

Working Group 1: Tropical Systems

Francisco Argeñal, Alberto López, Jay Campbell, Alejandro del Castillo
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Climate Change Impact in Tropical Cyclones for Mesoamerican and Caribbean Regions

1.- Introduction

2.- Objectives

3.- Primary physical parameters discussion for cyclones genesis

4.- Numerical models with WFR

5.- Methodology for the evaluation of climate change impact for Mesoamerican and Caribbean regions

6.- Analysis of results

7.- Commentaries and Conclusions

8.- Annexes of Graphics

Methodology (from first meeting...)

Step 2 Catalogue all Tropical Systems that occurred historically within the domain of interest.

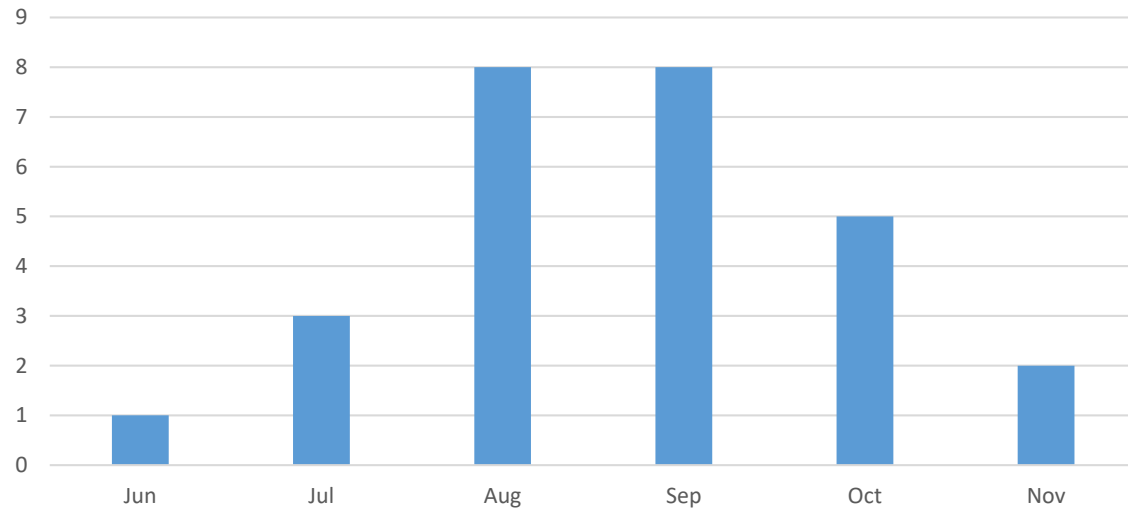
- Sub-divide the storms into Atlantic and Pacific occurrences.
- For each domain
- For each basin (Atlantic and Pacific)
- Select the highest intensity Tropical System for each year of the period of interest.
- To facilitate detection in tropical step 4 the storm must exist within domain of interest for approximately 48 hours.

Methodology

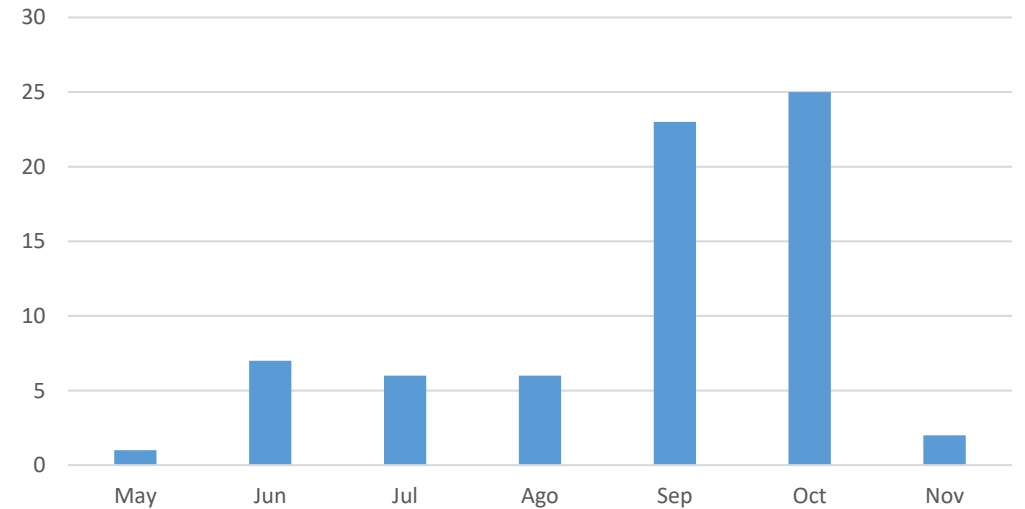
- Attempt to identify individual TC's identified in Step 2.
- For each Domain. (Gualdi et al. 2008)
- We assume that a model TC is active over a certain gridpoint A if the following conditions are satisfied:
- in A, relative vorticity at 850 hPa is $>3 \times 10^{-5} \text{ s}^{-1}$; there is a relative minimum surface pressure and wind velocity is $>14 \text{ m s}^{-1}$ in an area of **2.25°** around A; **(metric to be adjusted for each domain)**
- the wind velocity at 850 hPa is $>$ wind velocity at 300 hPa;
- the sum of temperature anomalies at 700, 500, and 300 hPa is $> 2^{\circ}\text{K}$, where the anomalies are defined as the deviation from a spatial mean computed over an area of **13 grid points in the east–west and 2 grid points in the north–south direction**;
- the temperature anomaly at 300 hPa is greater than the temperature anomaly at 850 hPa;
- the above conditions persist for a period longer than 1.5 days.

Historic Impact of Hurricanes in Atlantic and Pacific Basins

Atlantic Direct Impact Frequency in Mexico
1981 - 2010



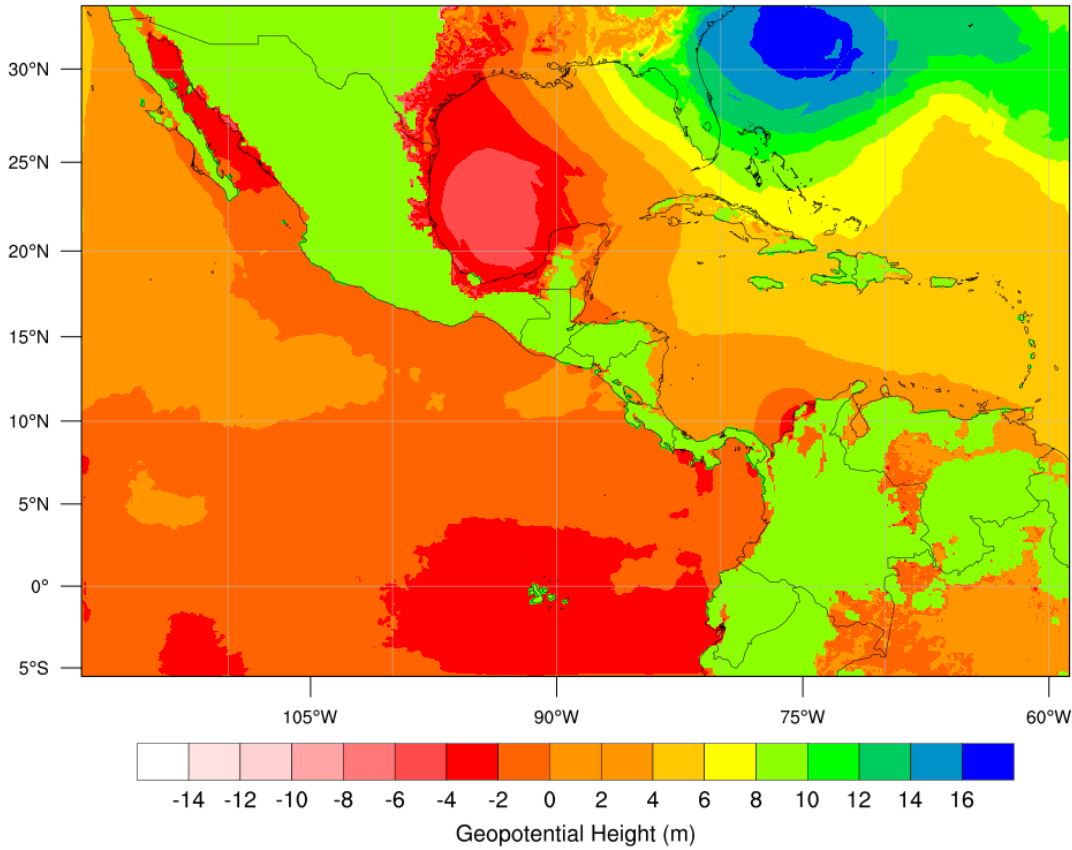
Pacific Direct Impact Frequency in Mexico
1981 - 2010



Changes in May

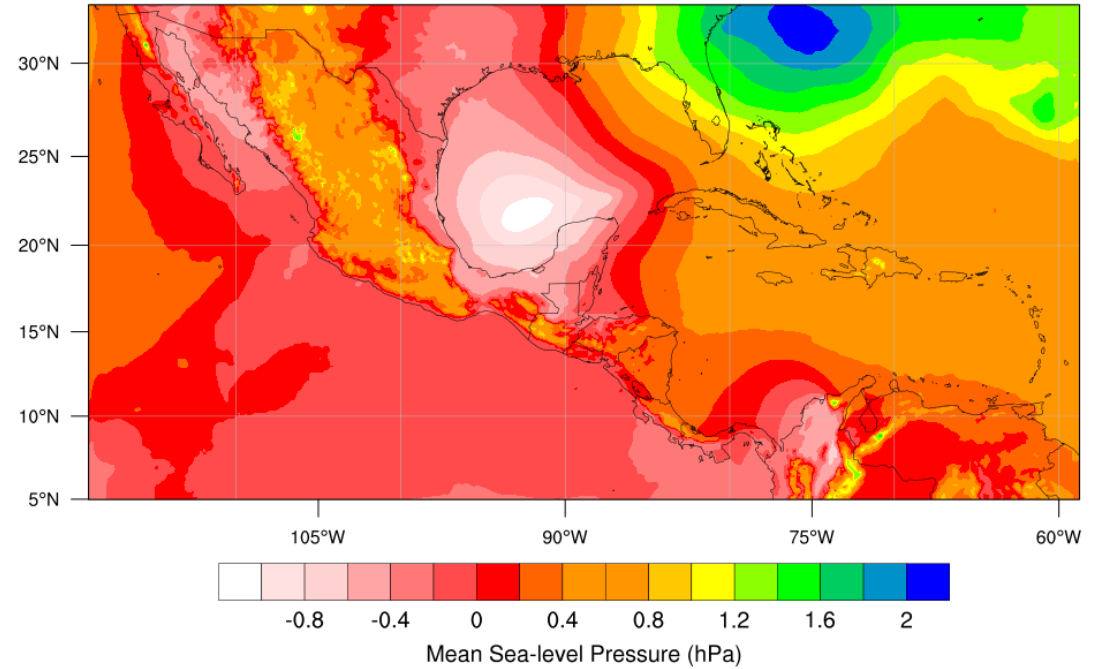
CCSM4 RCP8.5
May Projected Climatological Change

Fill: 1000hPa Geopotential Height (m)



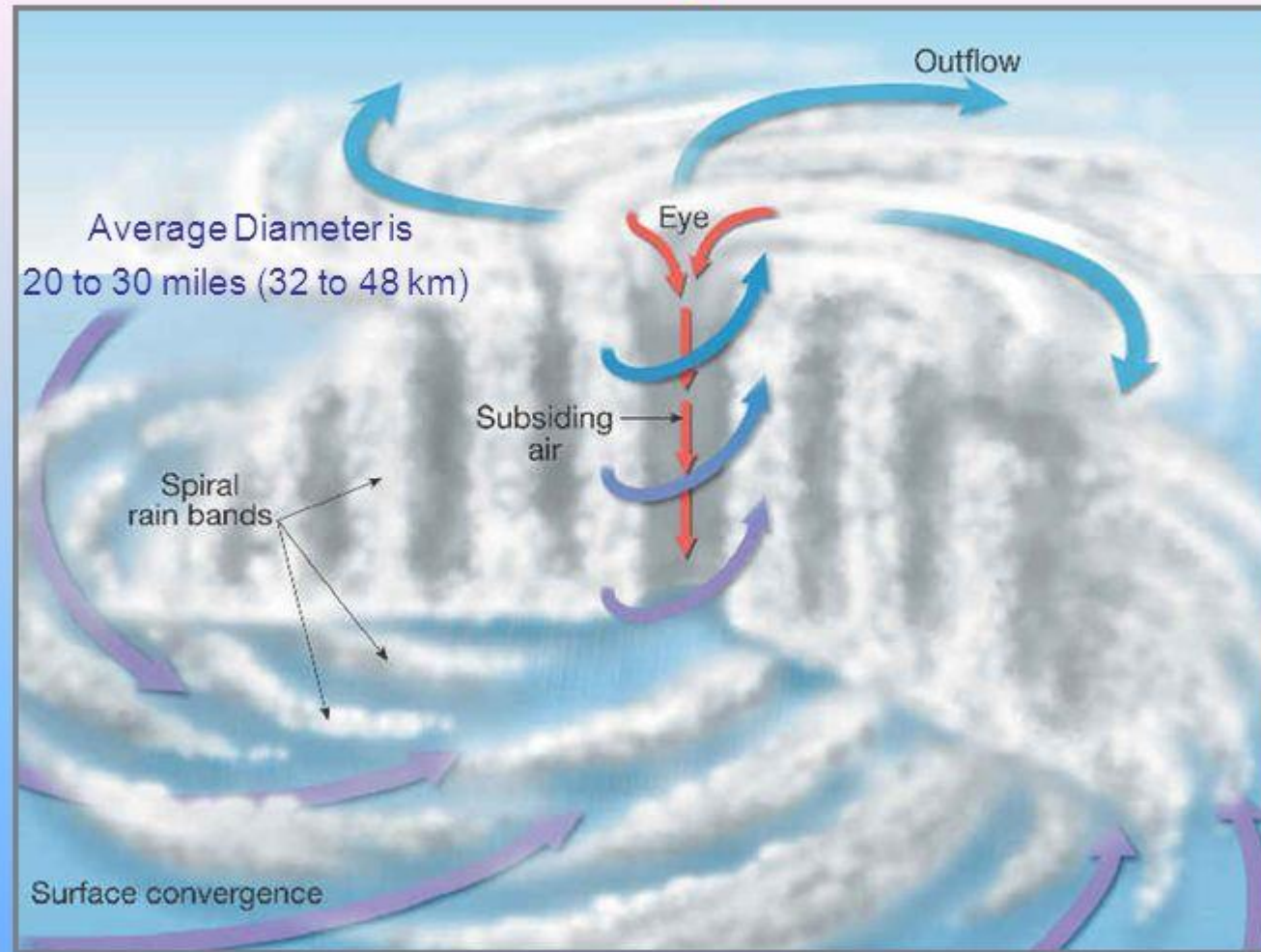
CCSM4 RCP8.5
May Projected Climatological Change

Fill: Mean Sea-level Pressure (hPa)



The Structure of a Hurricane:

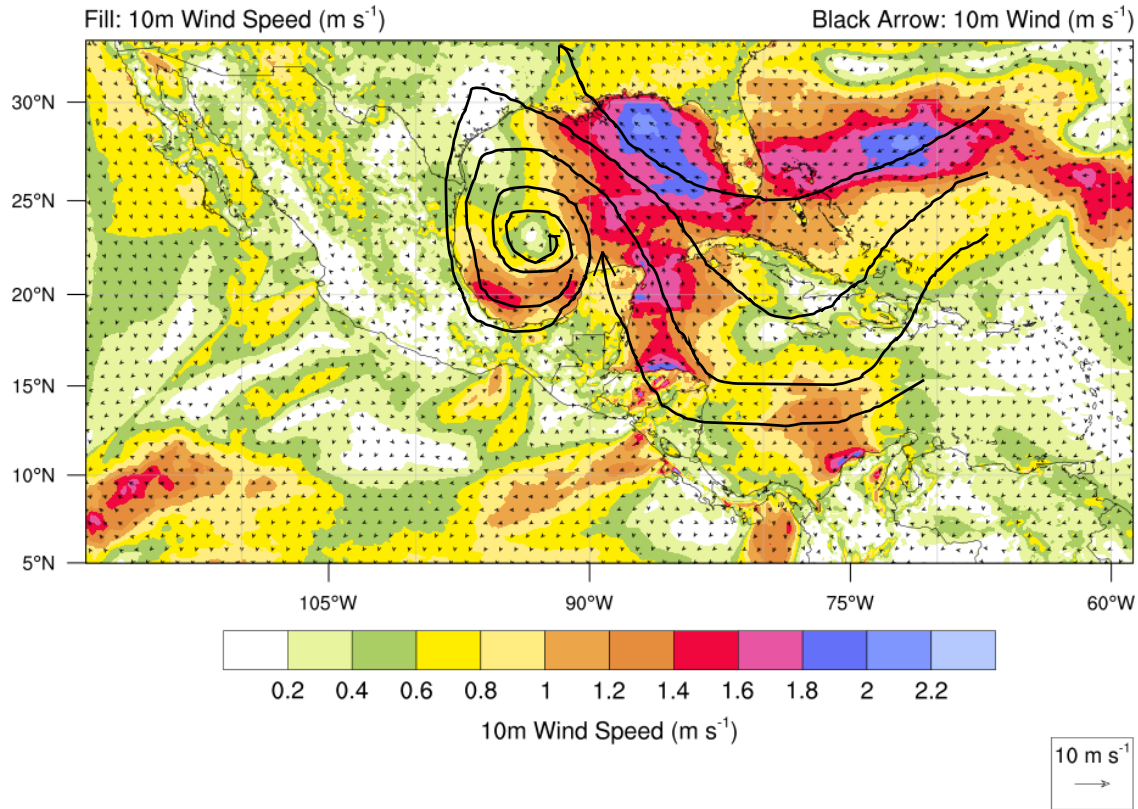
The Eye



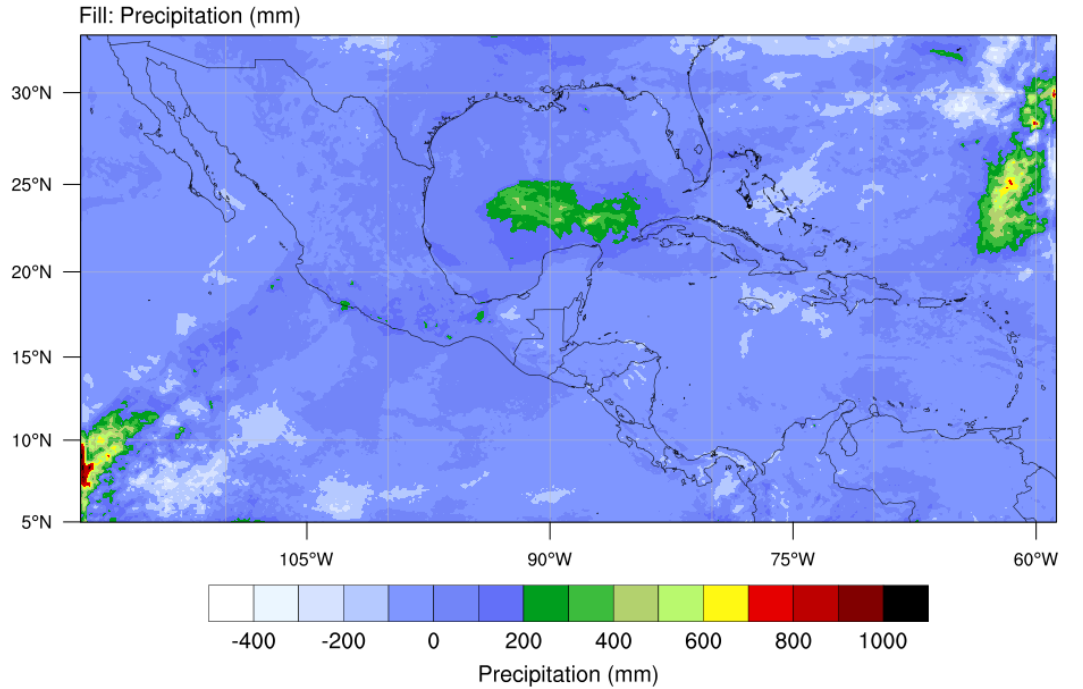
- A quasi-circular or quasi-oval region of light winds and skies that are clear to partly cloudy and free of rain.
- Caused by descending air that heats by compression, making it the warmest region of the storm.

Changes in May

**CCSM4 RCP8.5
May Projected Climatological Change**



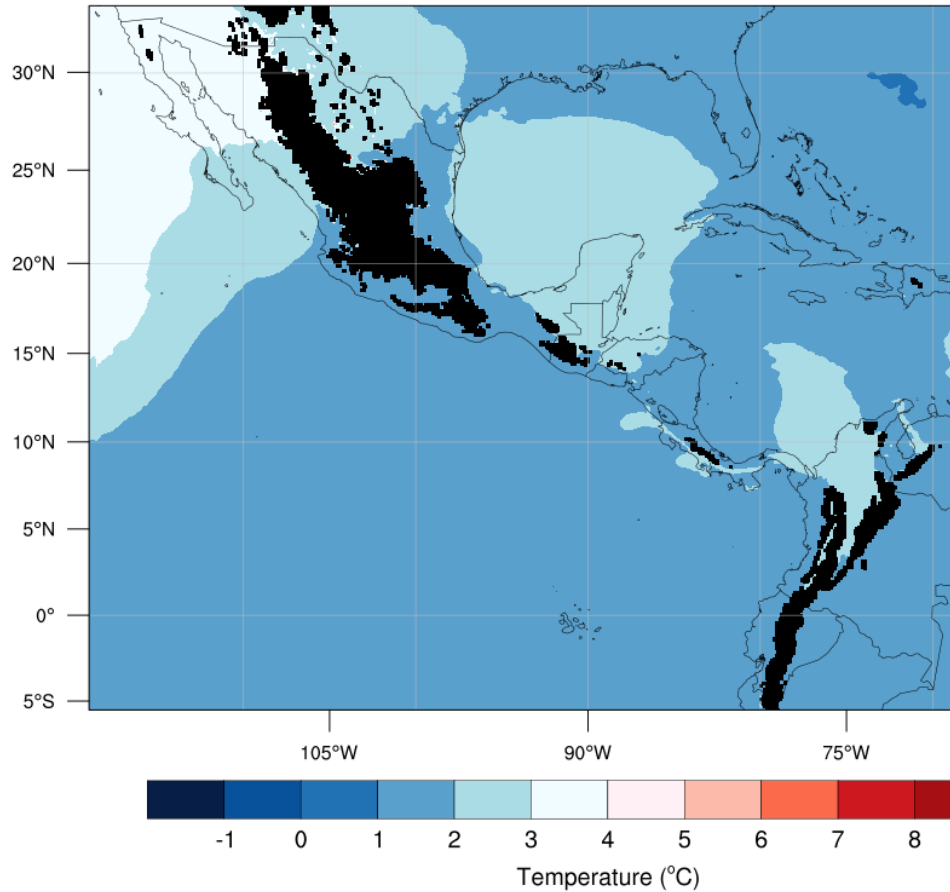
**CCSM4 RCP8.5
May Projected Climatological Change**



Changes in May

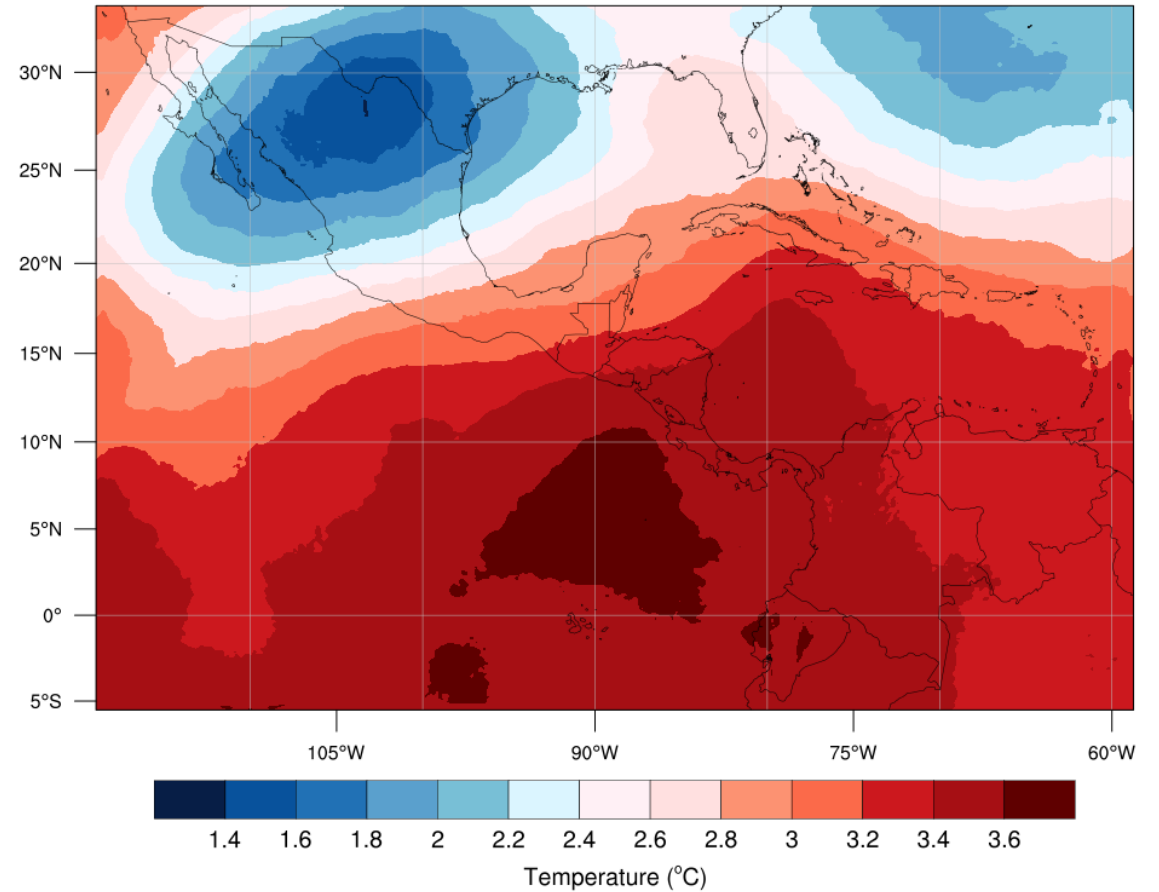
CCSM4 RCP8.5
May Projected Climatological Change

Fill: 850hPa Temperature (°C)



CCSM4 RCP8.5
May Projected Climatological Change

Fill: 300hPa Temperature (°C)

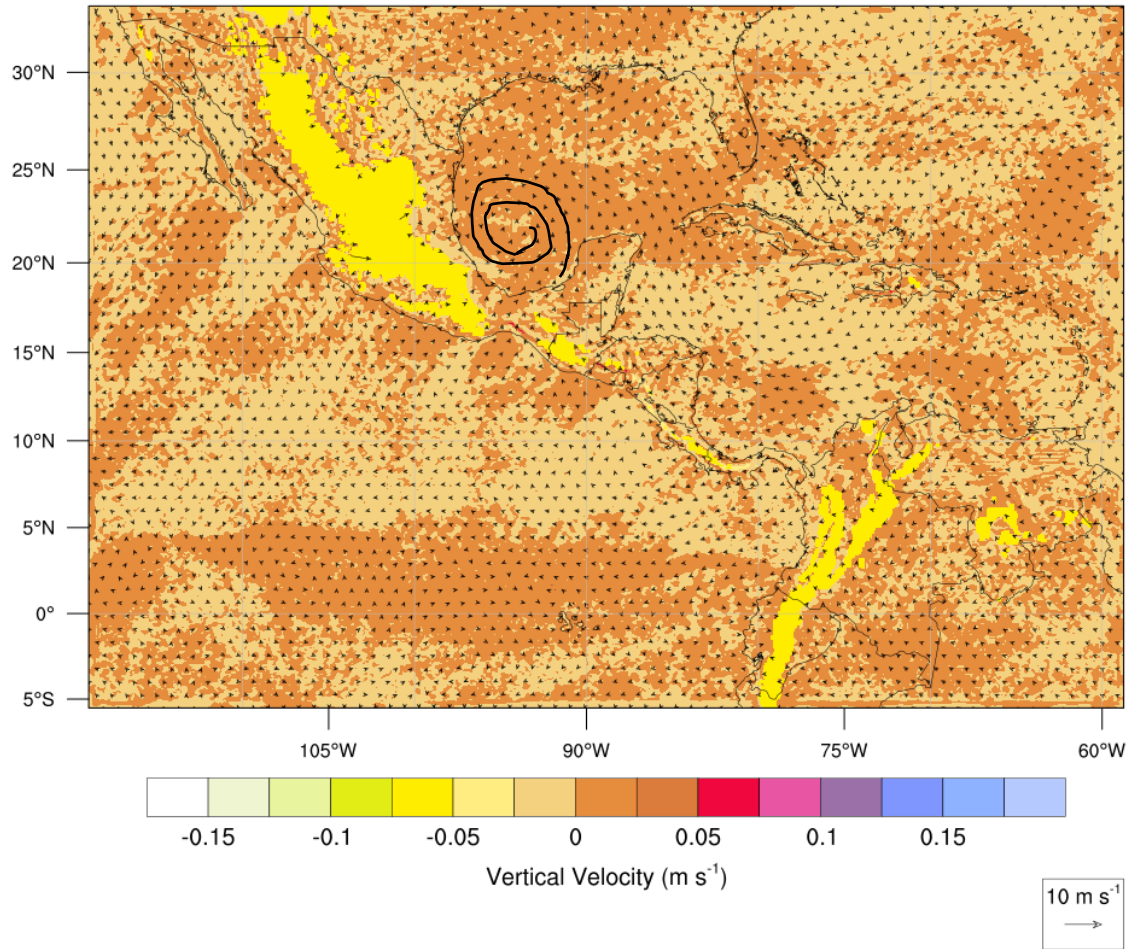


Changes in May

CCSM4 RCP8.5 May Projected Climatological Change

Fill: 850hPa Vertical Velocity (m s^{-1})

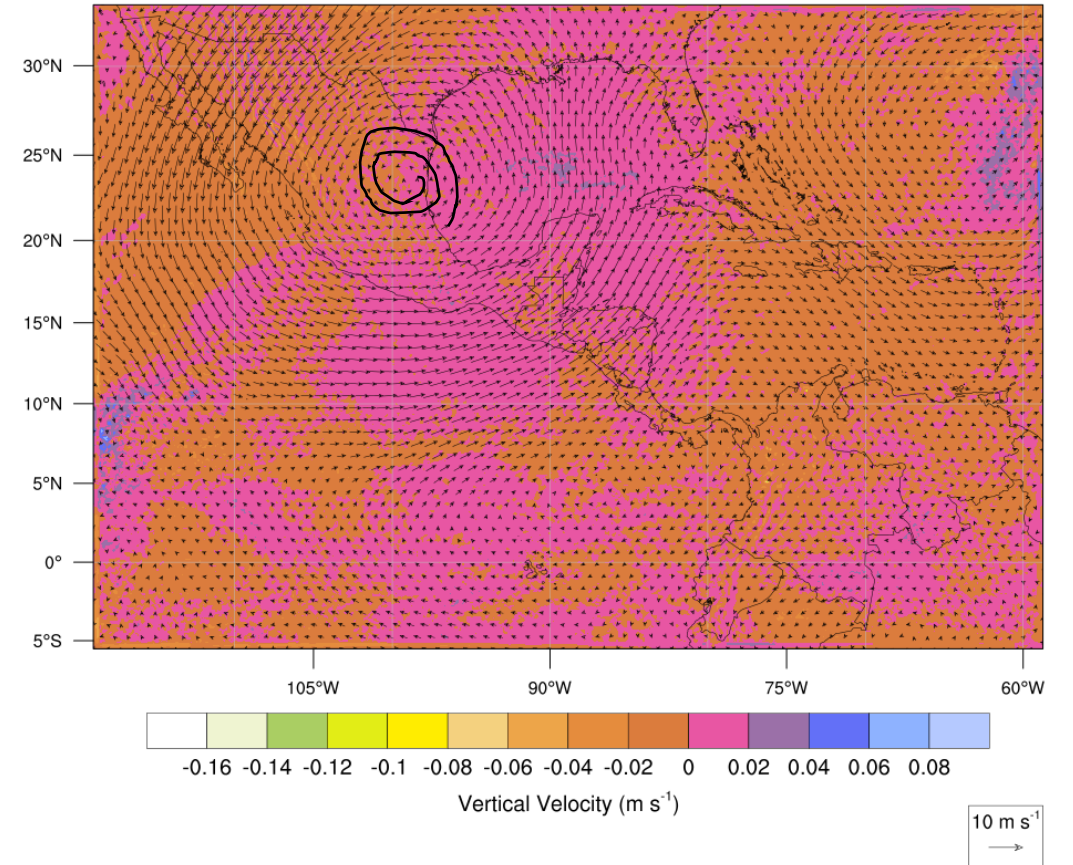
Black Arrow: 850hPa Wind (m s^{-1})



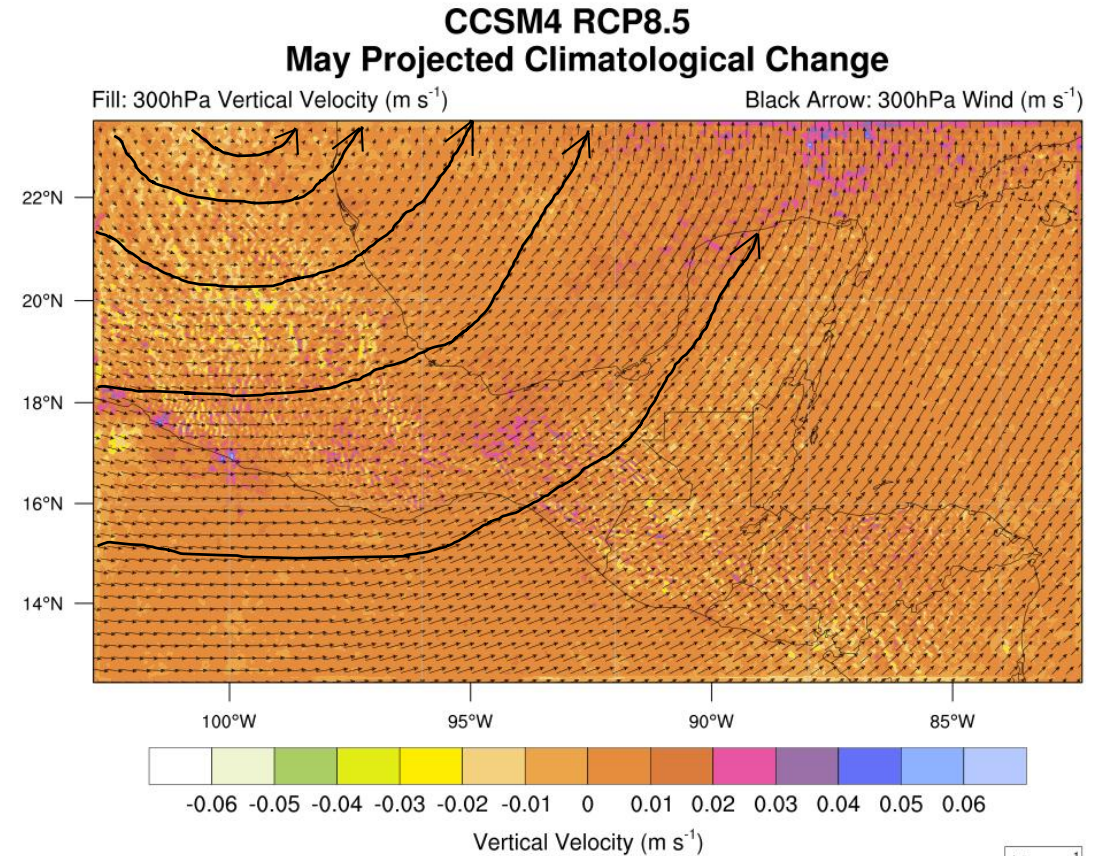
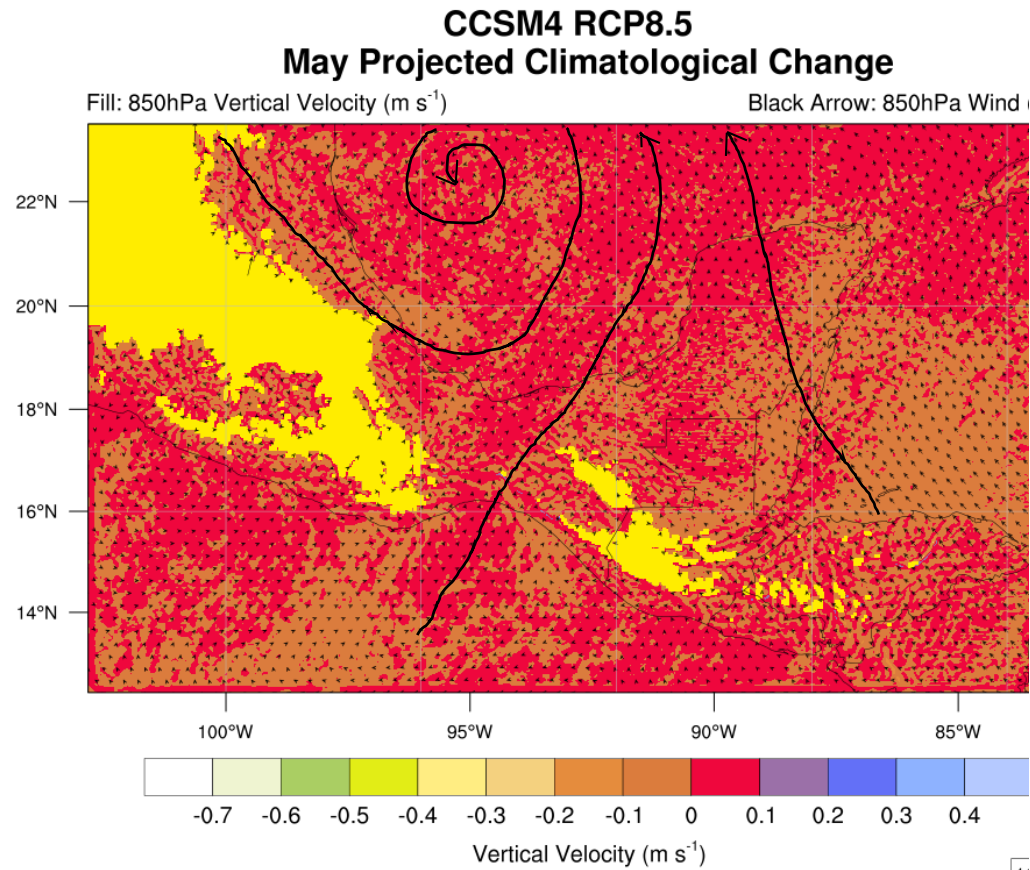
CCSM4 RCP8.5 May Projected Climatological Change

Fill: 300hPa Vertical Velocity (m s^{-1})

Black Arrow: 300hPa Wind (m s^{-1})

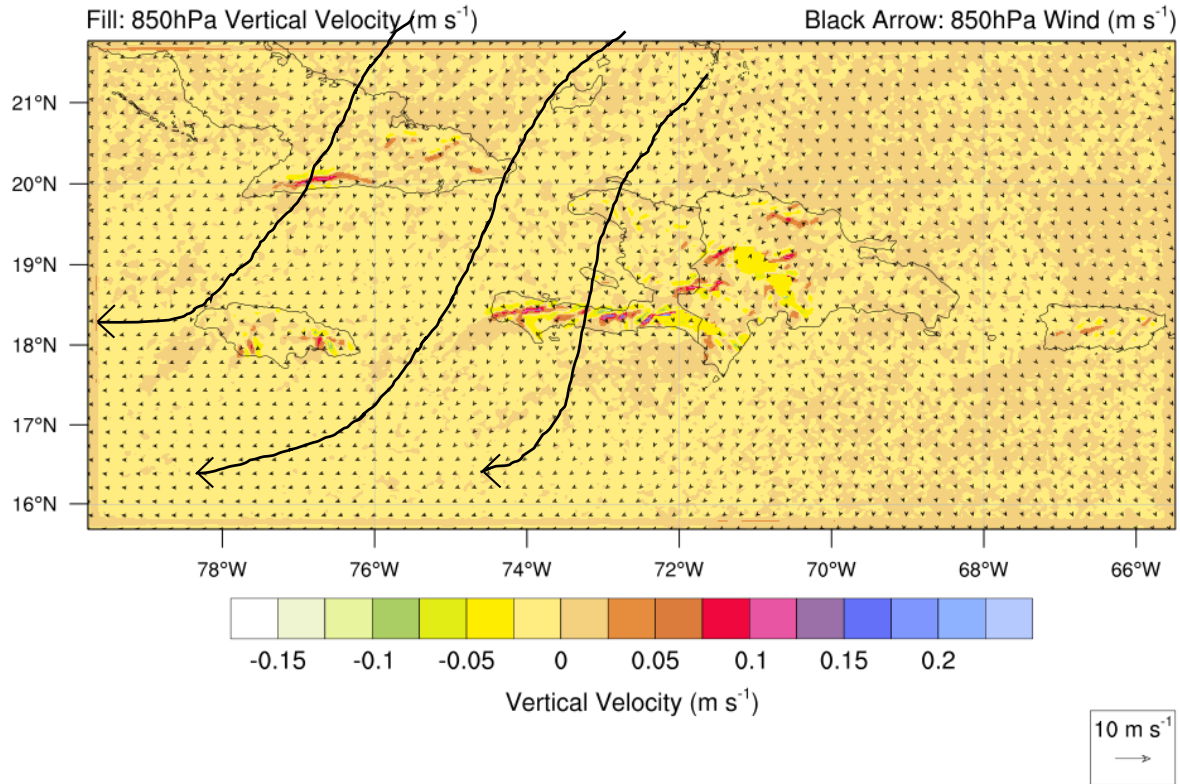


Changes in May

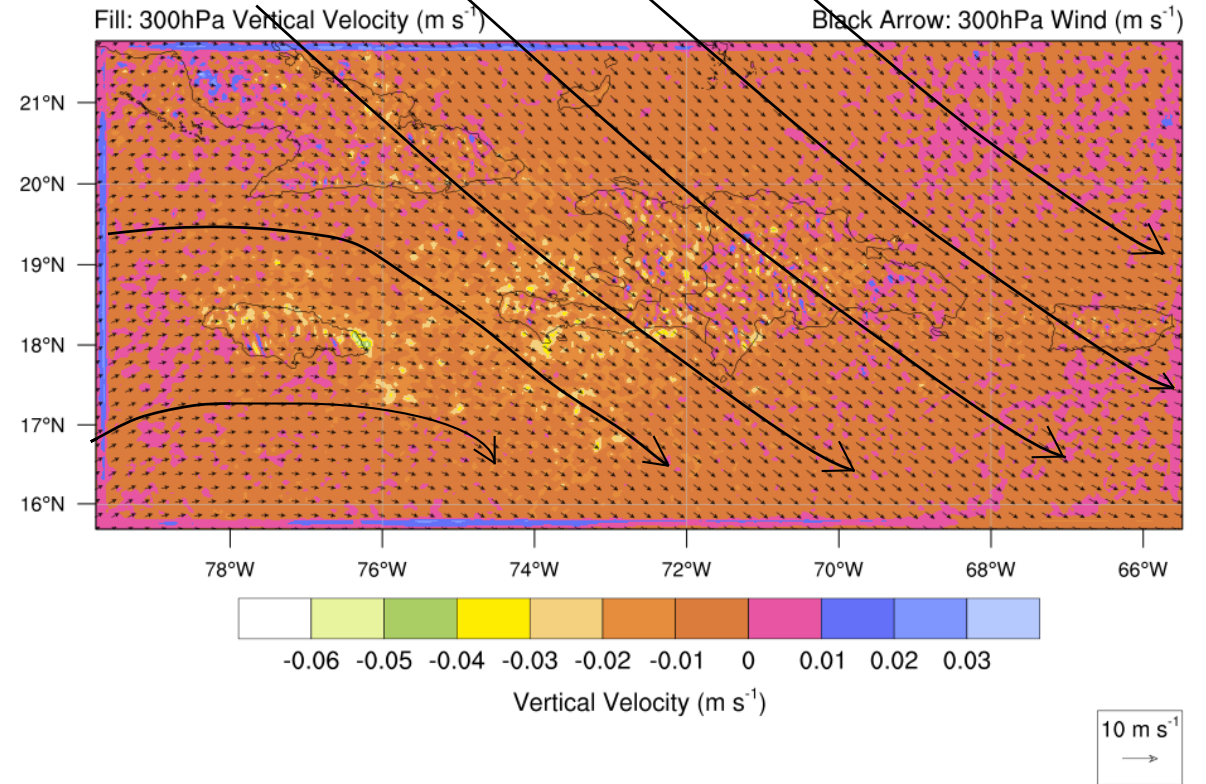


Changes in May

CCSM4 RCP8.5
May Projected Climatological Change



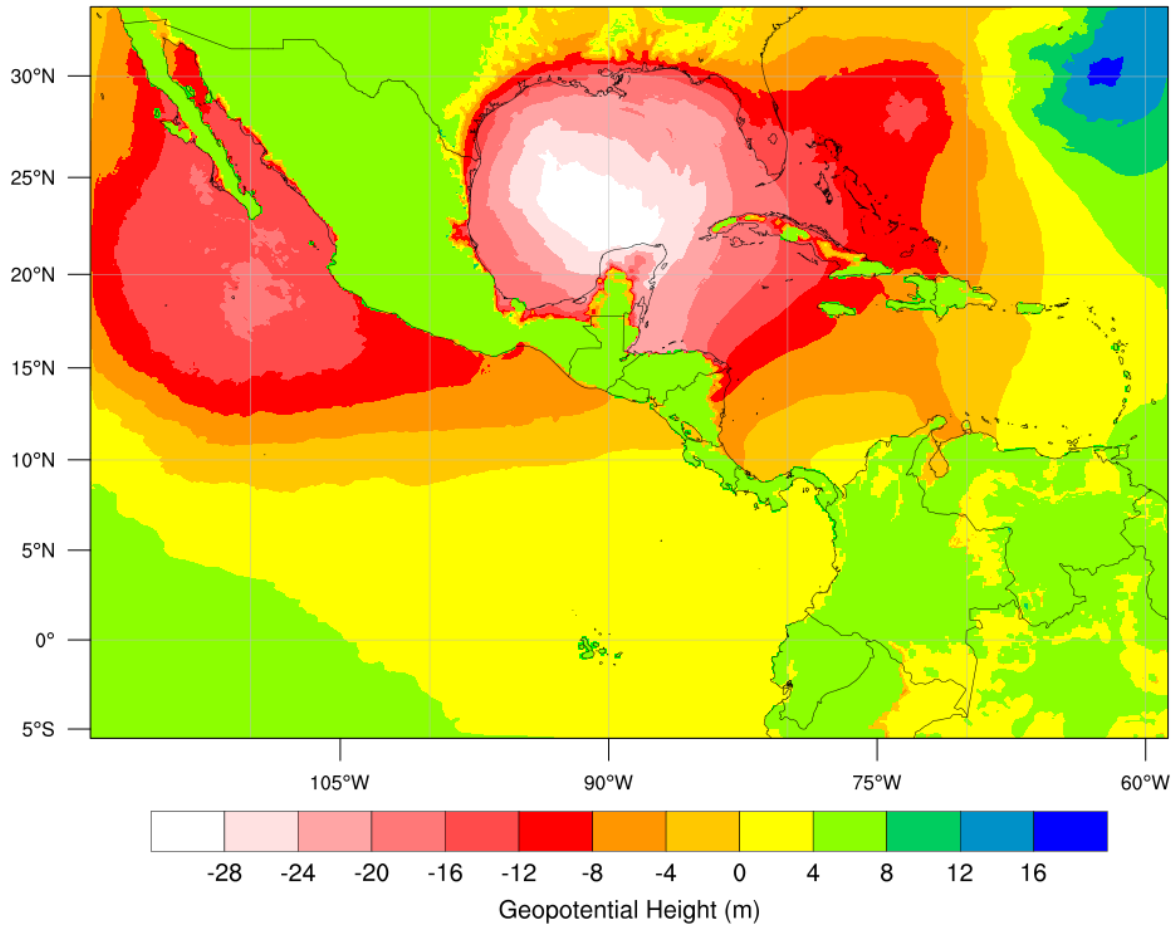
CCSM4 RCP8.5
May Projected Climatological Change



Changes in June

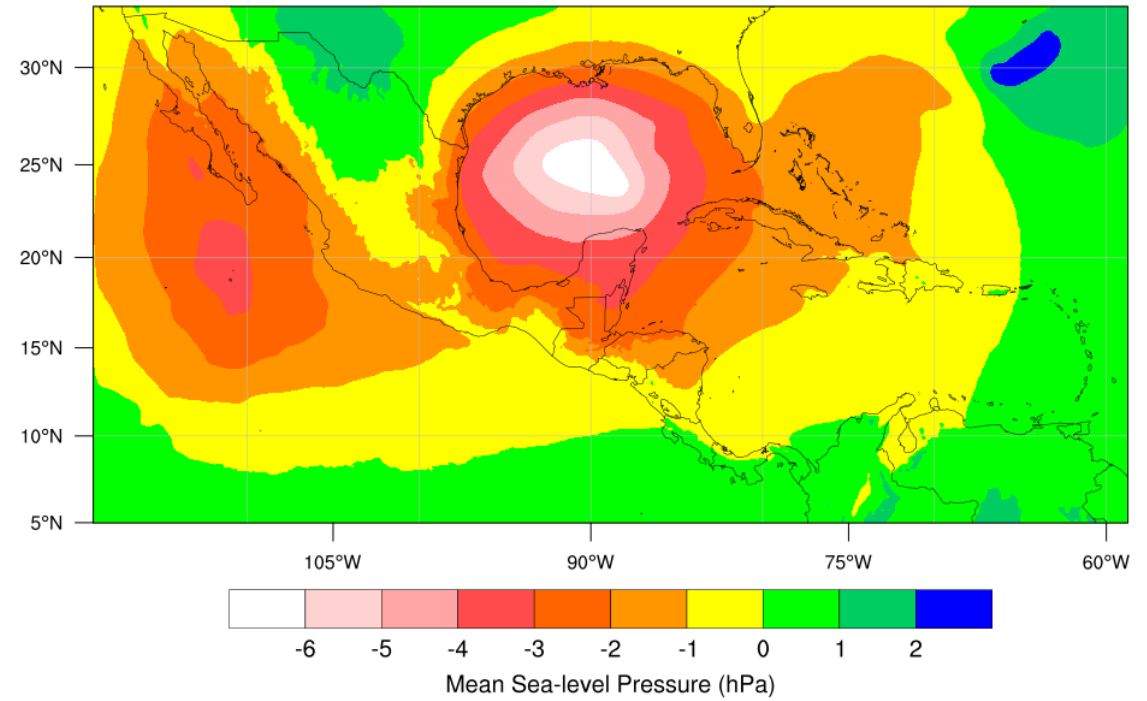
CCSM4 RCP8.5
June Projected Climatological Change

Fill: 1000hPa Geopotential Height (m)



CCSM4 RCP8.5
June Projected Climatological Change

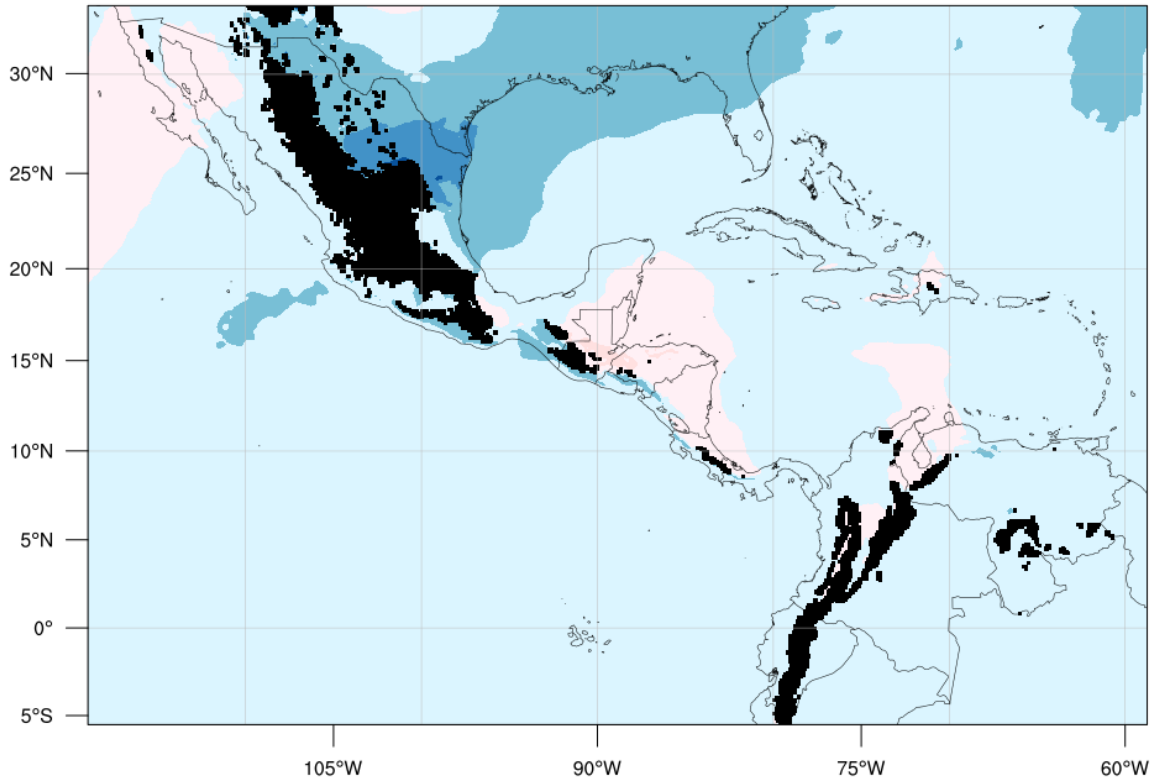
Fill: Mean Sea-level Pressure (hPa)



Changes in June

**CCSM4 RCP8.5
June Projected Climatological Change**

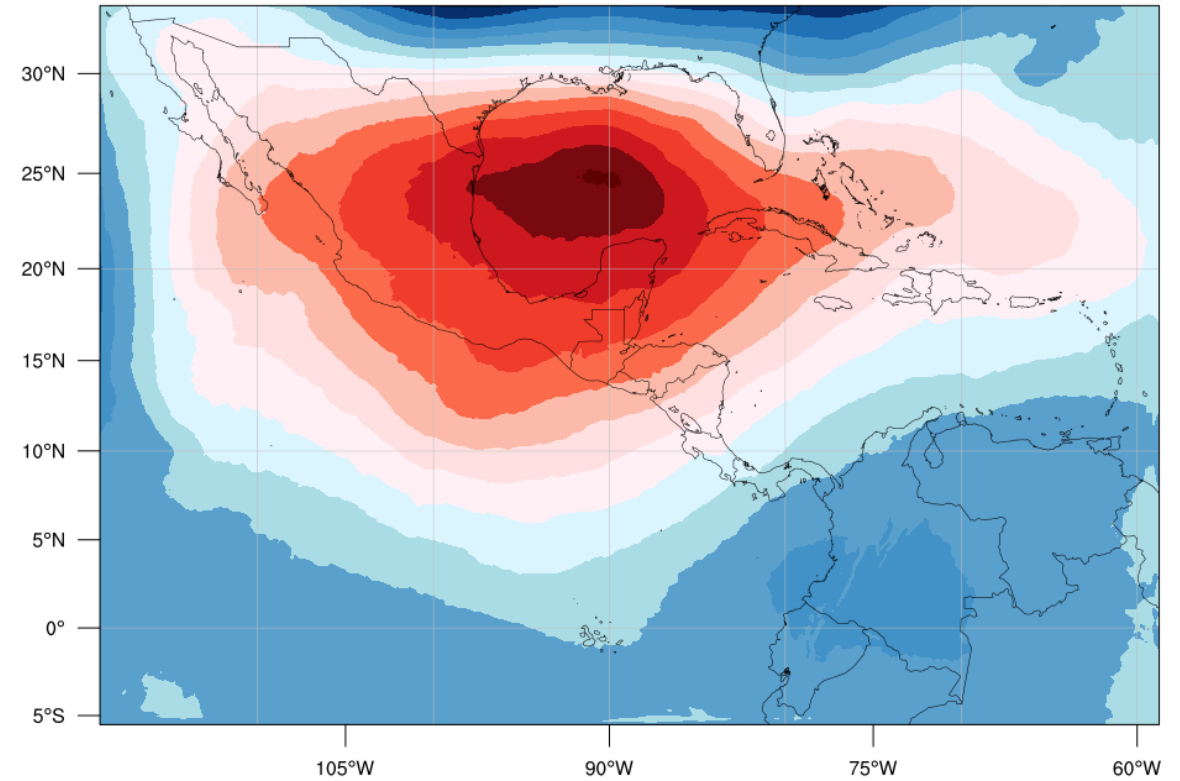
Fill: 850hPa Temperature (°C)



Temperature (°C)

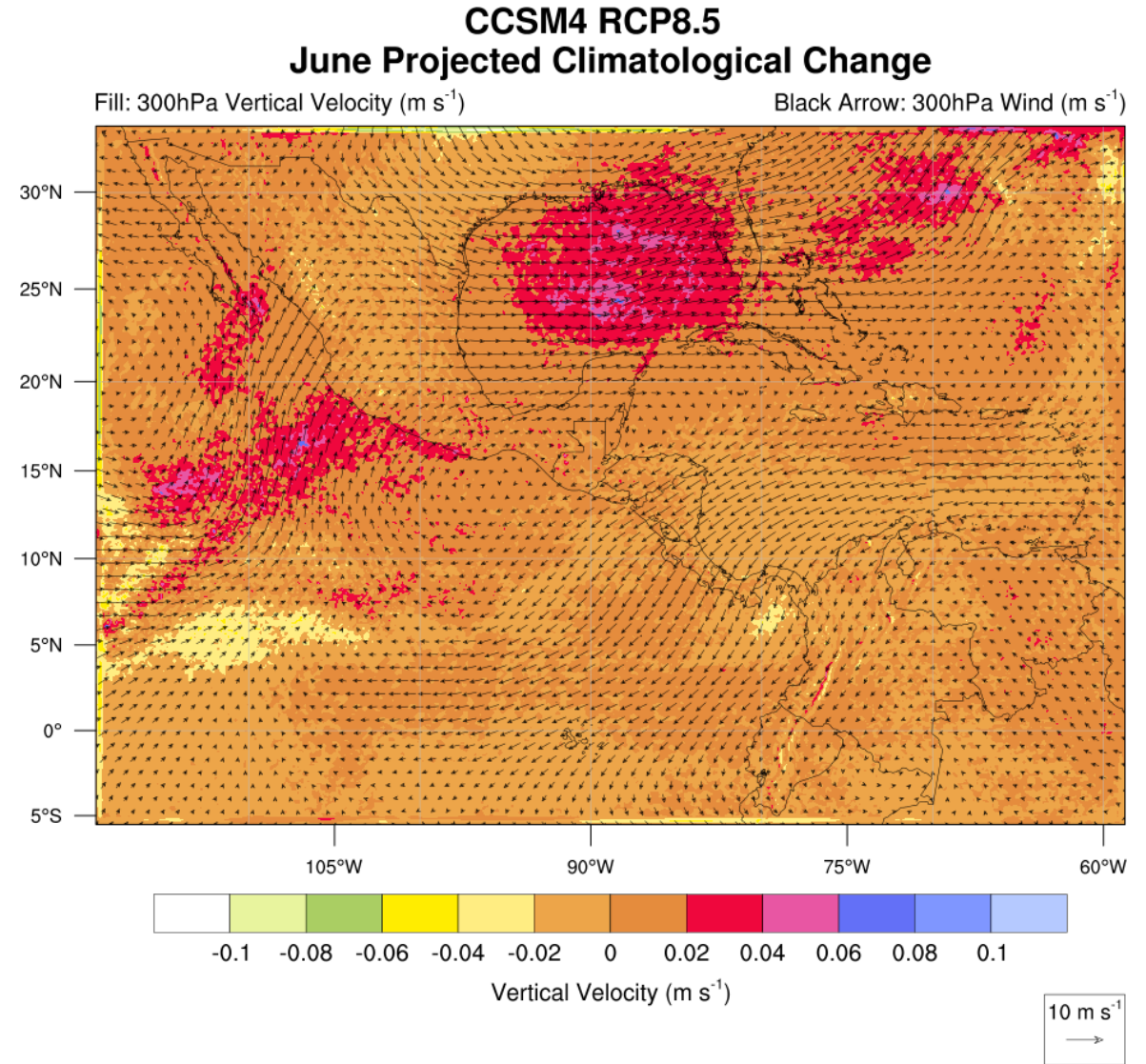
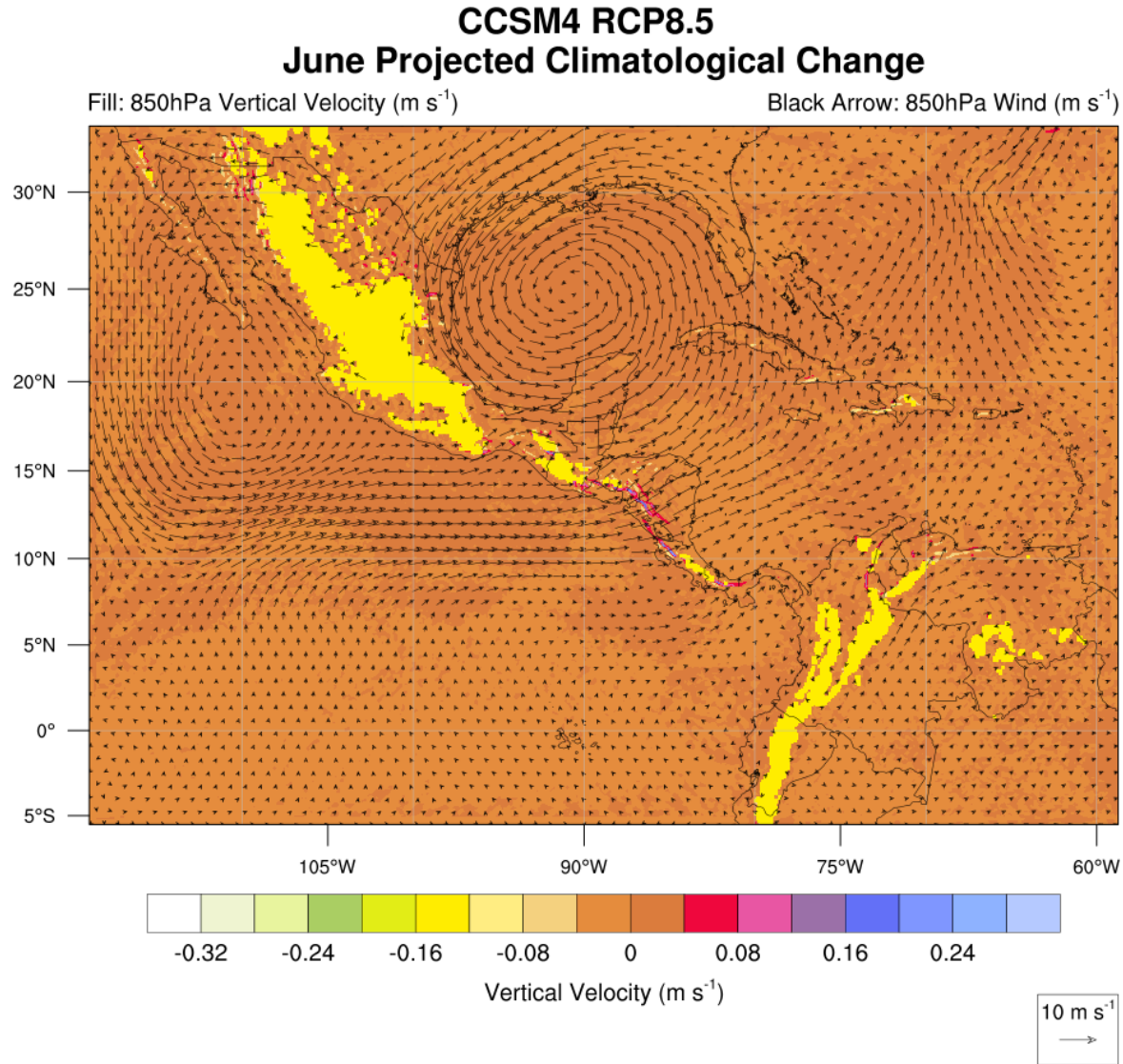
**CCSM4 RCP8.5
June Projected Climatological Change**

Fill: 300hPa Temperature (°C)



Temperature (°C)

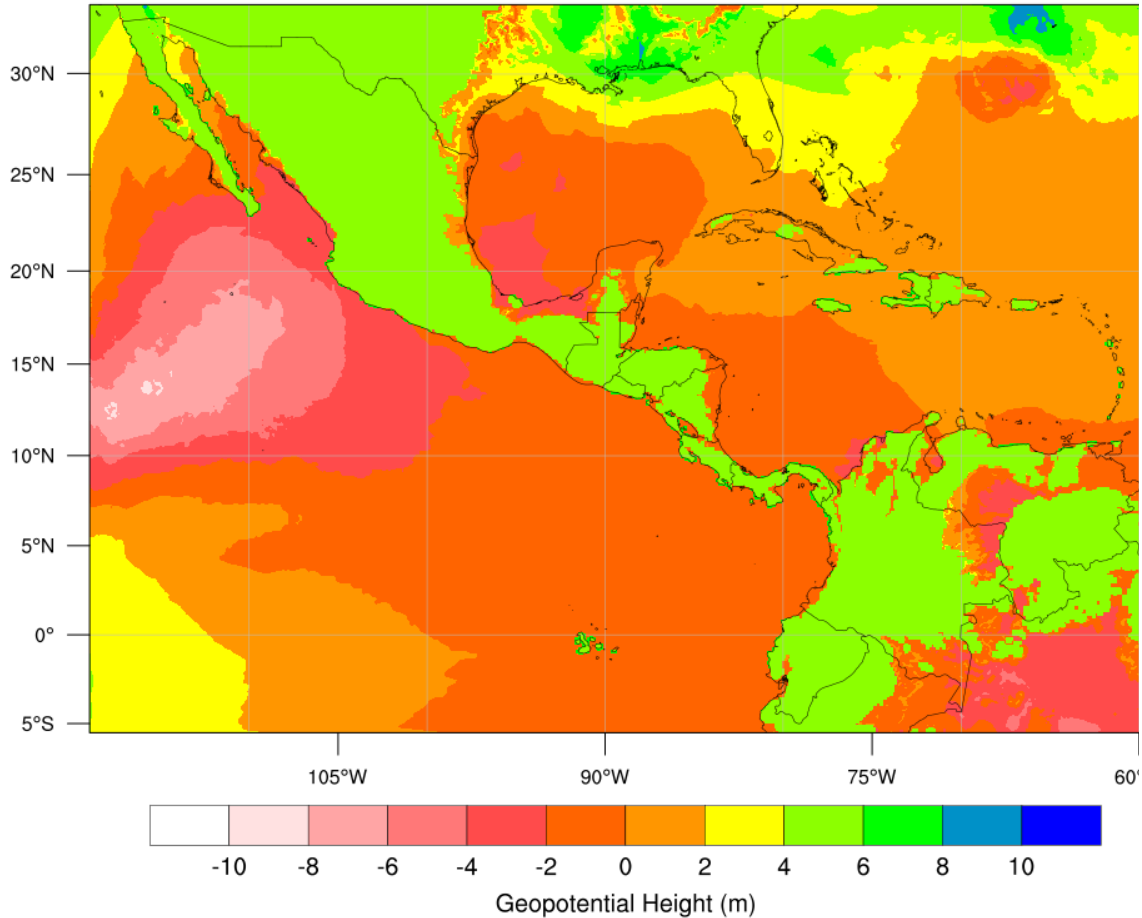
Changes in June



Changes in July

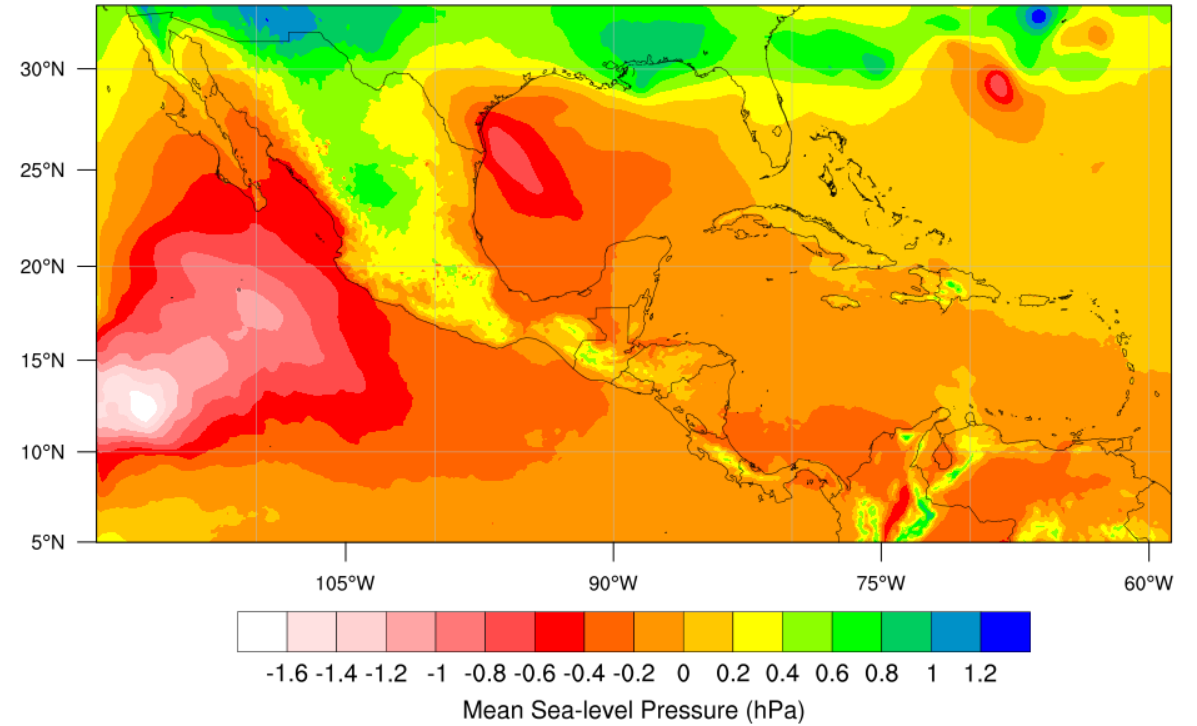
CCSM4 RCP8.5
July Projected Climatological Change

Fill: 1000hPa Geopotential Height (m)



CCSM4 RCP8.5
July Projected Climatological Change

Fill: Mean Sea-level Pressure (hPa)

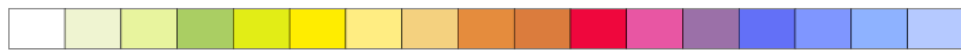
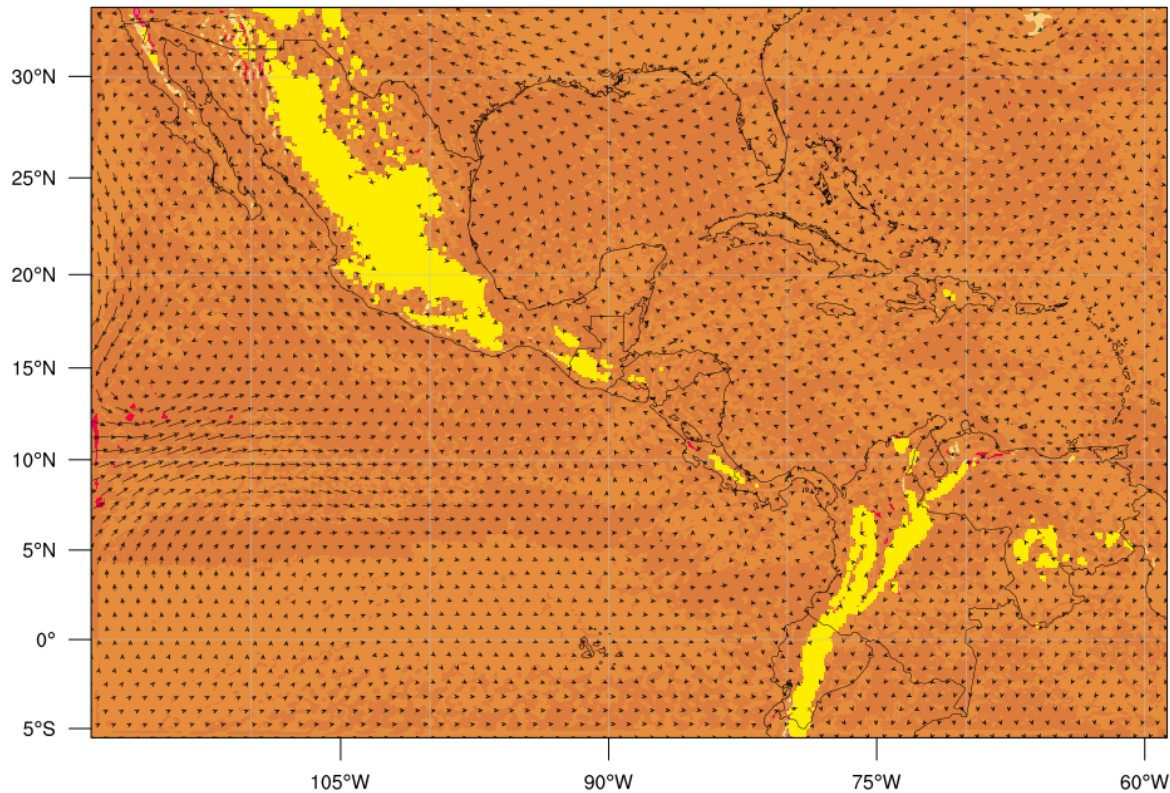


Changes in July

CCSM4 RCP8.5
July Projected Climatological Change

Fill: 850hPa Vertical Velocity (m s^{-1})

Black Arrow: 850hPa Wind (m s^{-1})



-0.16 -0.12 -0.08 -0.04 0 0.04 0.08 0.12

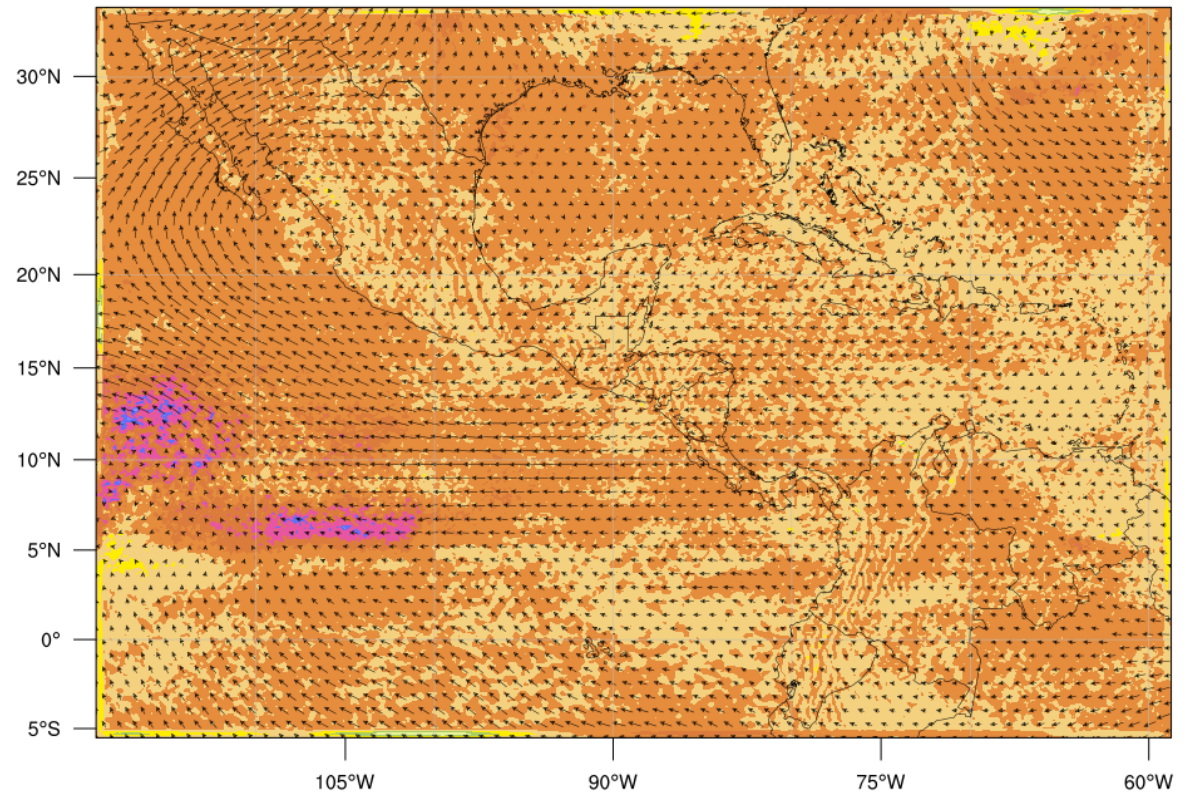
Vertical Velocity (m s^{-1})



CCSM4 RCP8.5
July Projected Climatological Change

Fill: 300hPa Vertical Velocity (m s^{-1})

Black Arrow: 300hPa Wind (m s^{-1})



-0.08 -0.06 -0.04 -0.02 0 0.02 0.04 0.06 0.08 0.1

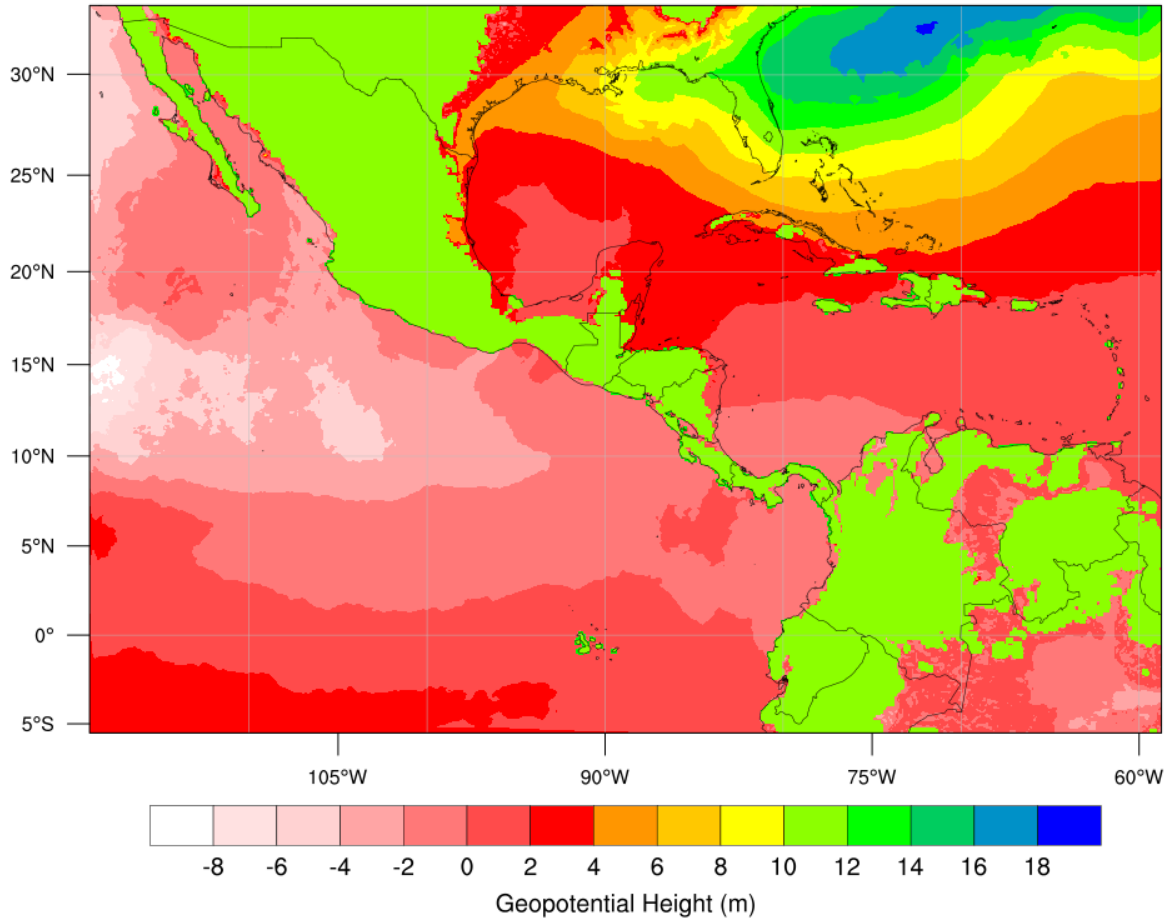
Vertical Velocity (m s^{-1})



Changes in August

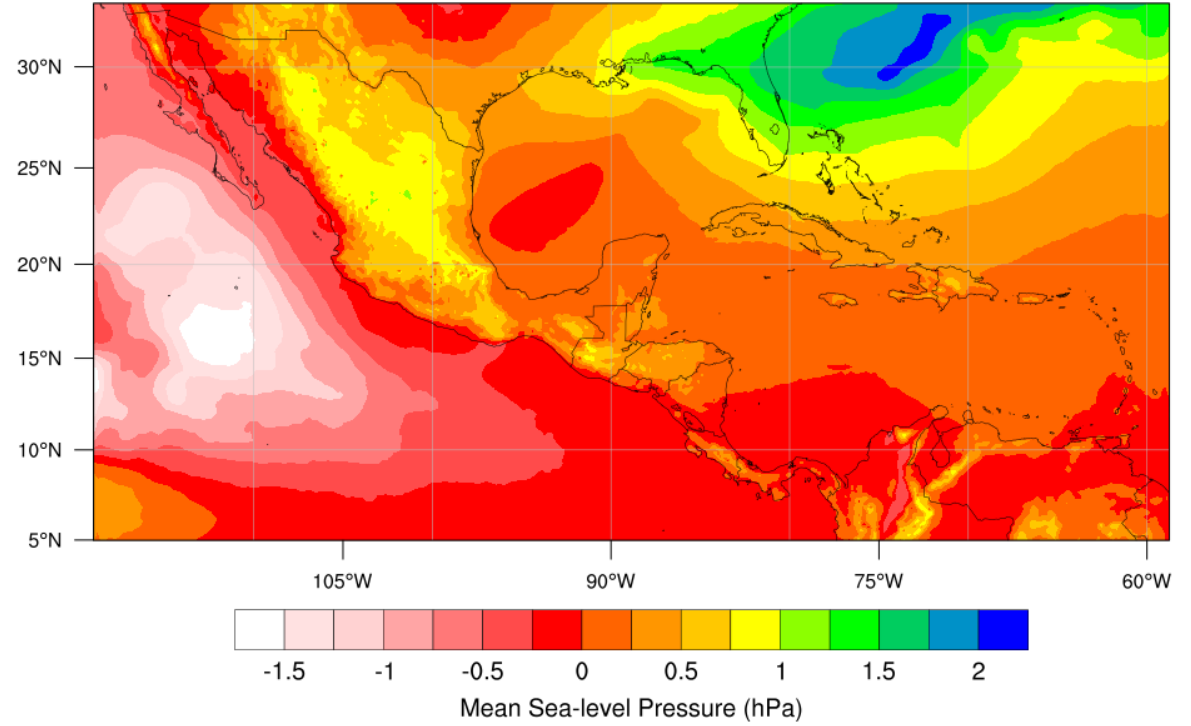
CCSM4 RCP8.5
August Projected Climatological Change

Fill: 1000hPa Geopotential Height (m)



CCSM4 RCP8.5
August Projected Climatological Change

Fill: Mean Sea-level Pressure (hPa)

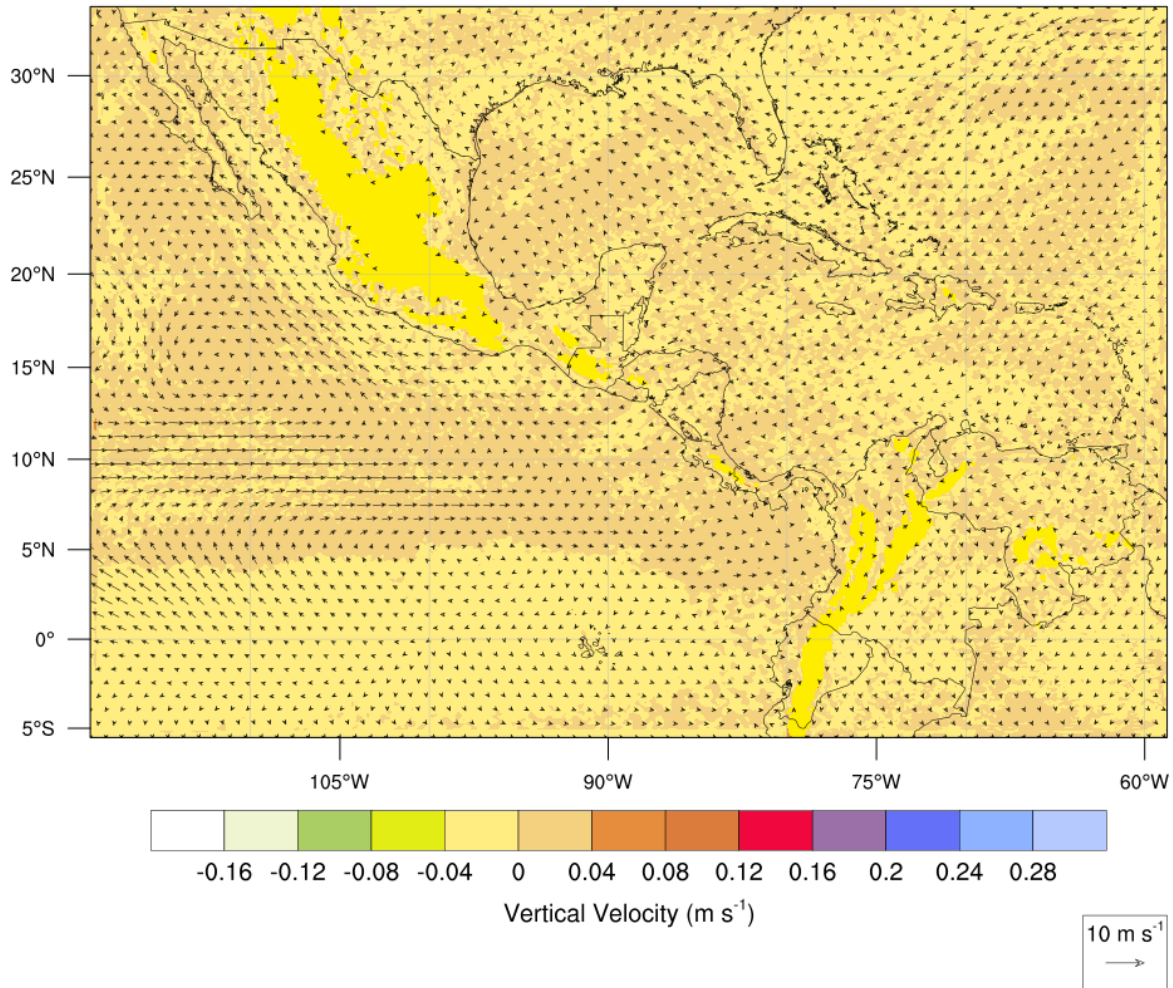


Changes in August

CCSM4 RCP8.5
August Projected Climatological Change

Fill: 850hPa Vertical Velocity (m s^{-1})

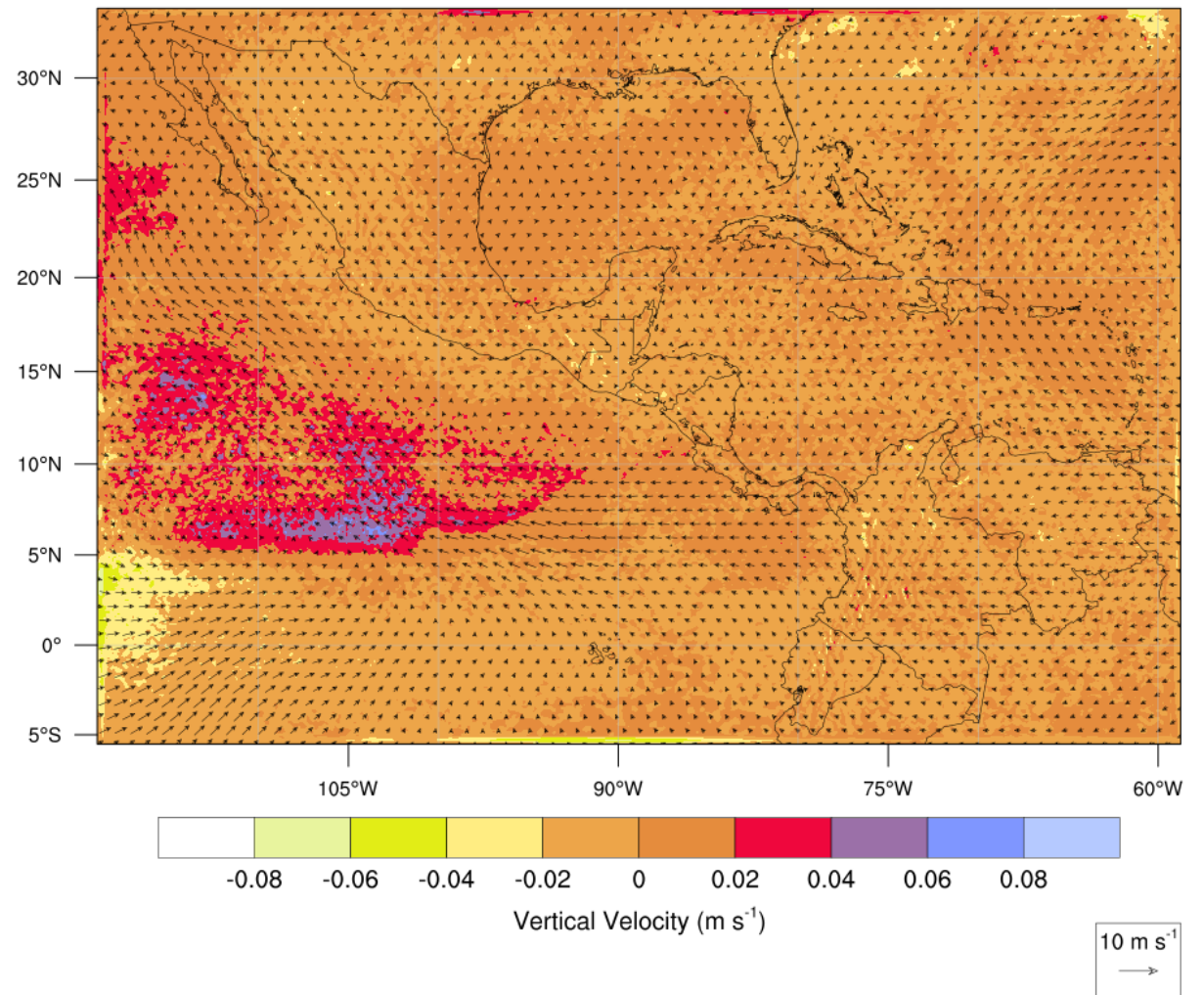
Black Arrow: 850hPa Wind (m s^{-1})



CCSM4 RCP8.5
August Projected Climatological Change

Fill: 300hPa Vertical Velocity (m s^{-1})

Black Arrow: 300hPa Wind (m s^{-1})

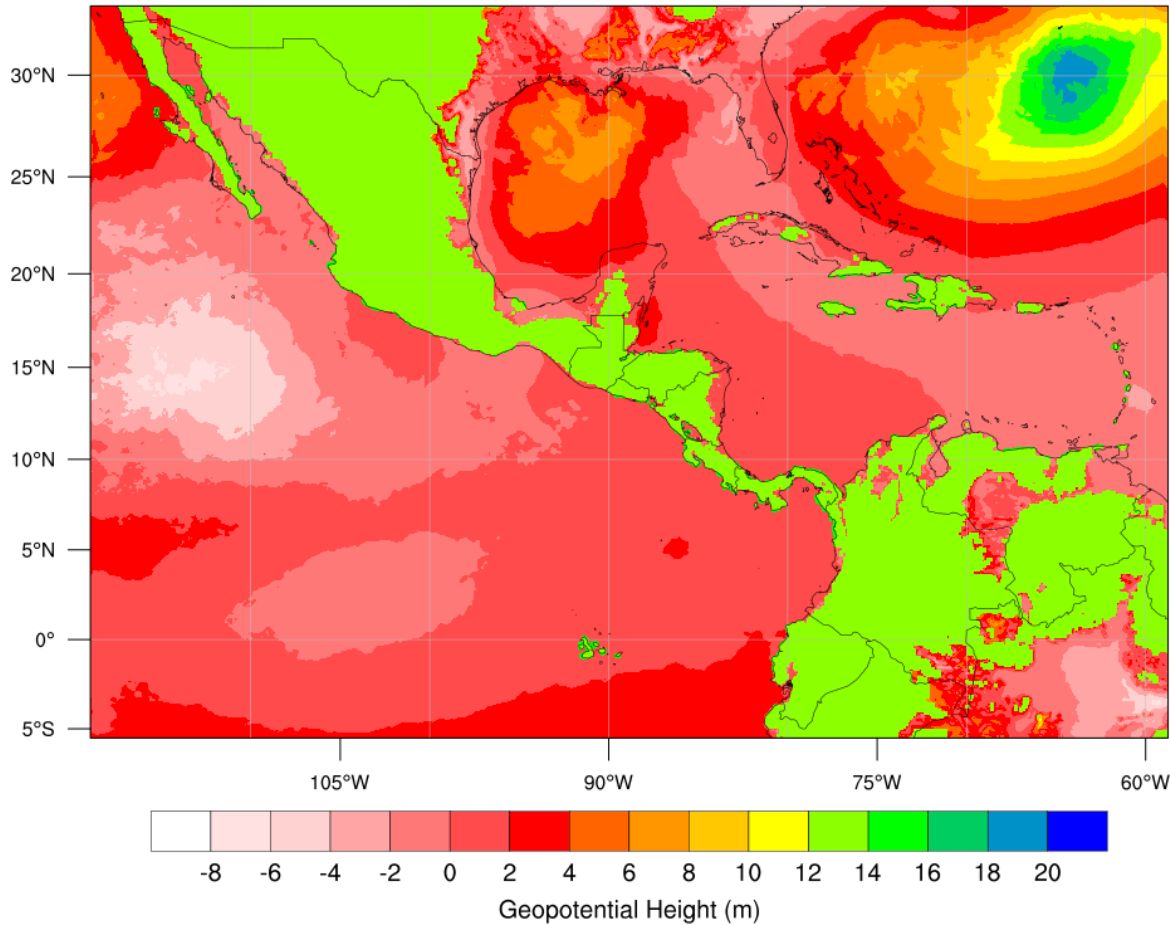


Changes in September

CCSM4 RCP8.5

September Projected Climatological Change

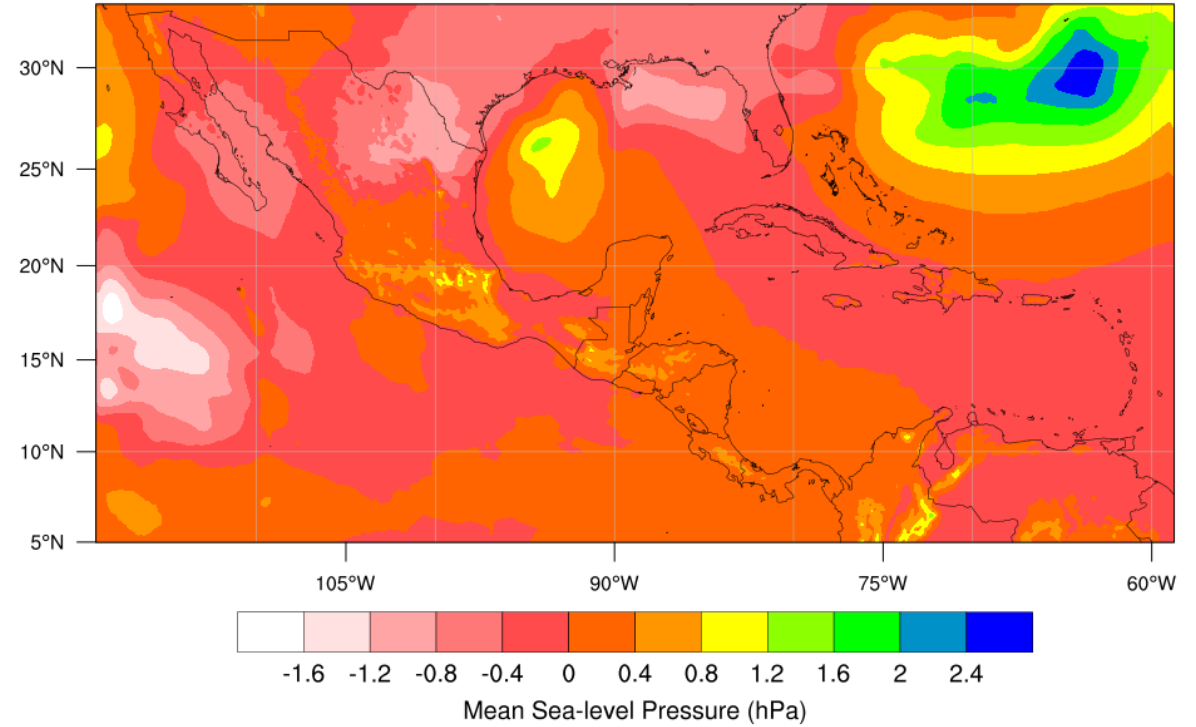
Fill: 1000hPa Geopotential Height (m)



CCSM4 RCP8.5

September Projected Climatological Change

Fill: Mean Sea-level Pressure (hPa)

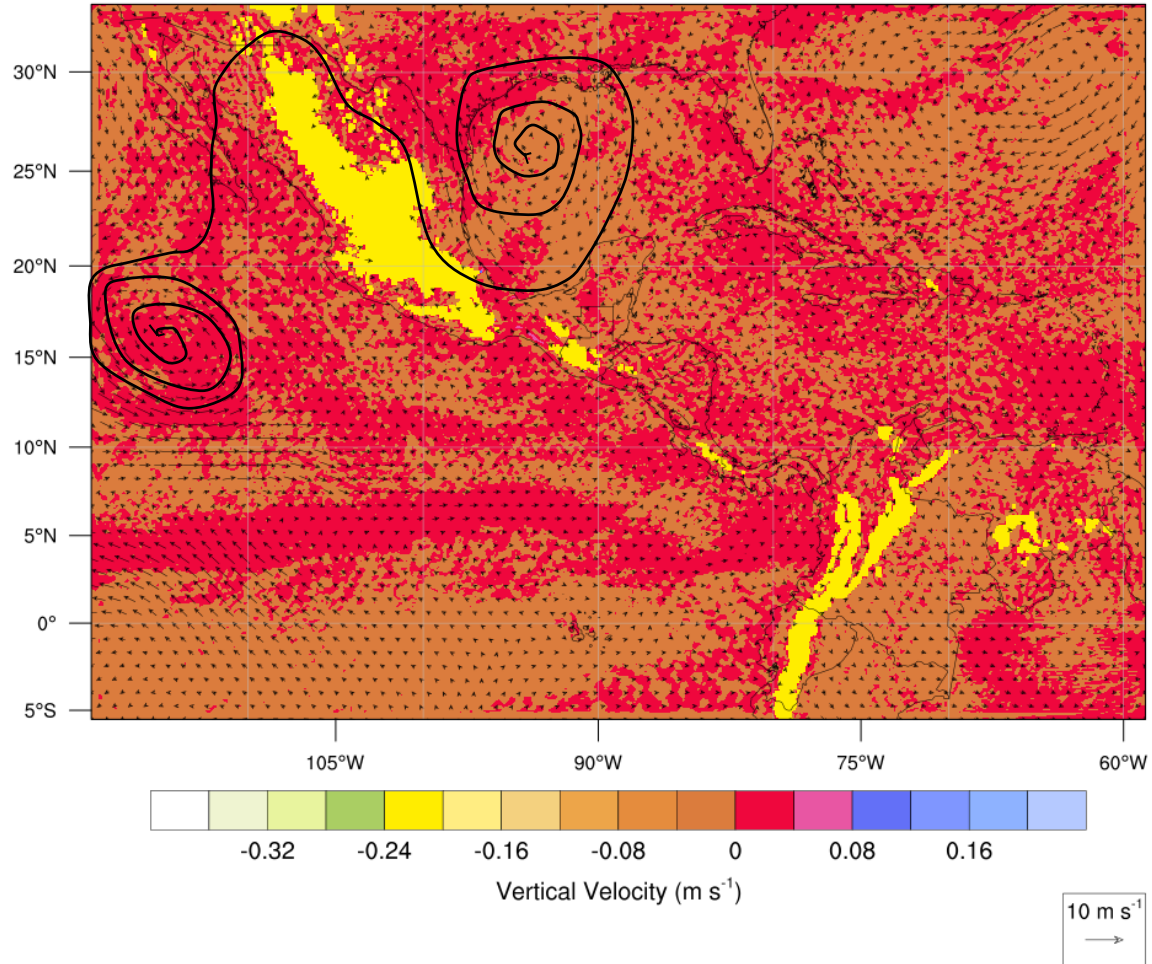


Changes in September

CCSM4 RCP8.5
September Projected Climatological Change

Fill: 850hPa Vertical Velocity (m s^{-1})

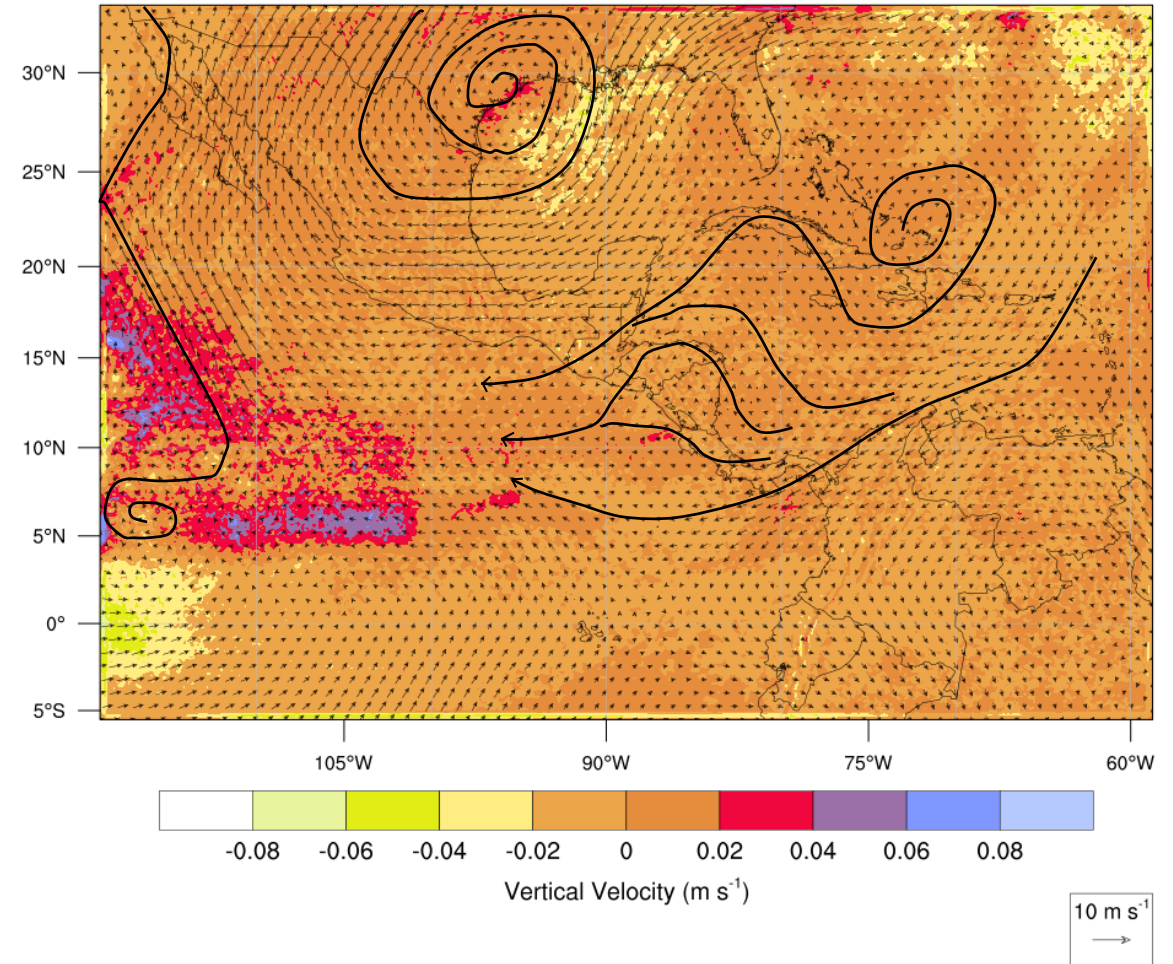
Black Arrow: 850hPa Wind (m s^{-1})



CCSM4 RCP8.5
September Projected Climatological Change

Fill: 300hPa Vertical Velocity (m s^{-1})

Black Arrow: 300hPa Wind (m s^{-1})

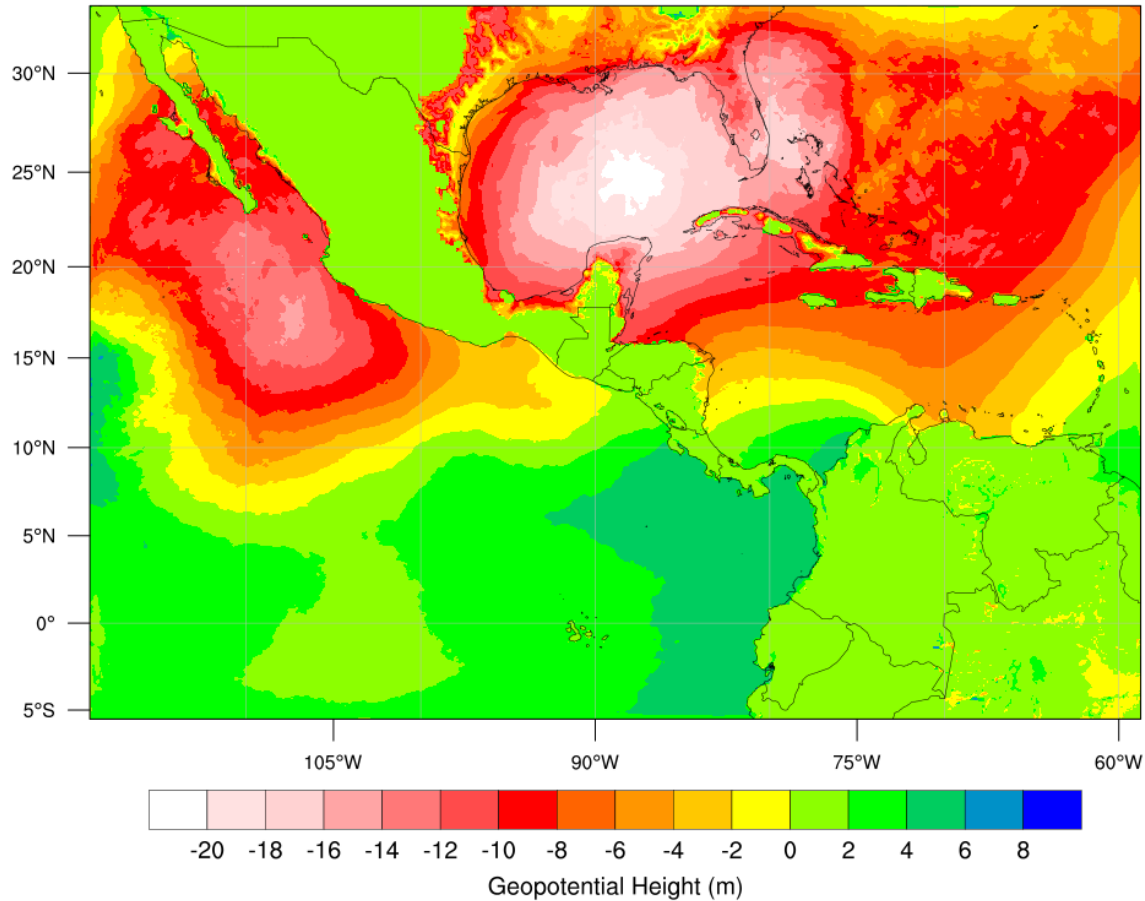


Changes in October

CCSM4 RCP8.5

October Projected Climatological Change

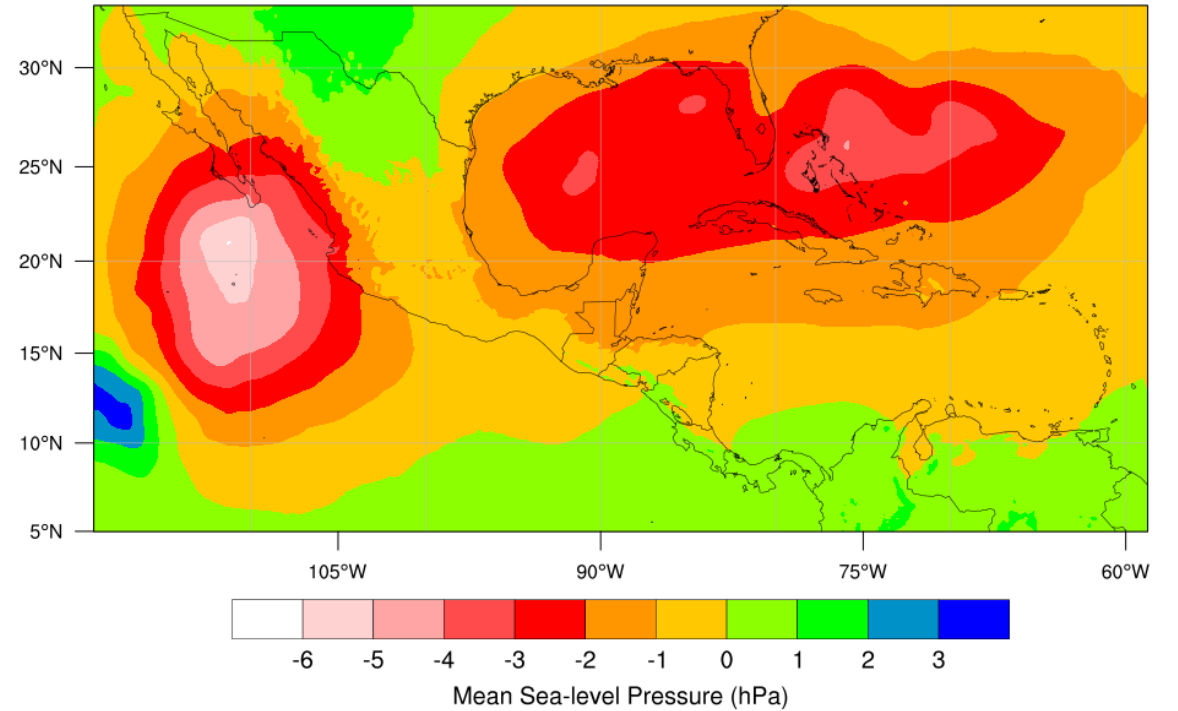
Fill: 1000hPa Geopotential Height (m)



CCSM4 RCP8.5

October Projected Climatological Change

Fill: Mean Sea-level Pressure (hPa)



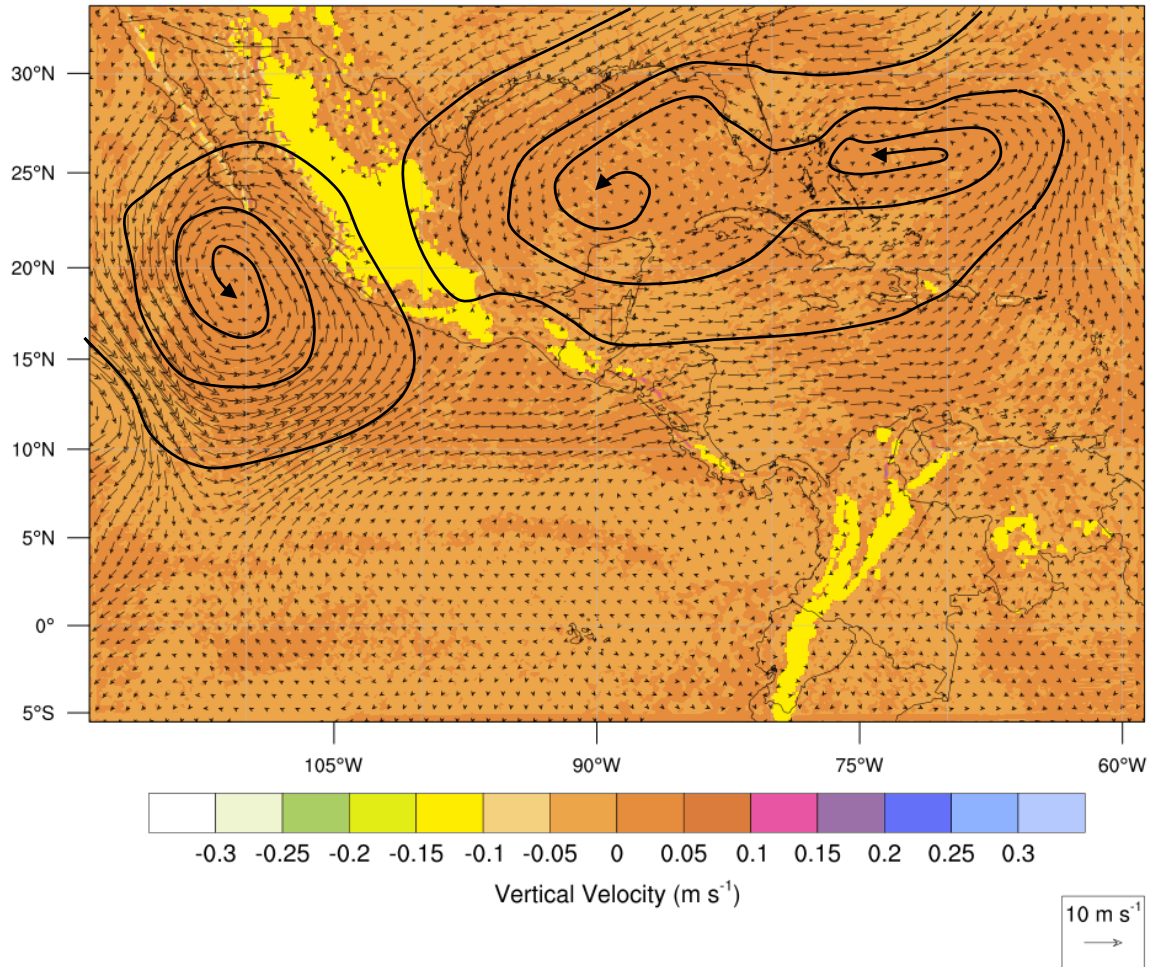
Changes in October

CCSM4 RCP8.5

October Projected Climatological Change

Fill: 850hPa Vertical Velocity (m s^{-1})

Black Arrow: 850hPa Wind (m s^{-1})

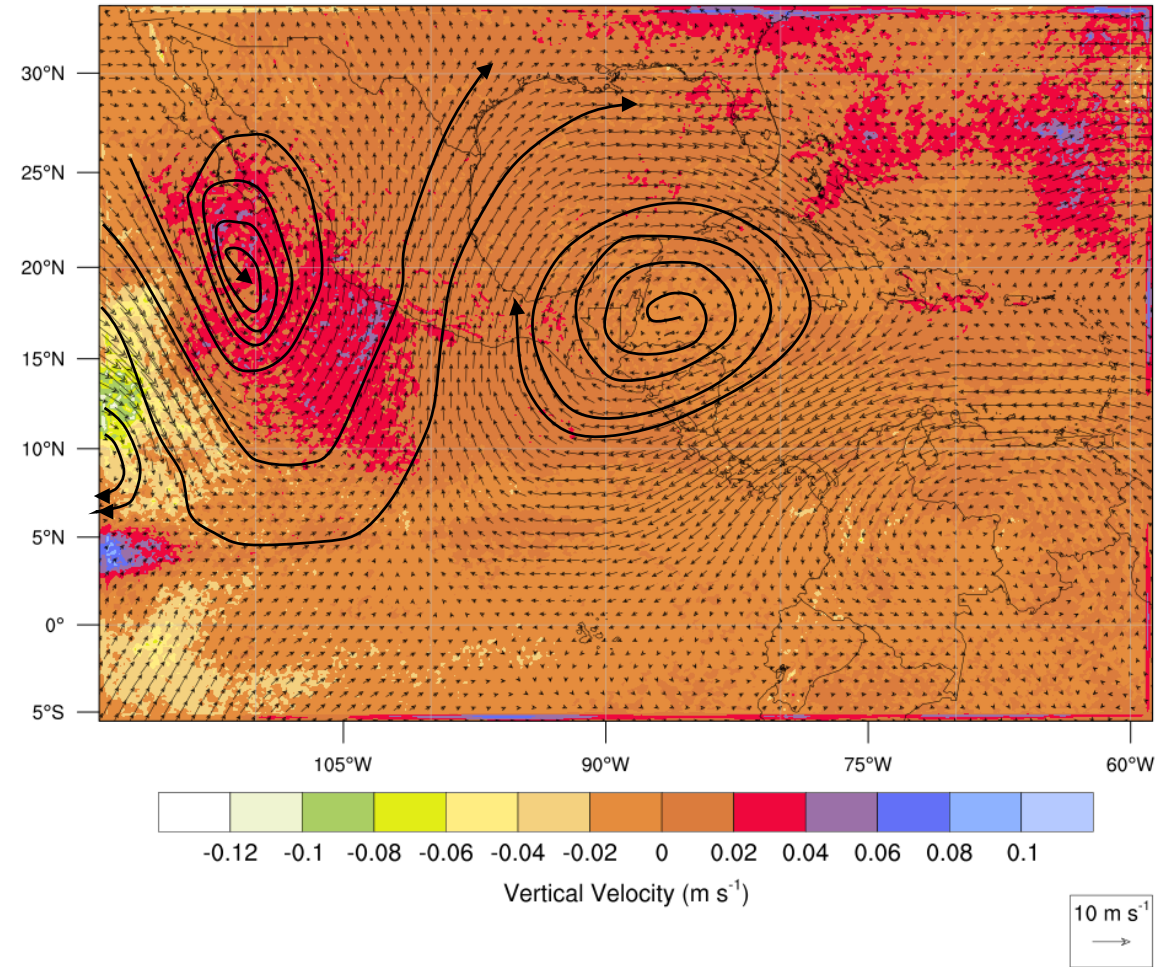


CCSM4 RCP8.5

October Projected Climatological Change

Fill: 300hPa Vertical Velocity (m s^{-1})

Black Arrow: 300hPa Wind (m s^{-1})



Recommendations

- Add tropospheric data
- Add SST data and graphics
- Explore the possibility to add Skew T Diagrams
- Recalculate humidity change, there is an error