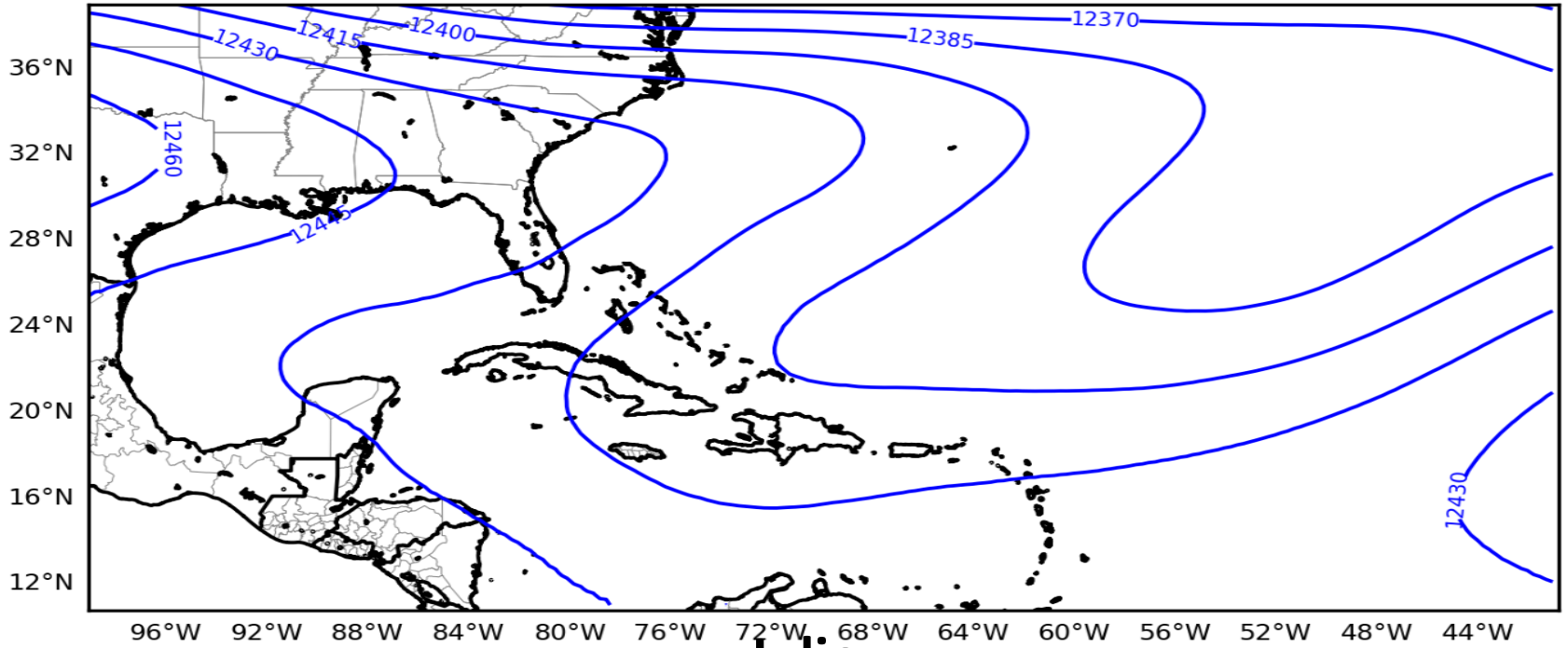
Media últimos 10 años

200 hPa

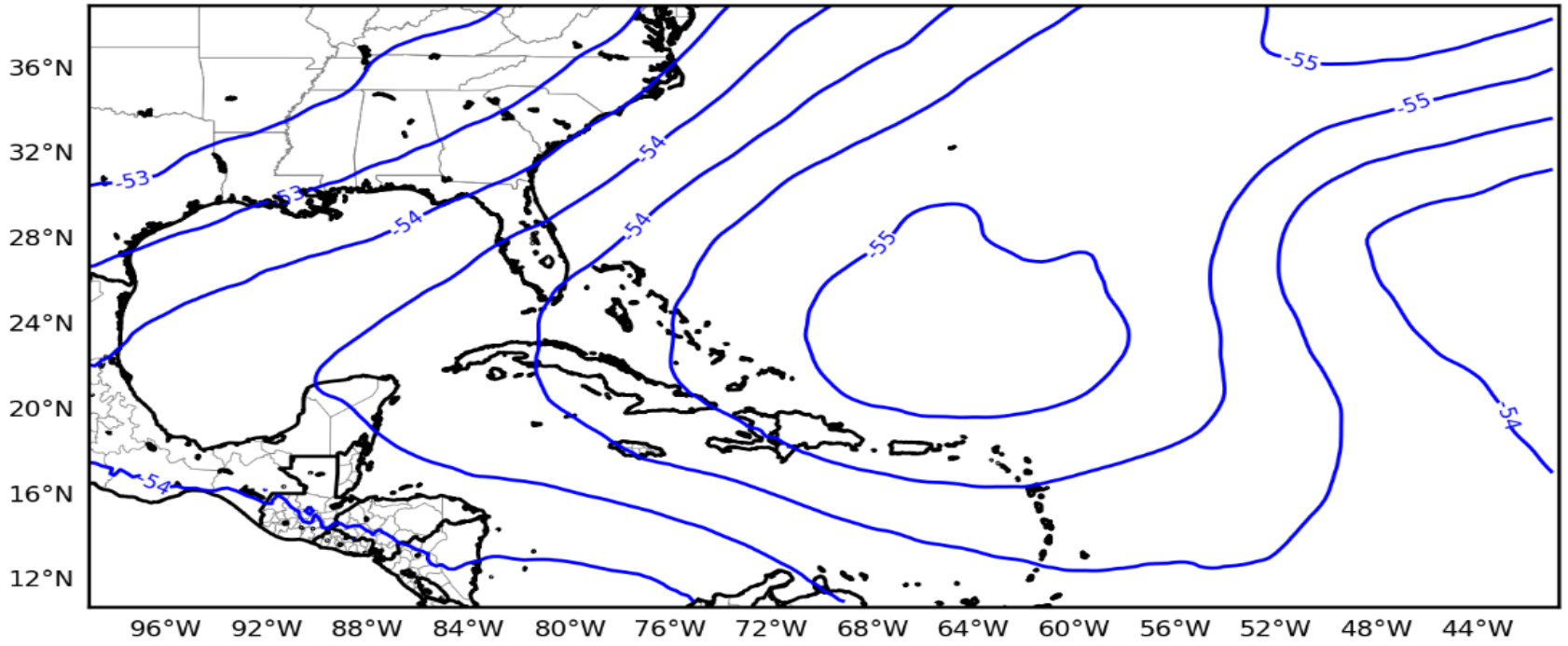
Few significant changes on TUTT

Influence on July-September

Closed cold center on mean temperature map located northeast of Hispaniola on July.

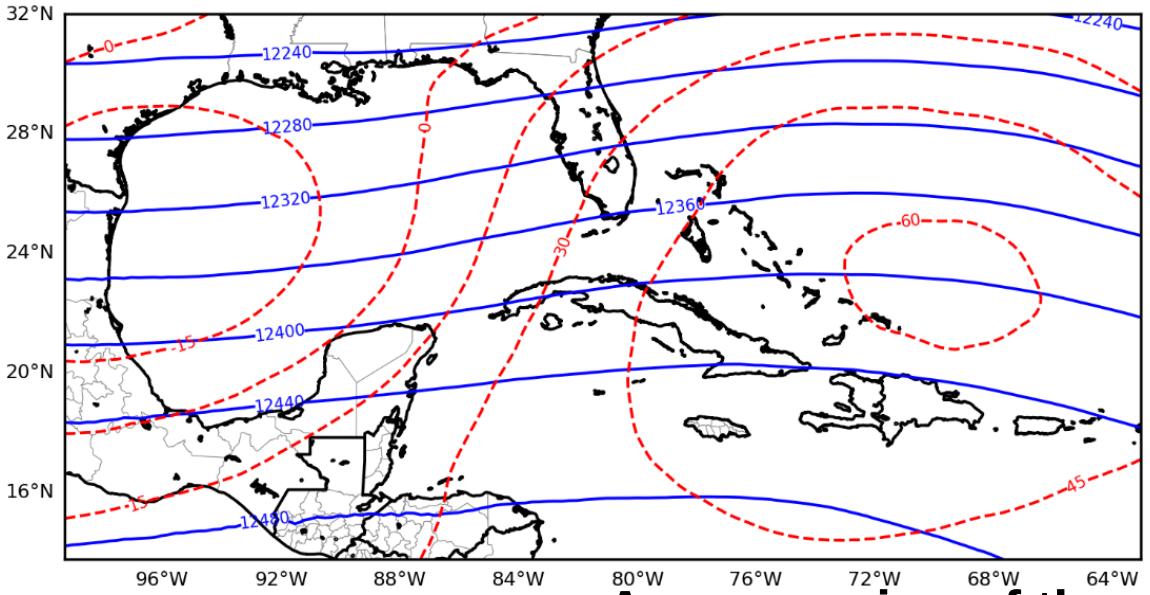


Julio

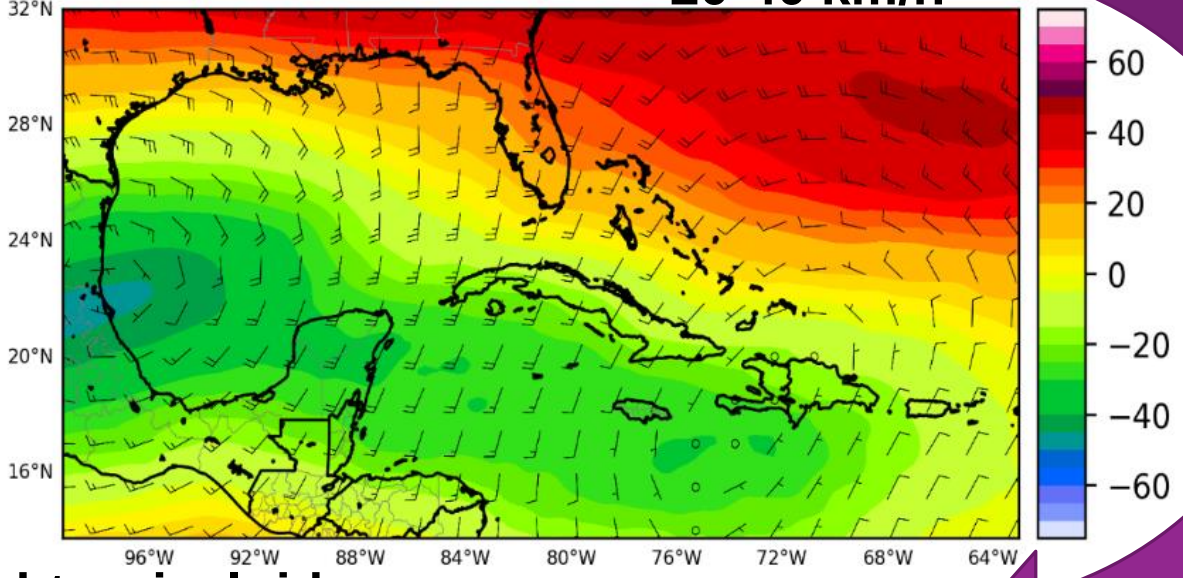


2010-2019 decade

strengthening of high geopotential values

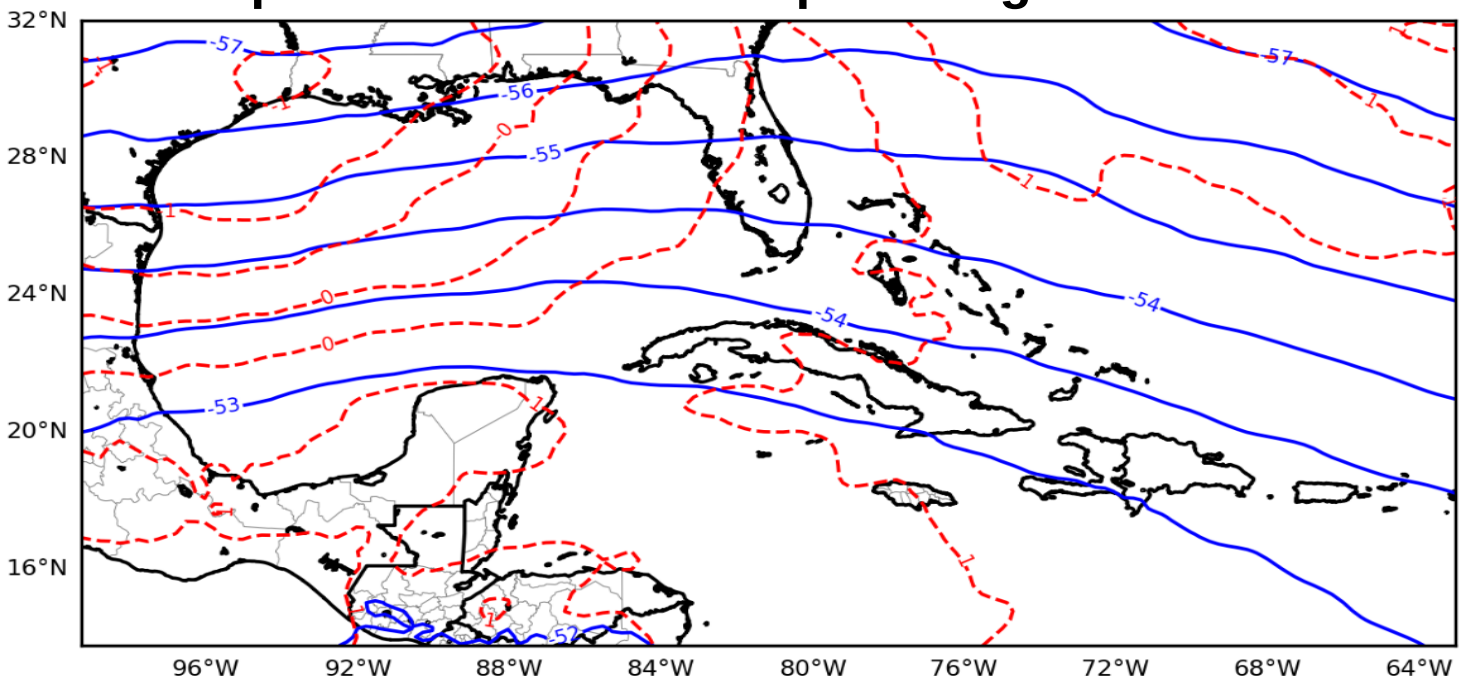


20-40 km/h



15-60 m^2/s^2

An expansion of the subtropical ridge



southward extension of the subtropical jet stream

Higher temperature gradients

Baroclínics atmosphere

era5

Anomalies

May 200 hPa

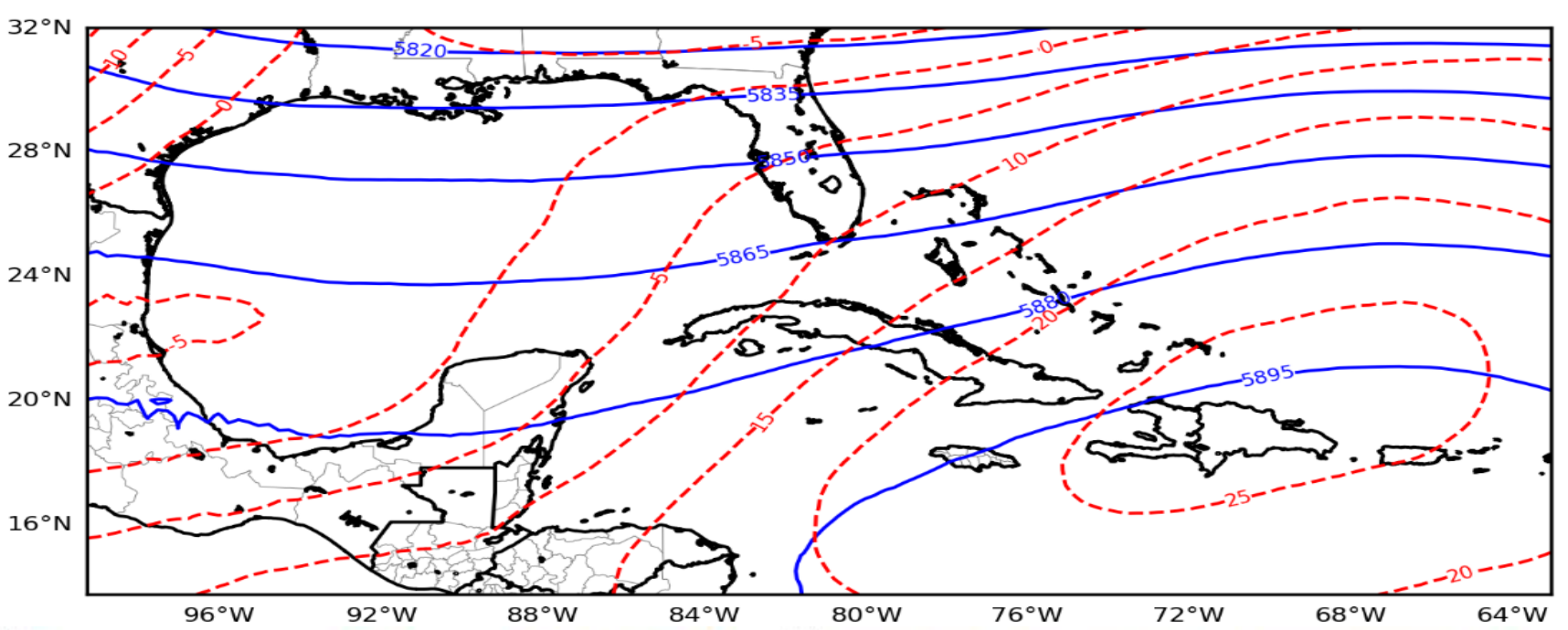
500 hPa

Lower geopotencial and temperature values of anomalies than upper air

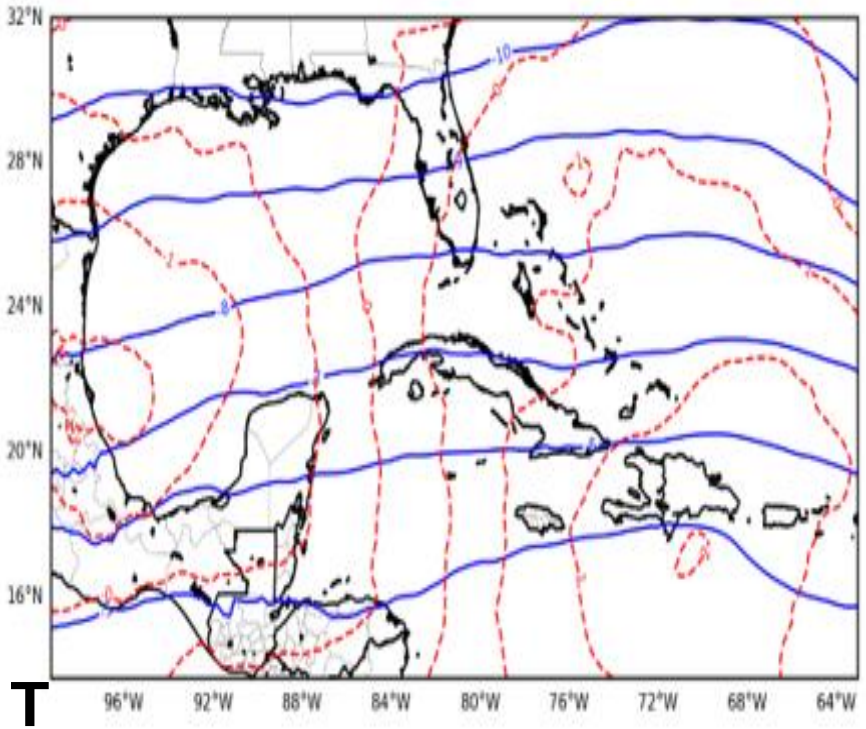
Western displacement of May-June Trough

Anomalies

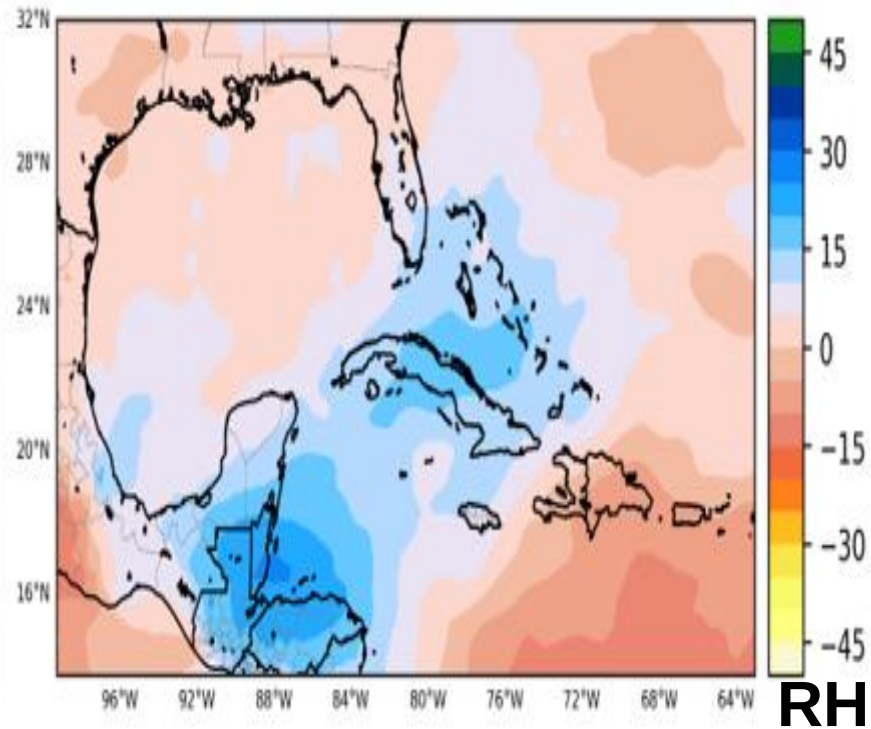
G



T



RH

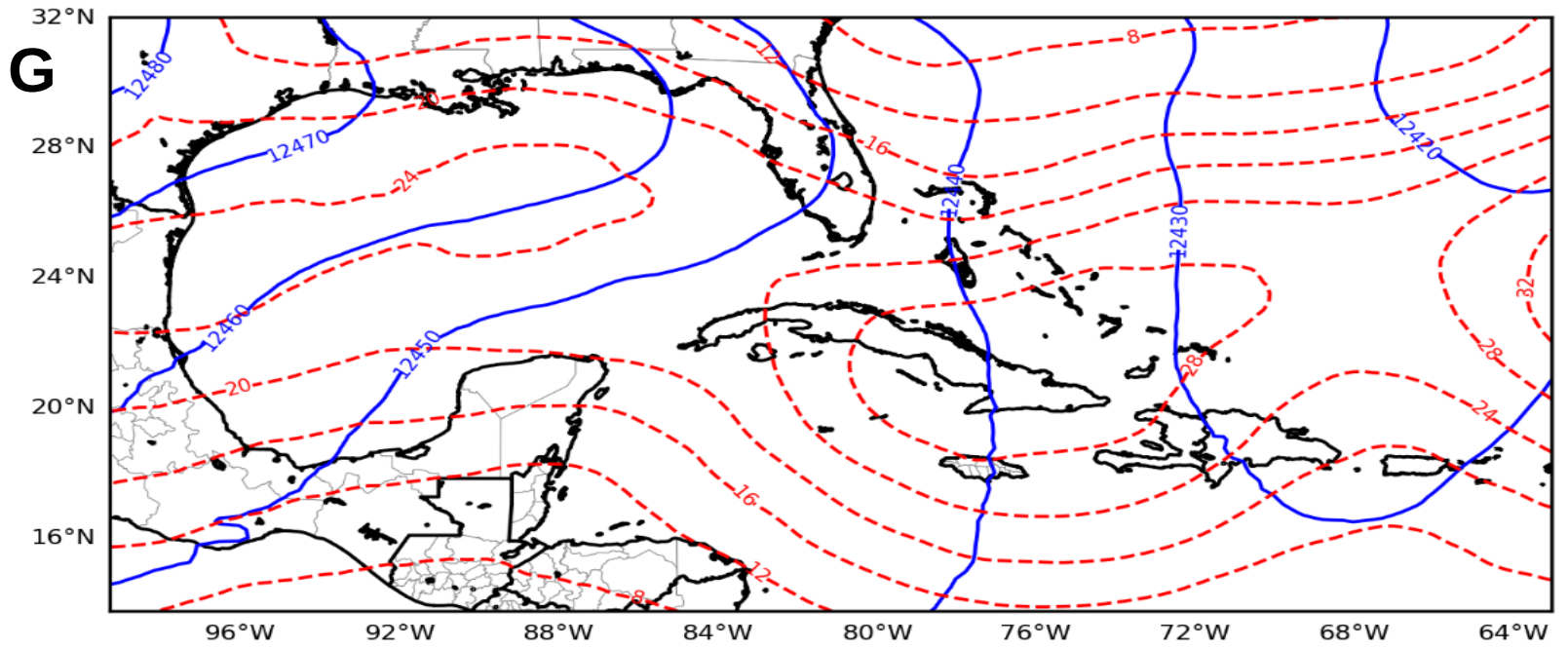


200 hPa

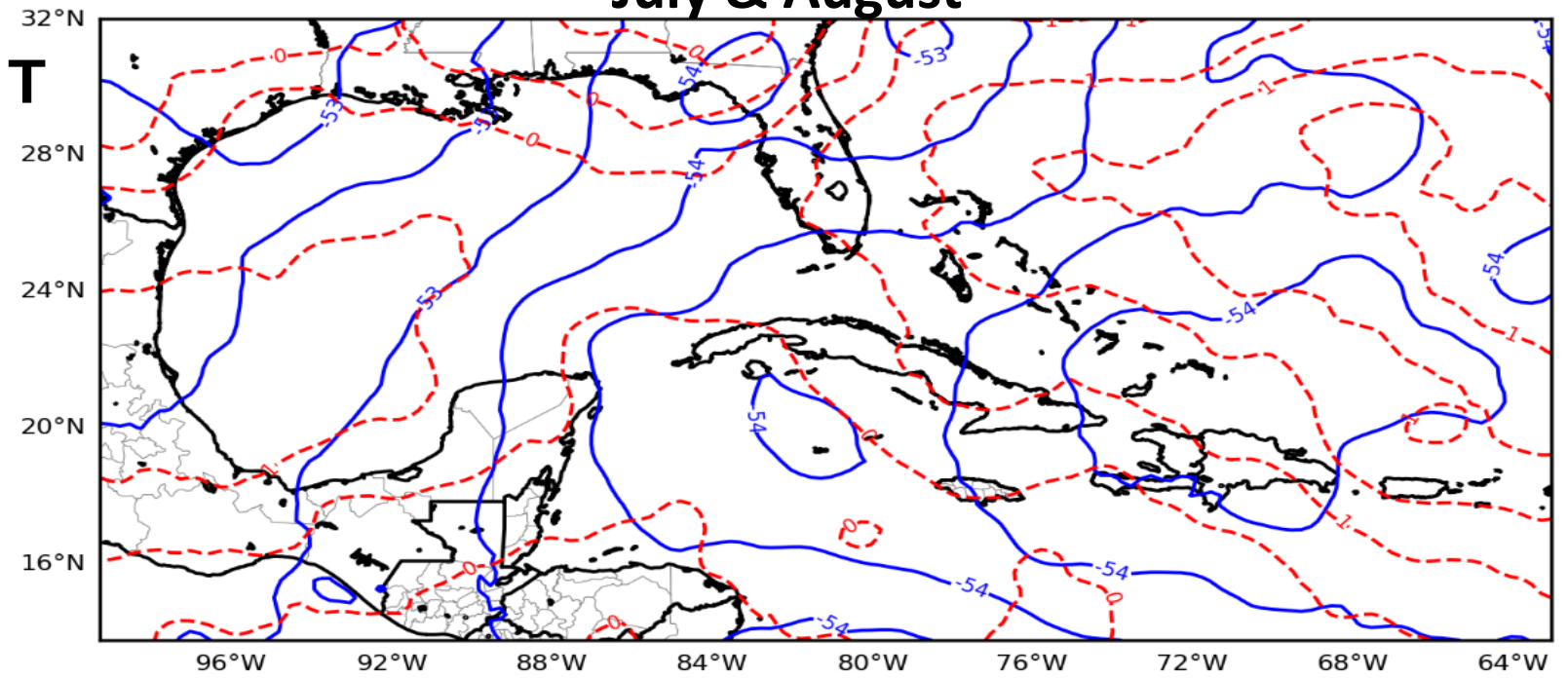
Slight increase of geopotencial values

TUTT contraction, fundamentally in the tropical zone

Southerly shift of the cold core



July & August

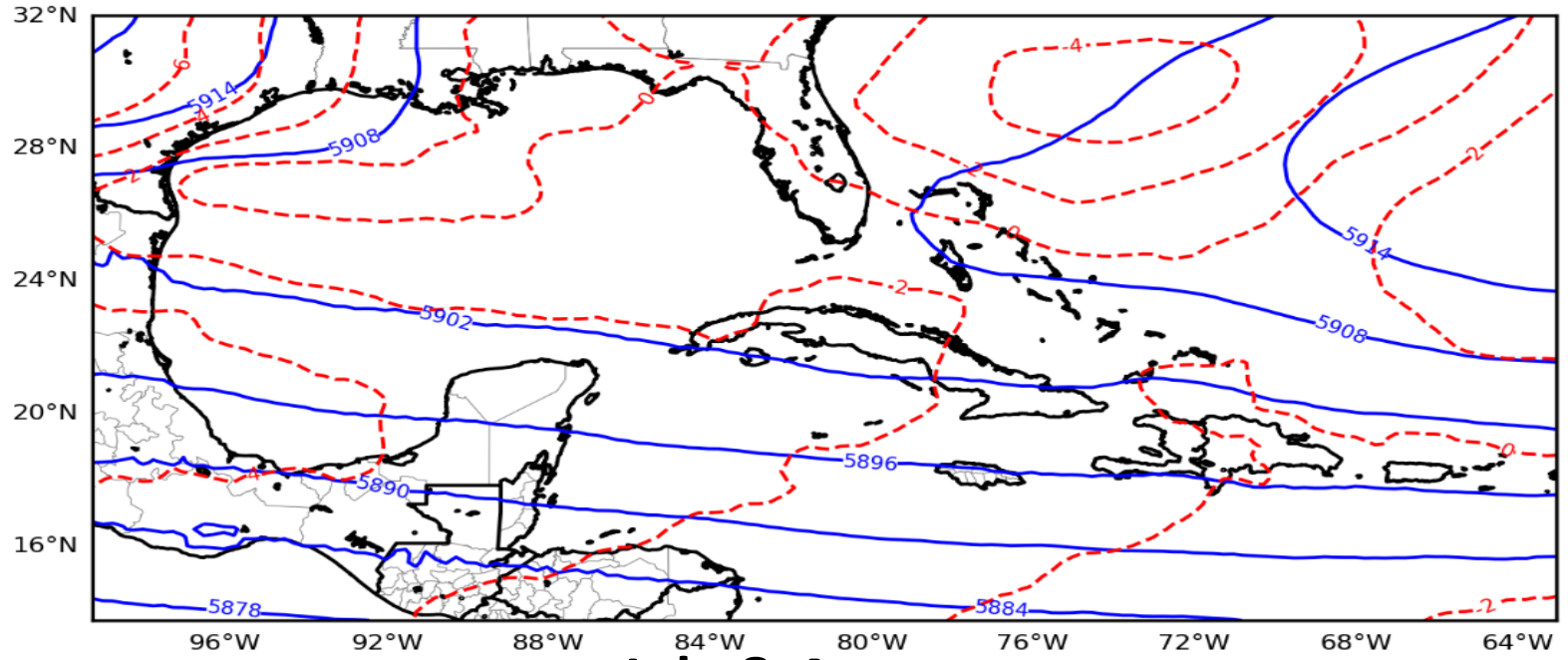


era5

Anomalies

Lower anomalies values

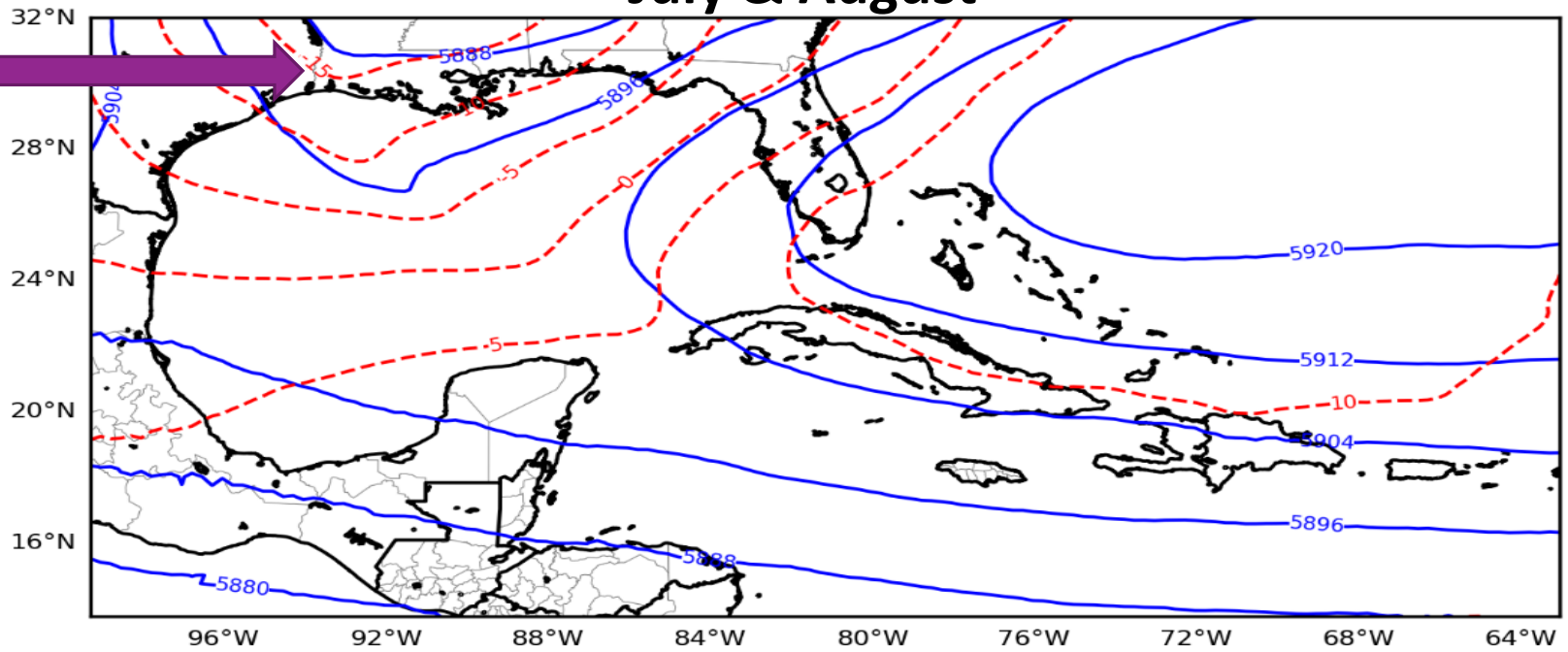
The belt of high geopotential values persists



July & August

Negatives Values

Trough zone



Lower & middle levels

Anomalies

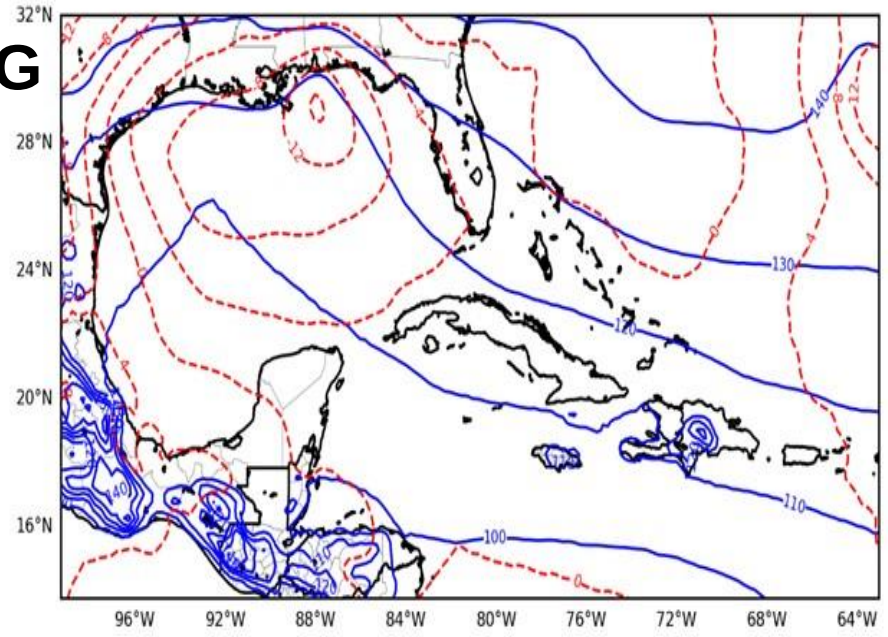
Negatives anomalies values close to Gulf of Mexico.

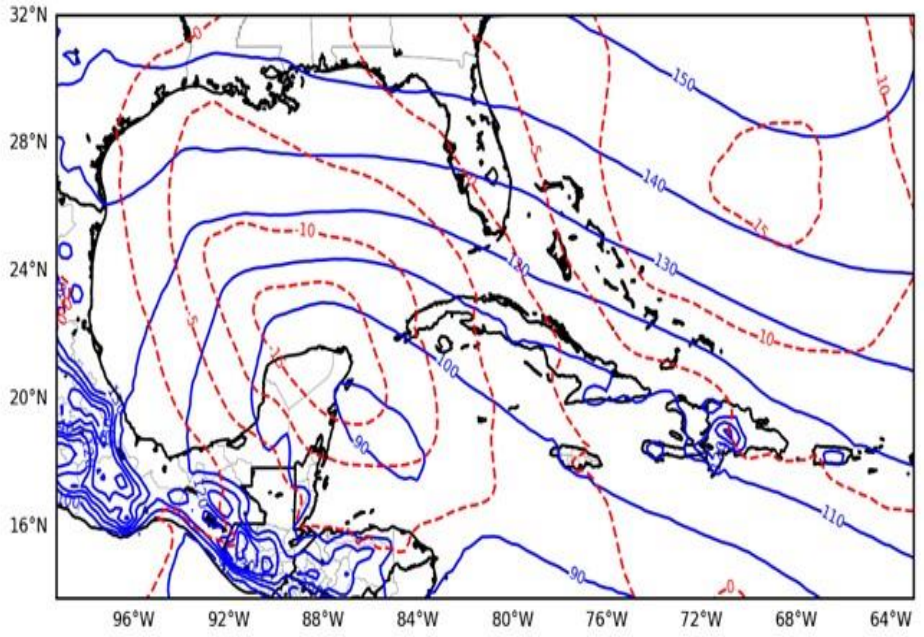
Weak winds

Barotropic atmosphere

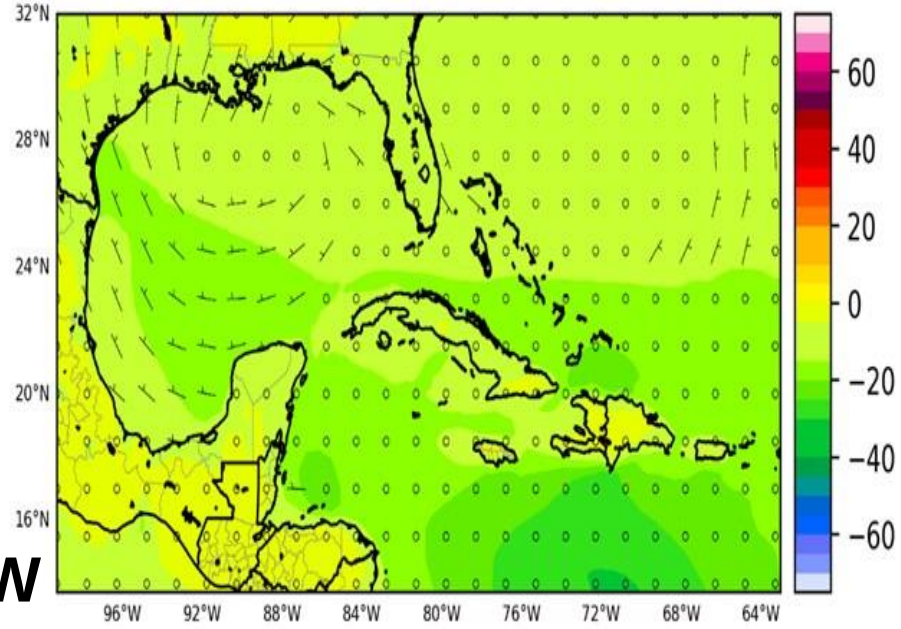
Tropical Cyclones

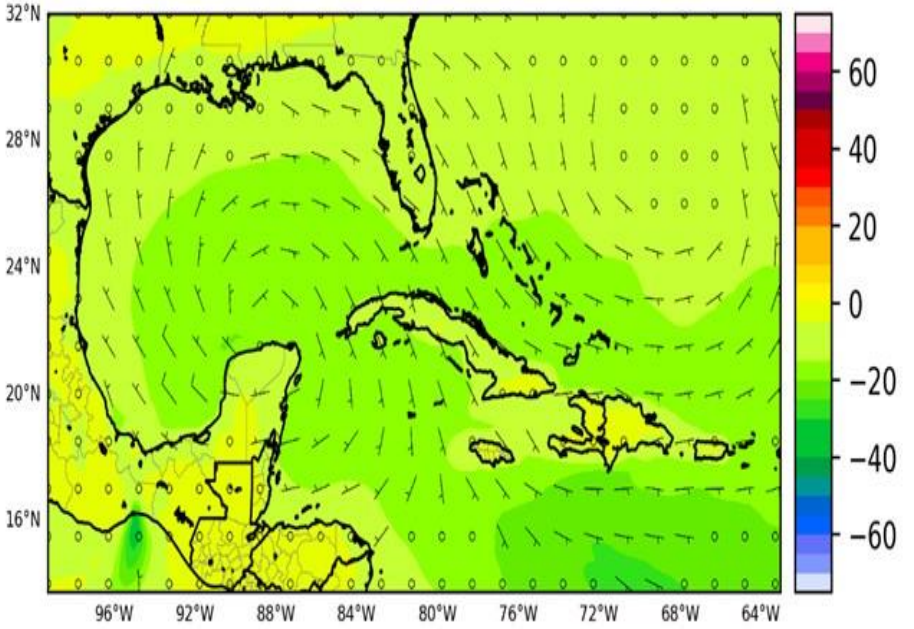
G





W





Anomalies **1000 hPa** **September y October**

The northern and southern domain borders contain the largest errors

May at 200 hPa

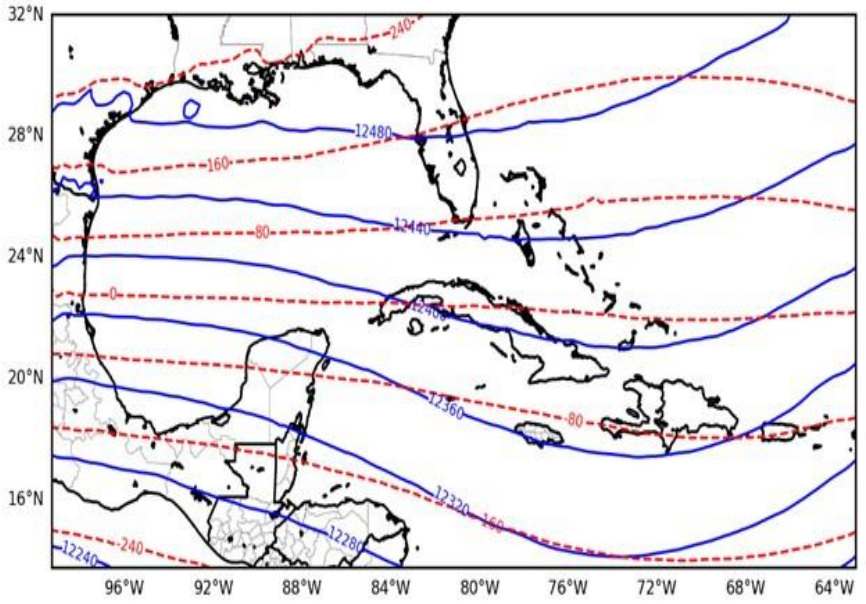
Greater gradients of the meteorological fields at north.

The interaction with the ITCZ is located south of the domain

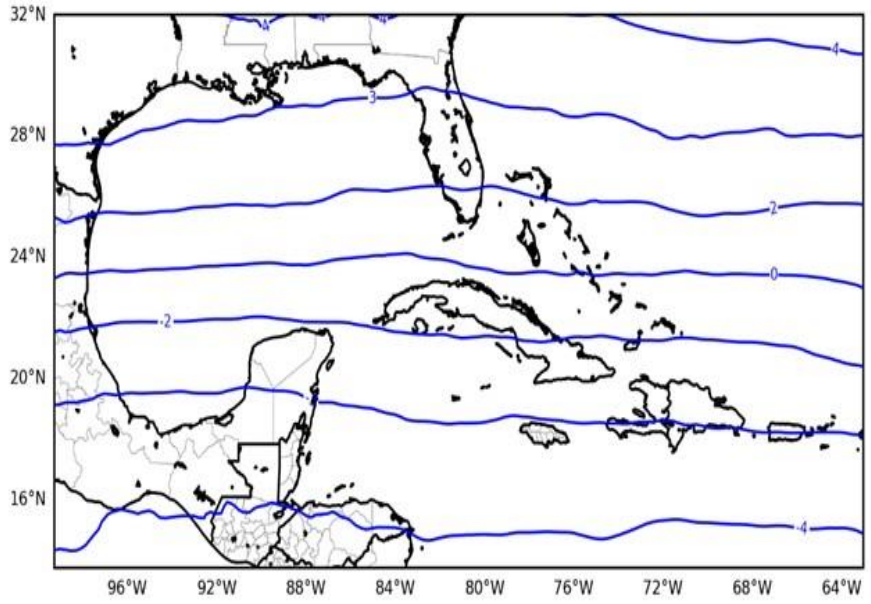
SisPI underestimates the baroclinic behaviours

Errors respect ERA5

G≈240 - 80 m^2/s^2



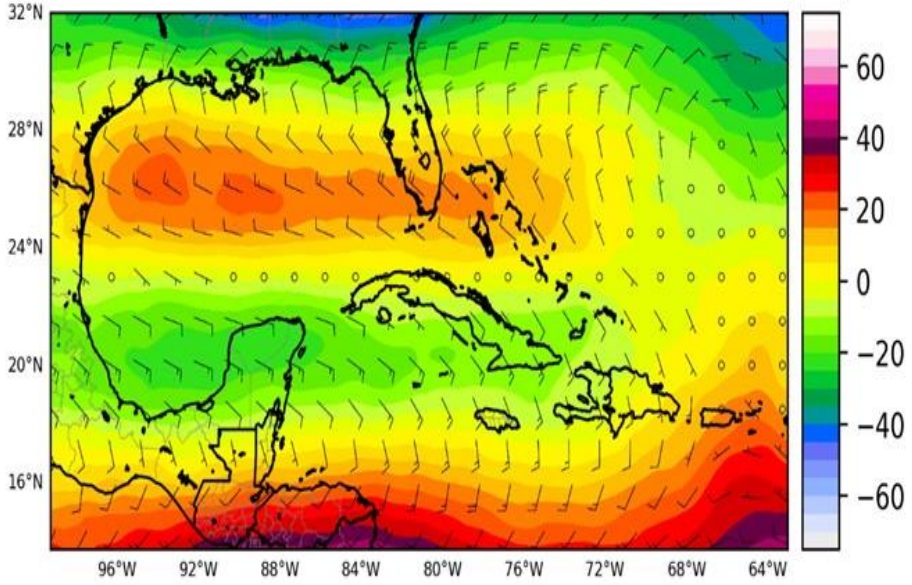
T≈2-4ºC



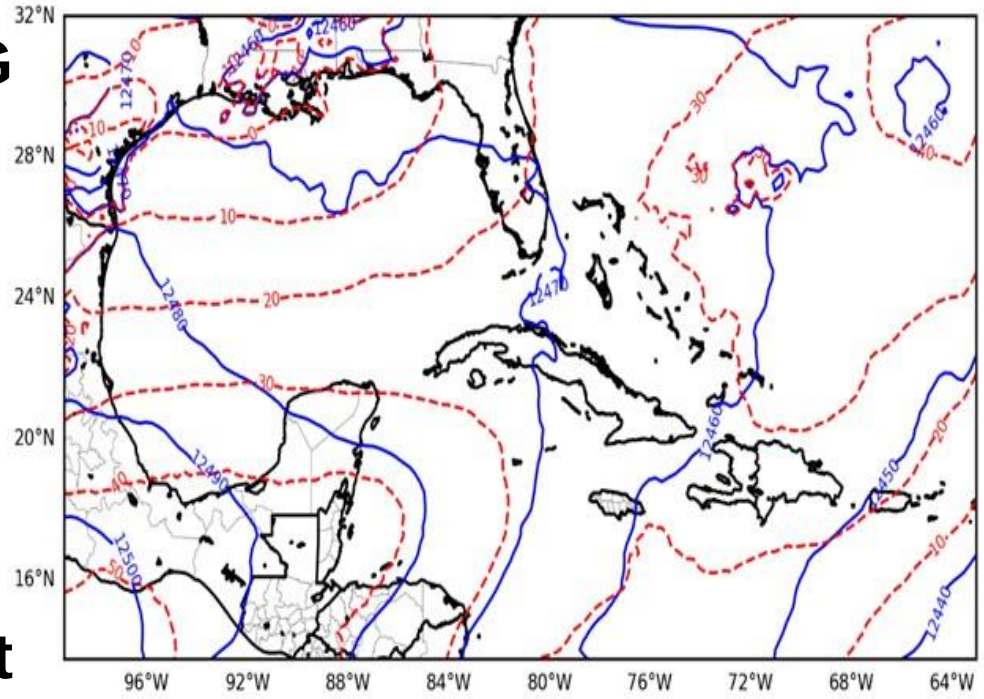
20-40 km/h

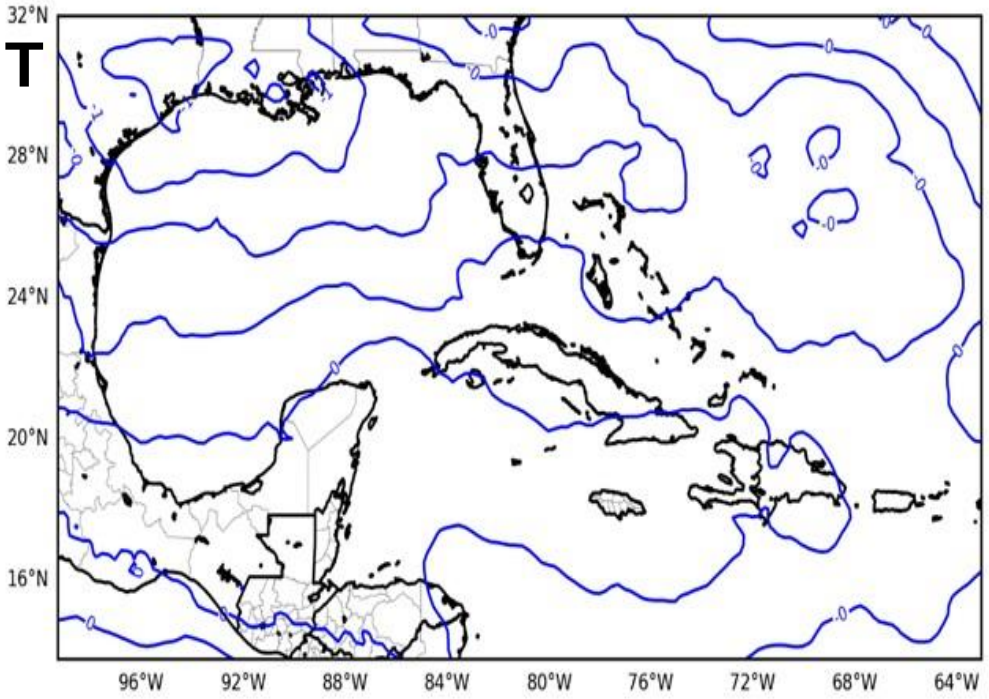
W

30-40 km/h



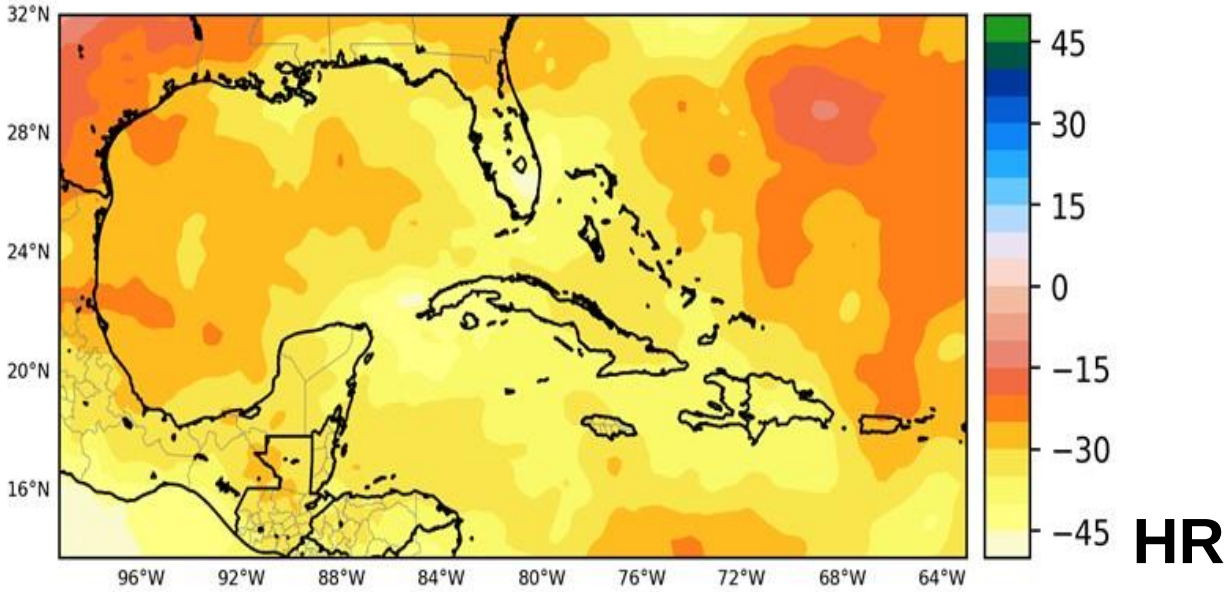
Progressively decreasing until reaching a minimum on July and begin to rise again from August





TUTT more compressed as a result of positive errors in geopotential field

Cold core region localized over Hispaniola



Errors respect ERA5

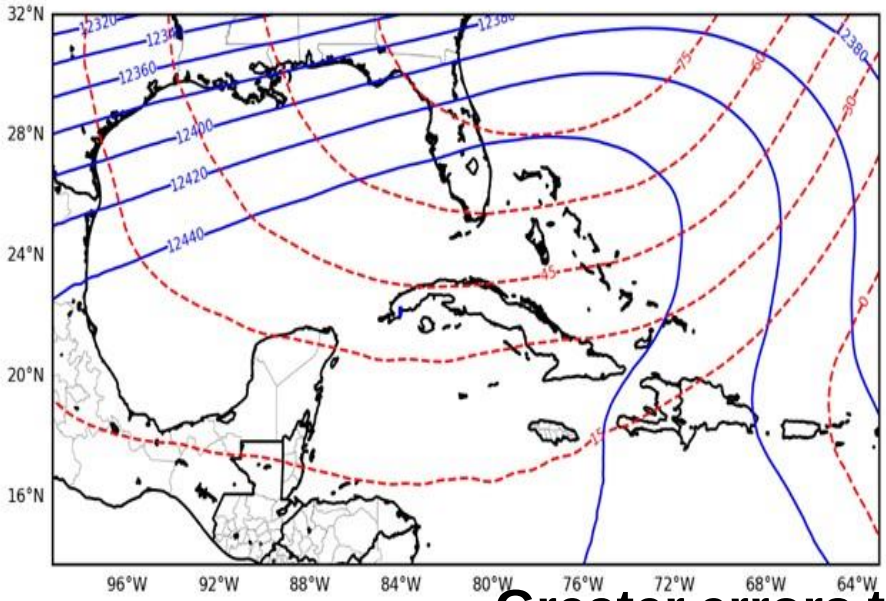
200 hPa June-August

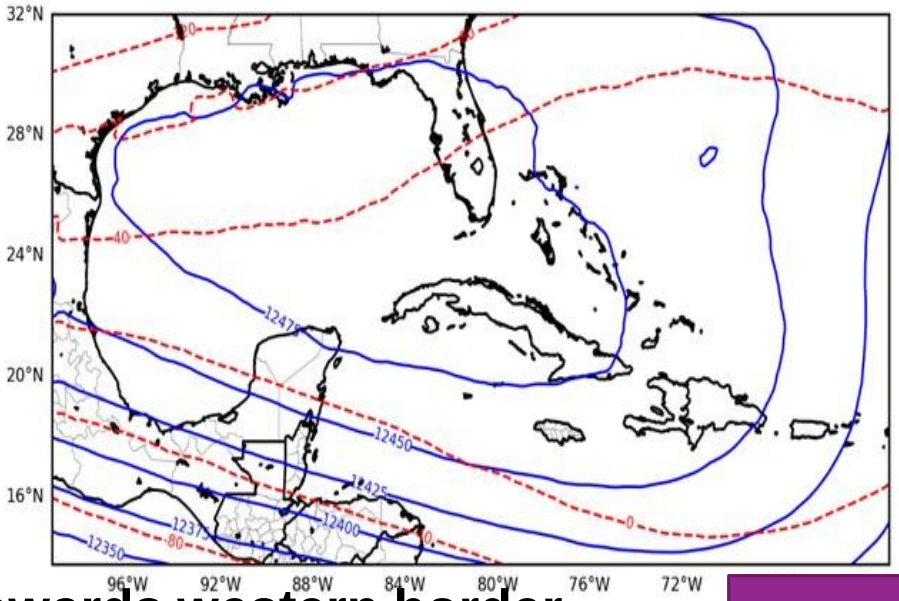
Errors gradually increase

September

October

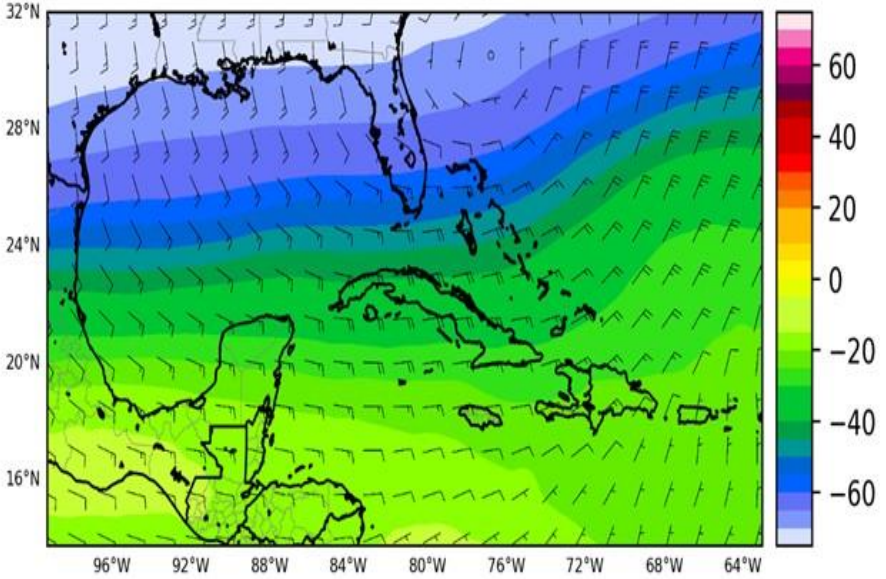
60 m²/s²

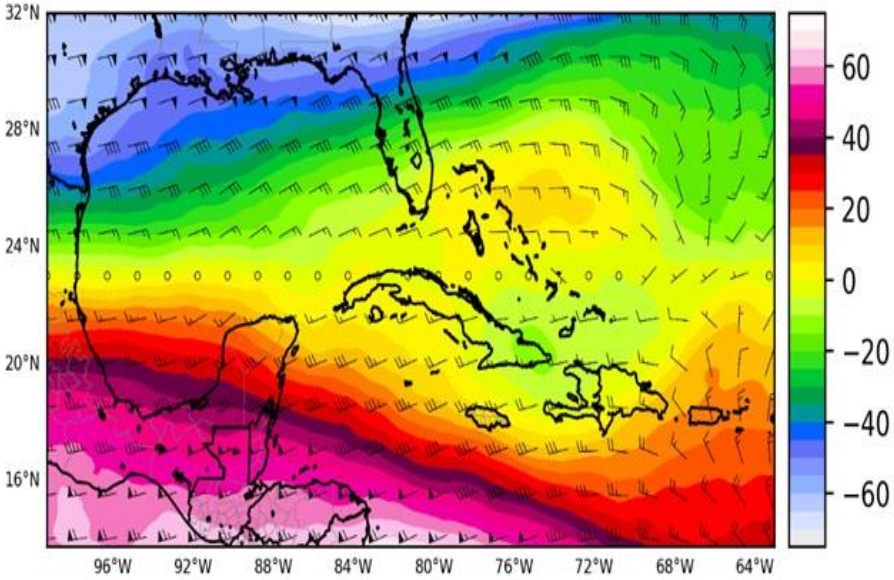




120 m²/s²

Greater errors towards western border





Deficiencies to represent the Mexican ridge

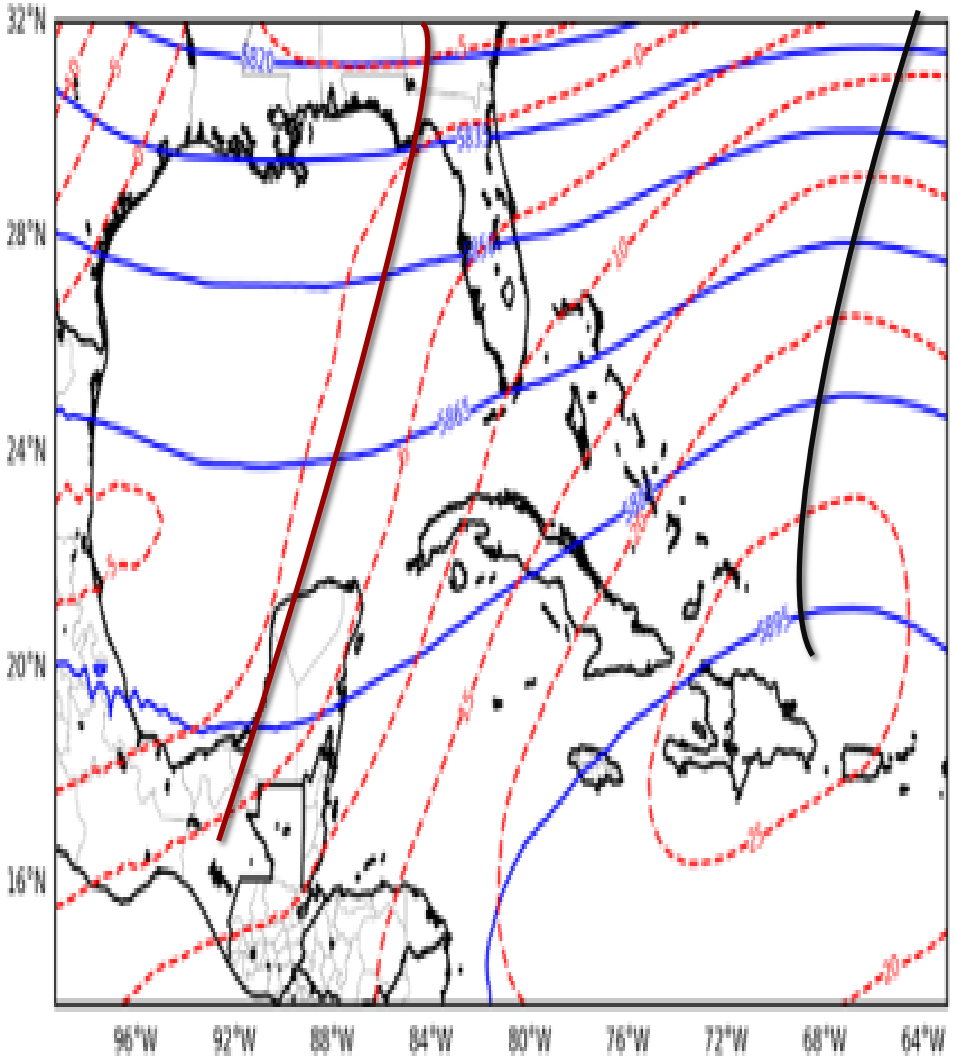
Errors respect ERA5

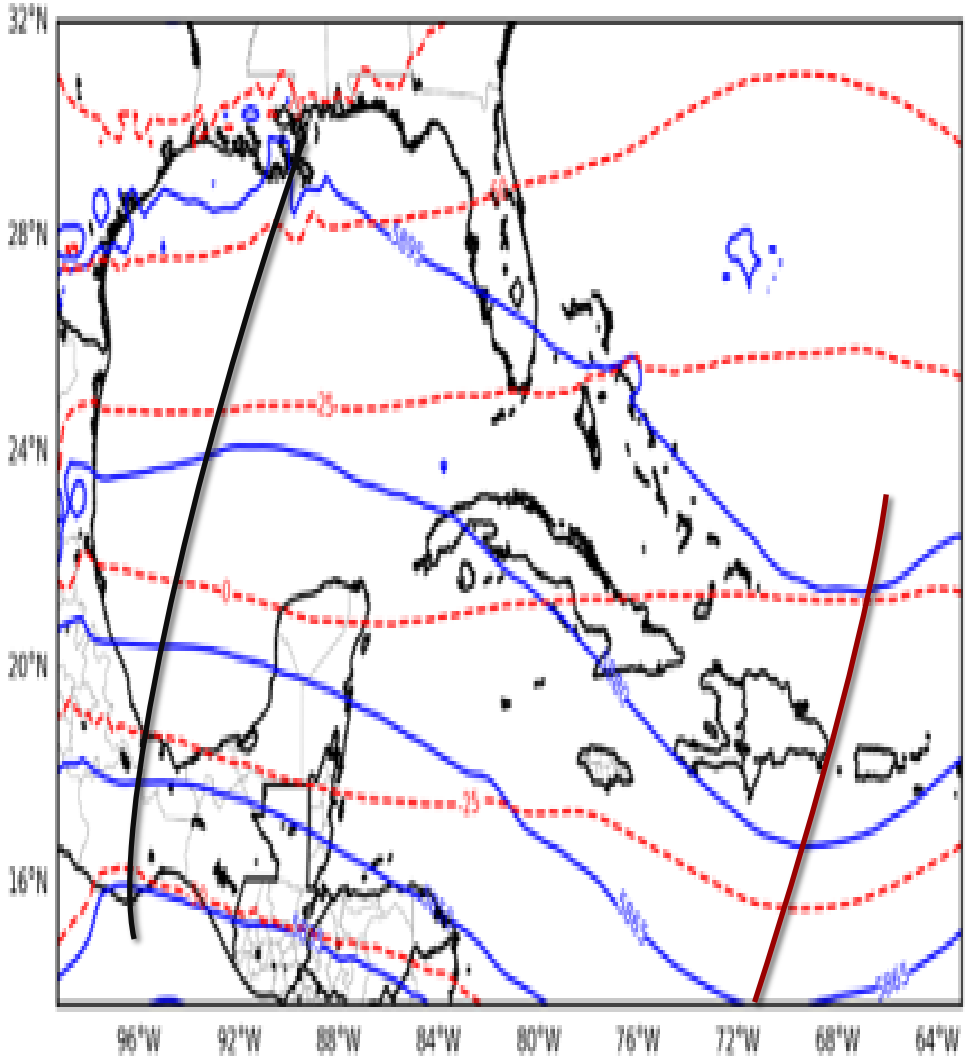
200 hPa

The synoptic flow representation is contrary to month average

Trough over Gulf of Mexico

Ridge to the eastern domain border





Ridge over Gulf of Mexico

Trough to the southeast domain border

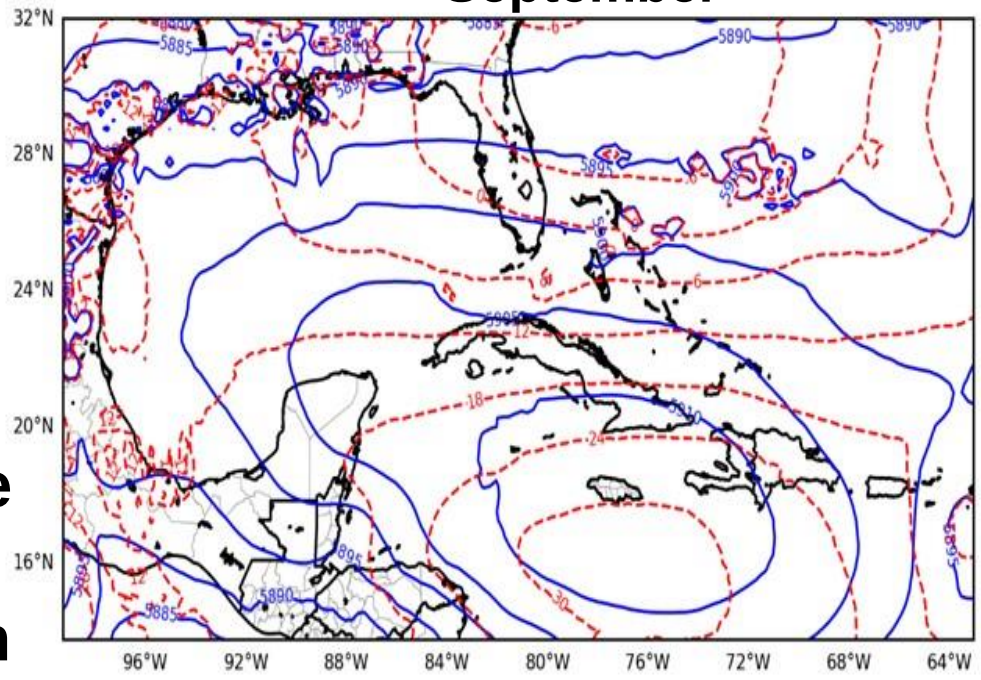
Errors respect ERA5

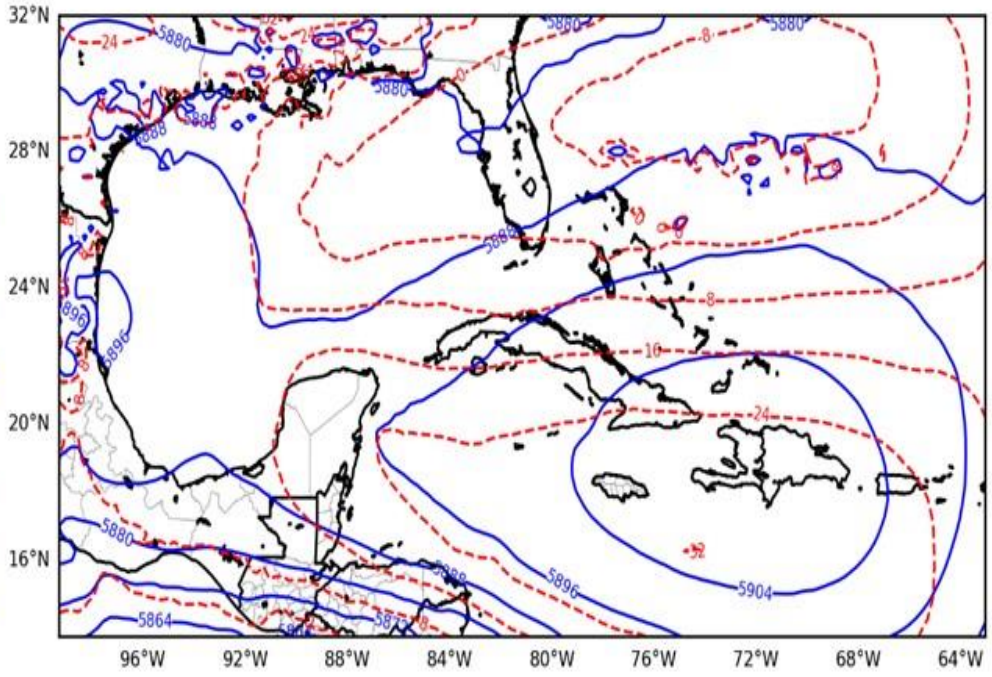
May 500 hPa

500 hPa

September

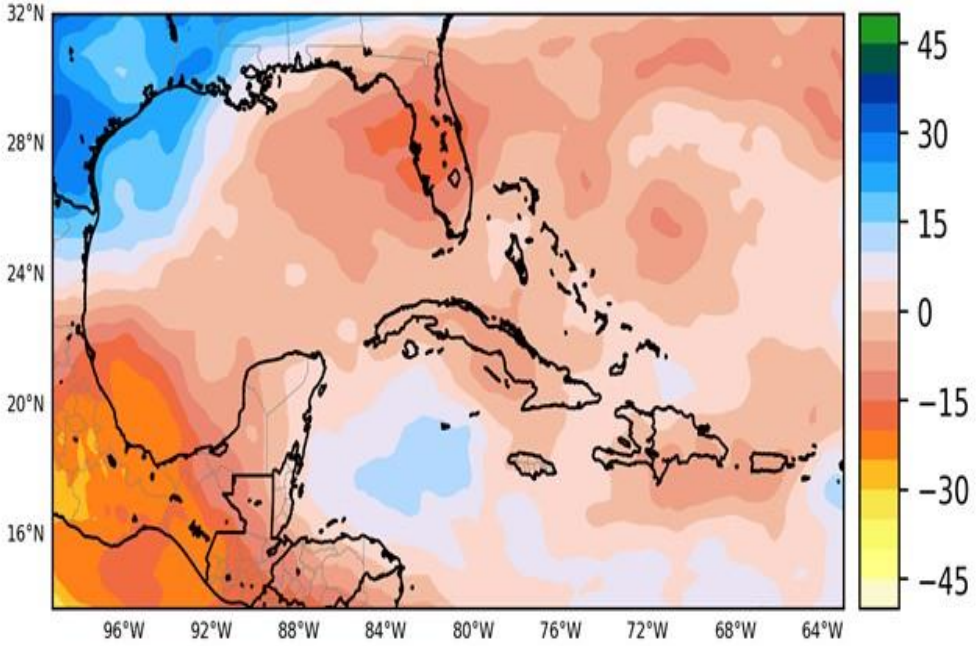
October

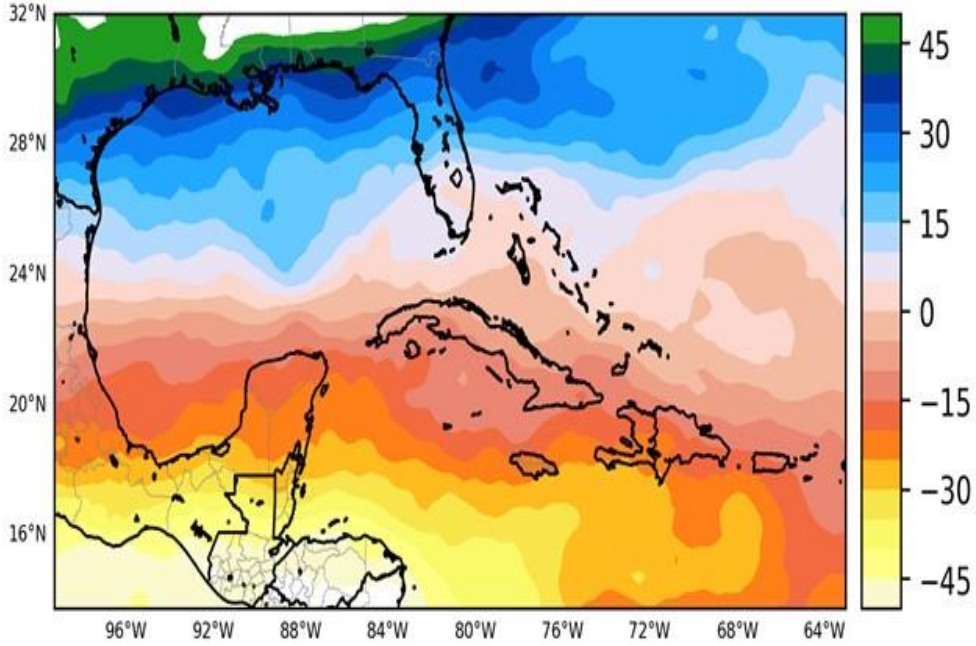




Negative errors were observed north of Antilles and positive in the central and eastern Caribbean Sea

Change of position at south of the subtropical and Mexican ridges



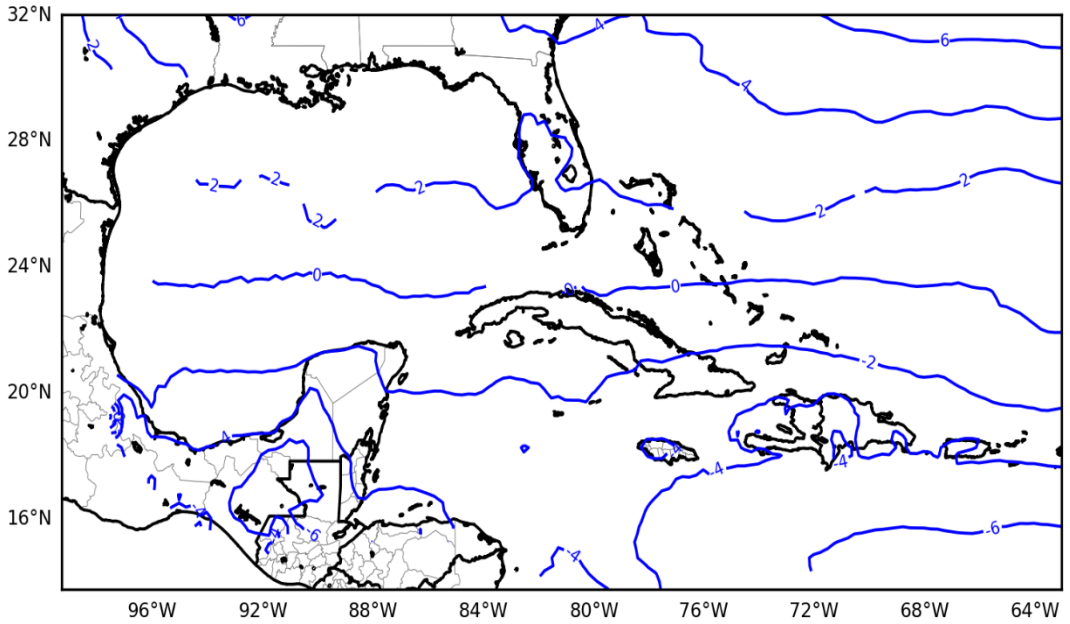


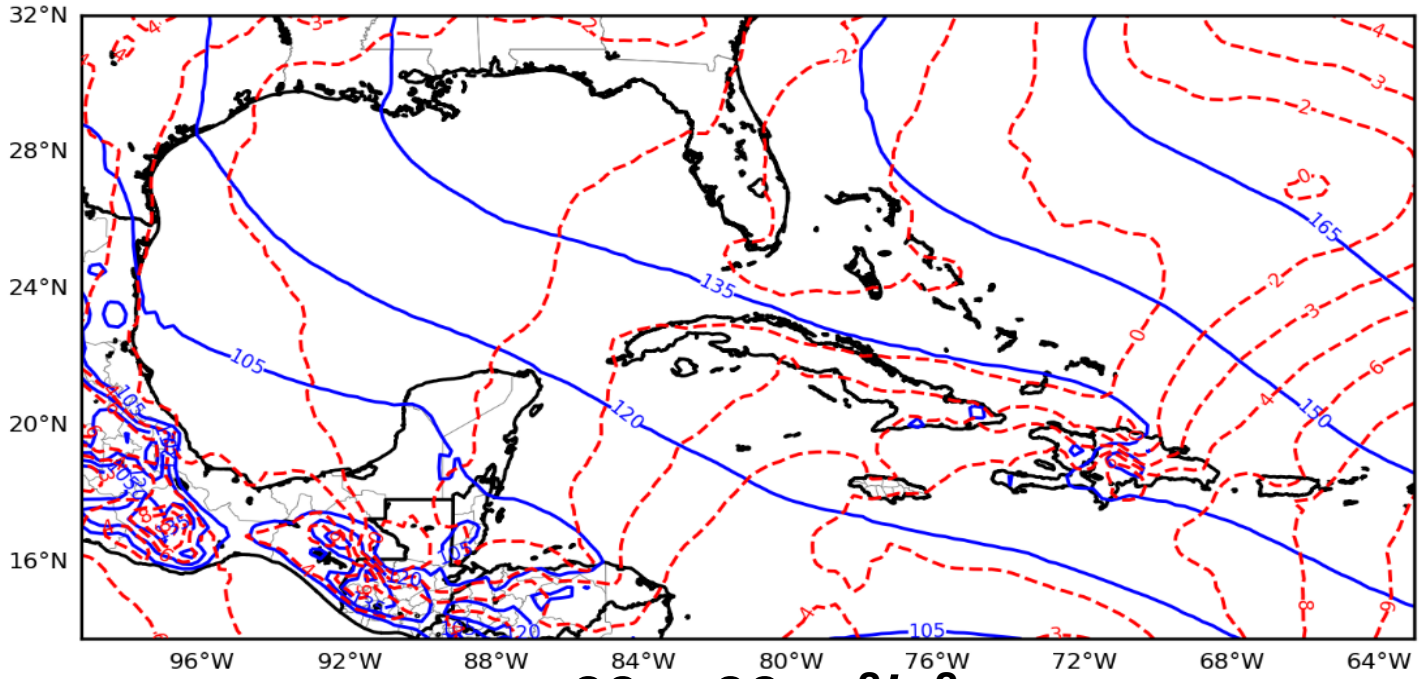
Errors

Contrary representation of synoptic flow

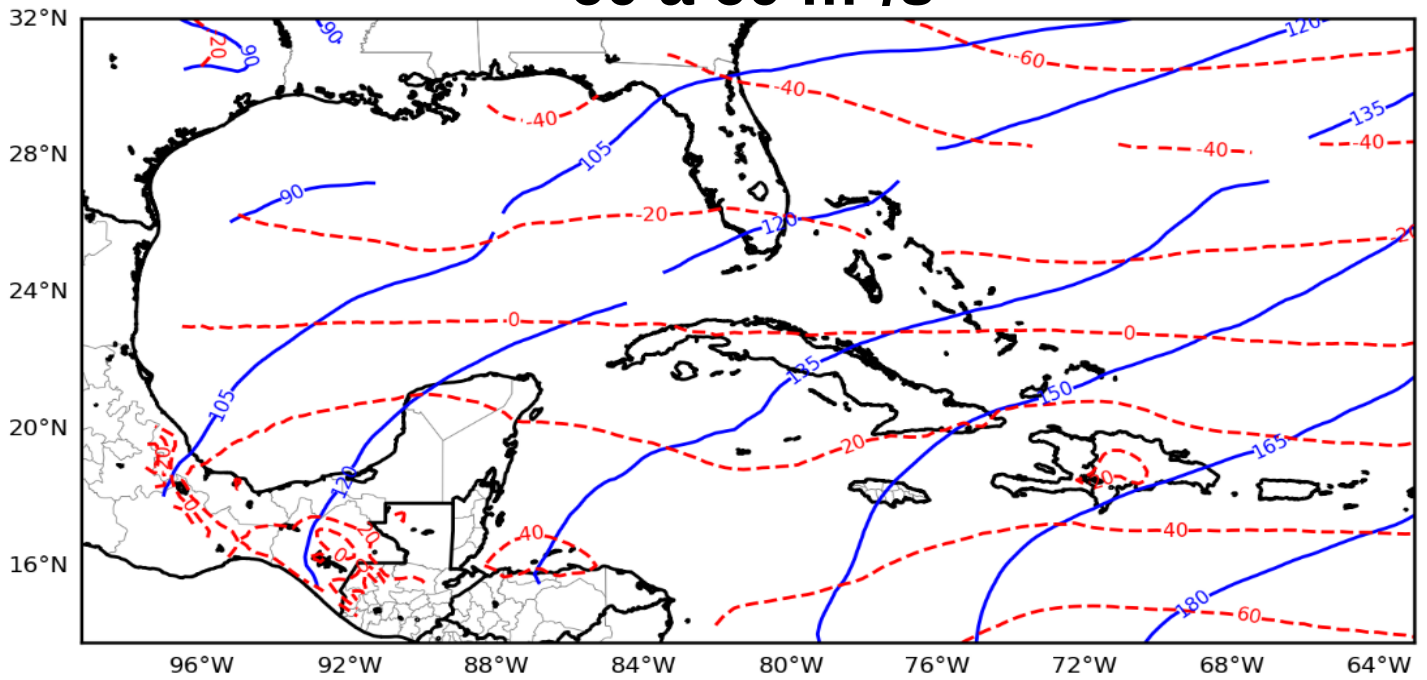
Change of position at south of the subtropical ridge at surface

-6 a 6ºC





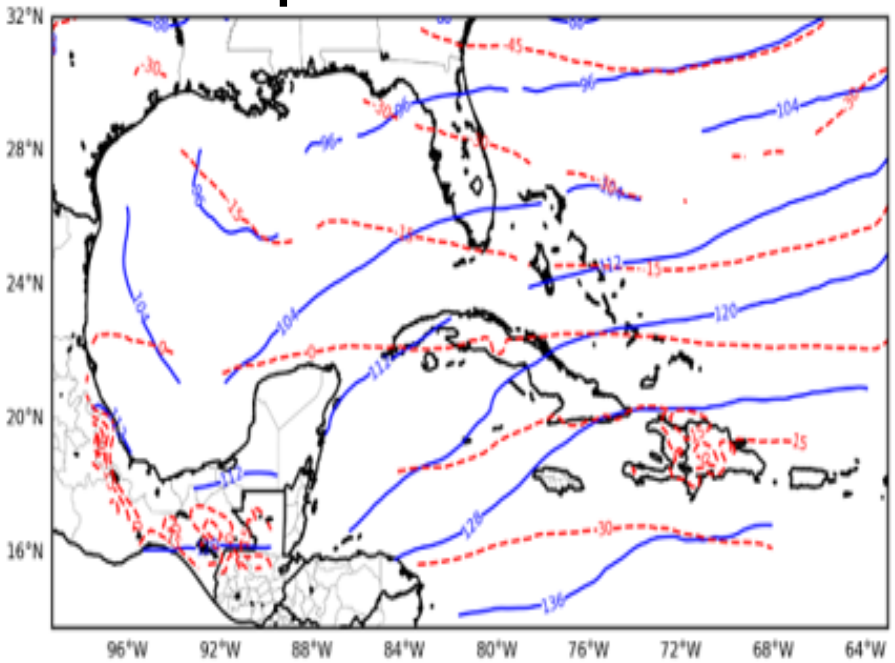
-60 a 60 m²/s²

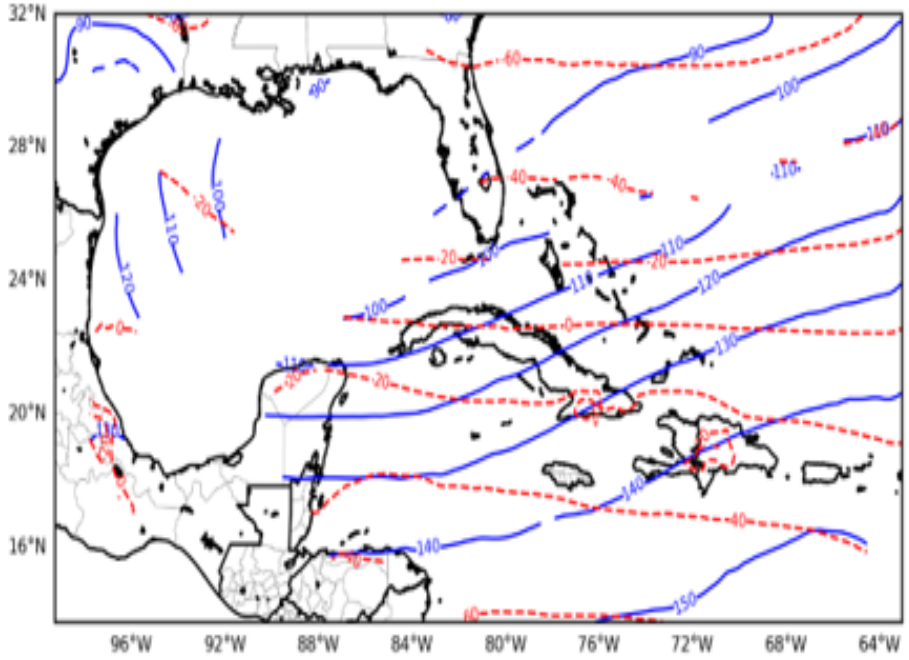


Errors **1000 hPa May**

Septiembre

Octubre





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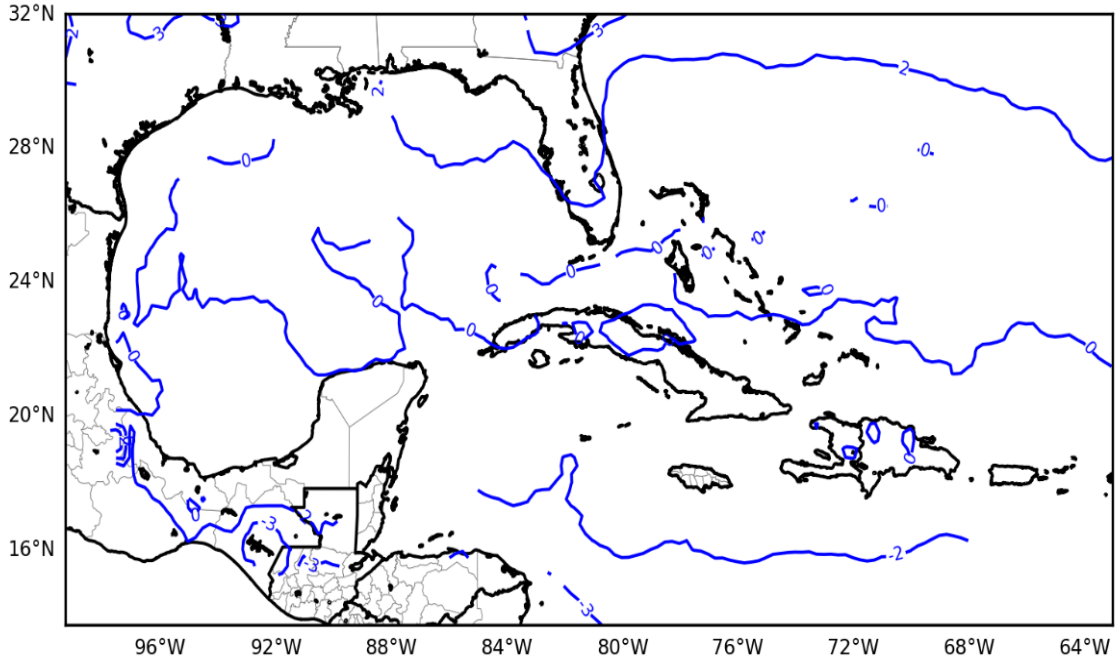
Geopotencial Errors increase

Contraction of the anticyclonic ridge

Temperature overestimation towards the northern border



Errors respect ERA5

1000 hPa

1. **SisPI tends to locate high geopotential areas south than its real position, which that produces modifications in synoptic flow.**
2. **Because of the deficiencies of SisPI to represent the correct position of the North Atlantic subtropical anticyclone , it tends to forecast a drier tropospheric column compared to the actual.**
3. **The northern and southern domain borders contain the largest errors, mainly at north, where, according to anomalies obtained in 2020, a baroclinic zone tends to be generated, which creates an additional noise on said border. At south it is on segments of the ZIC, which can also be the reason for additional model error sources.**

Conclusions

4. **The behavior of SisPI errors presents a maximum in May, then descends until reaching a minimum in July, rising again until reaching a second peak in October, which does it is less than the first month of the wet season. Corroborating that the mixture present in the transition months is very difficult to represent by the model.**

5. **The main errors seem to be more associated with their own configuration that with the anomalies obtained with respect to the decadal mean of the wet season analyzed.**

Conclusions

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Thanks a lot!

Analysis of SisPI performance to represent the North Atlantic subtropical anticyclone

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