

# Recent Researches of South America Climate

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M

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# Outline

**Part I:** land surface temperature validation over SE Brazil

**Part II:** simulation of the cyclone IBA – South Atlantic Ocean

} exercise

**Part III:** paper outline



# Introduction

With the increase of the horizontal resolution of the regional climate models, **satellite observations** have become a source of information to validate the simulations.



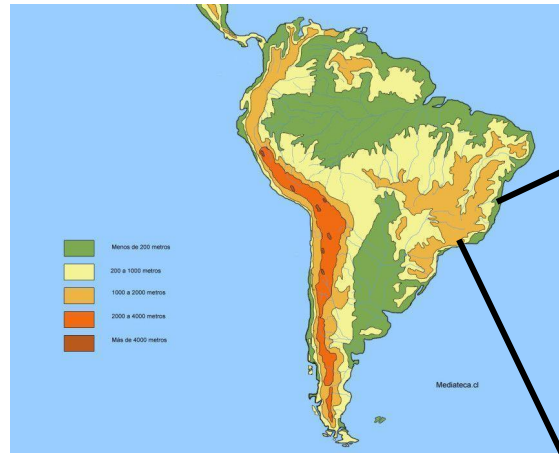
<https://eos.com/modis-mcd43a4/>

# Objective

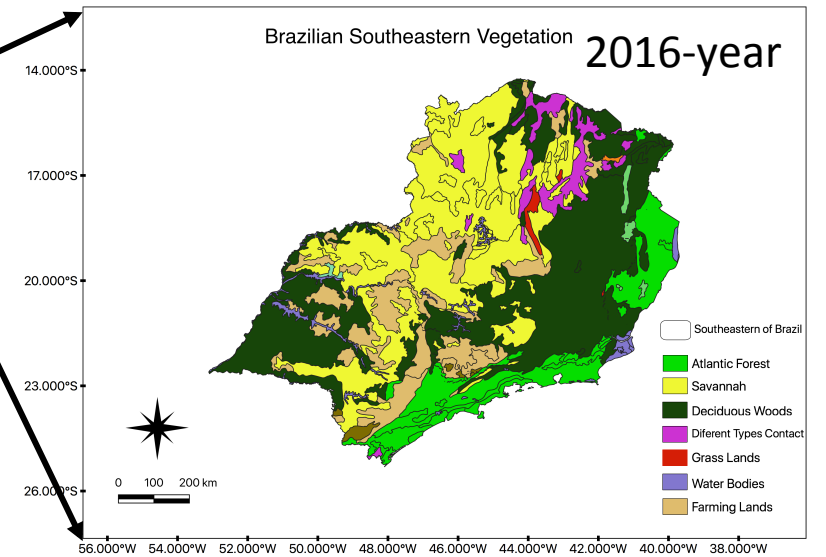
To validate **land surface temperature (LST)** simulated with **RegCM4.6.1** and **RegCM4.7.1** over southeastern Brazil with the **MODIS** products (1 km of grid space).

LST is the radiative skin temperature of the land surface, as measured in the direction of the remote sensor.

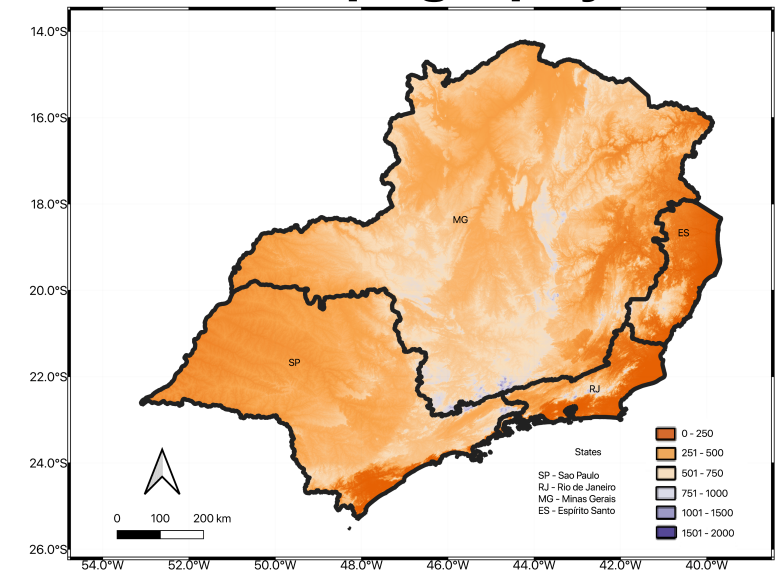
(<https://land.copernicus.eu/global/products/lst>)



## Southeast of Brazil - Vegetation



## Topography



# Characteristics of Simulations

**Period:** 2010

**Boundaries:** ERA-Interim

**Horizontal resolution:** 5 km

**Cumulus convection:**

Emanuel

**Surface Scheme:**

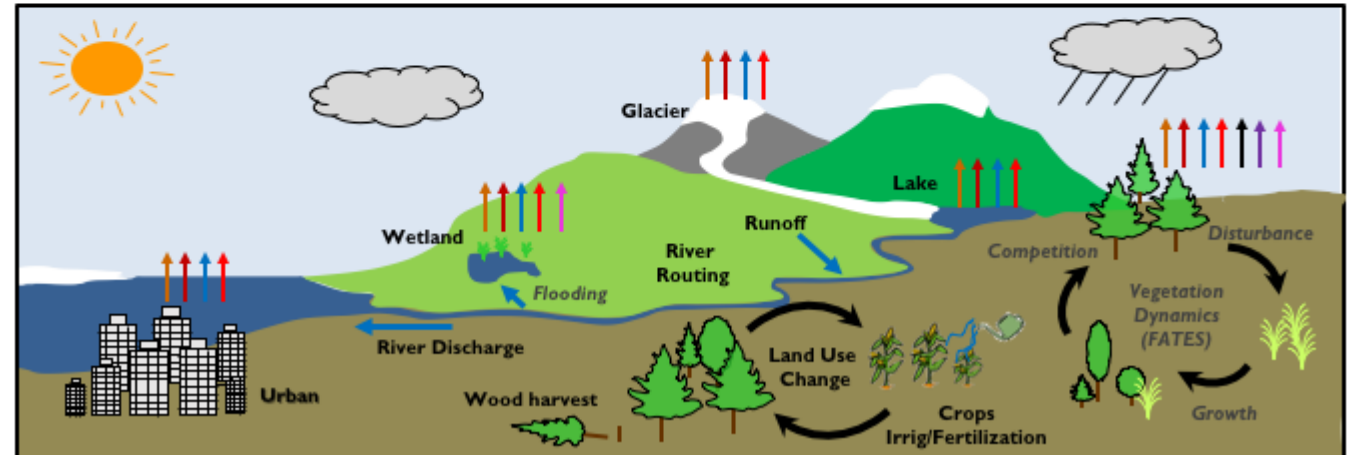
**RegCM4.6.1**

**RegCM4.7.1**

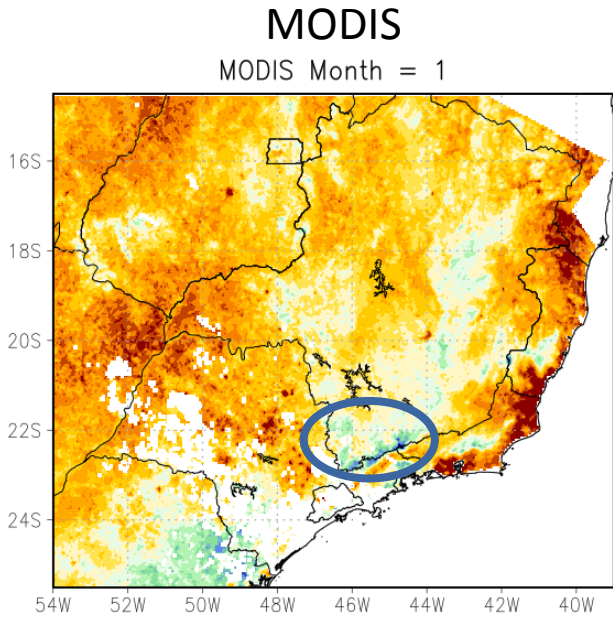
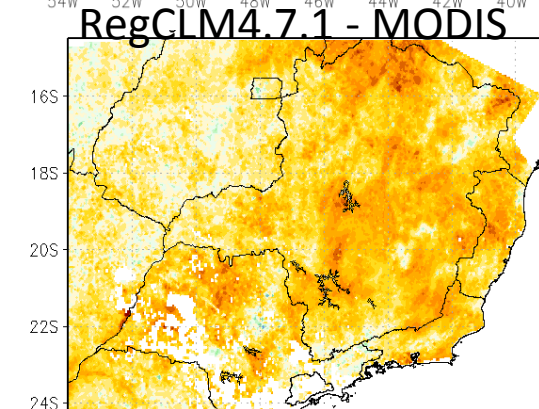
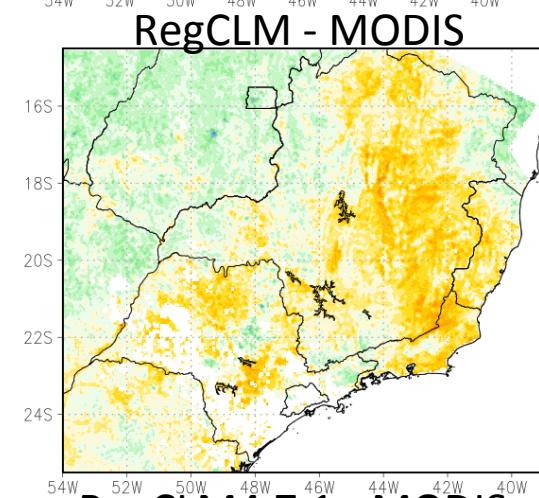
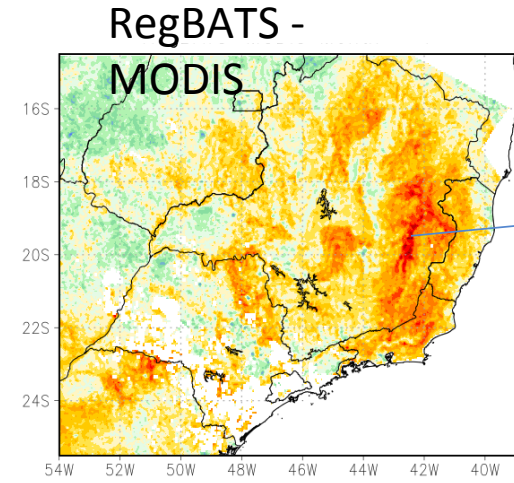
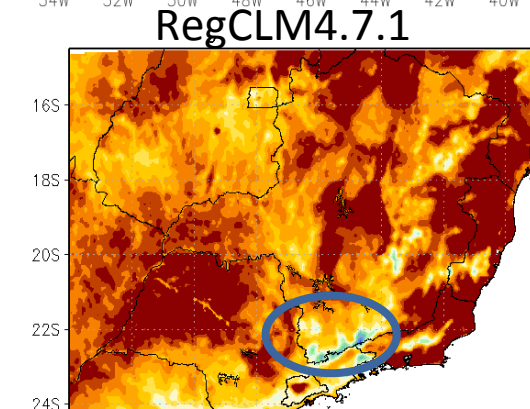
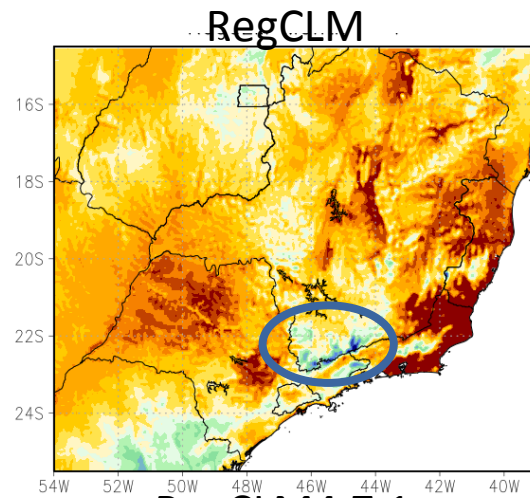
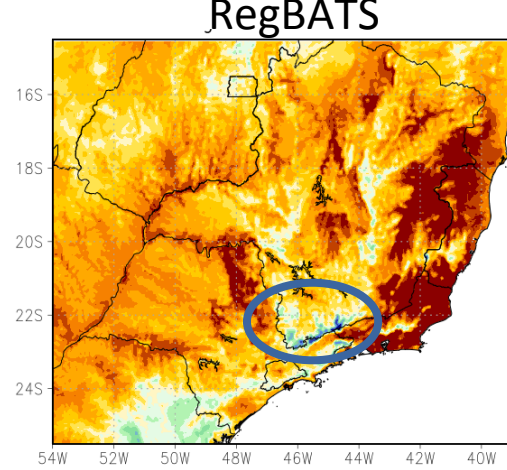
BATS

CLM

CLM



# January land surface temperature



Temperature on the mountains is well simulated.

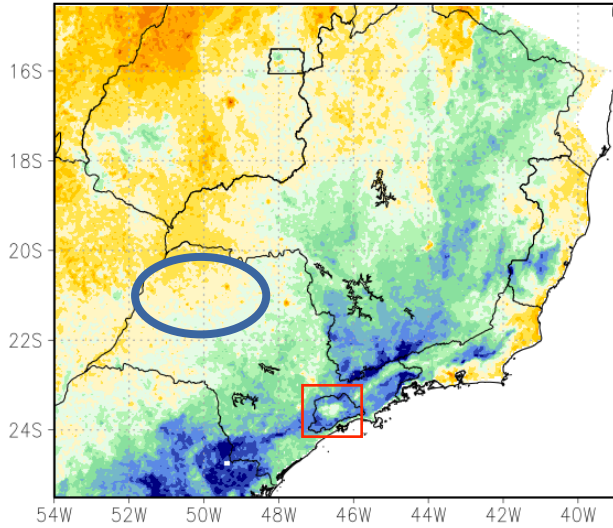
In the other months, negative bias is dominant with BATS and positive bias with CLM. For example →

# April

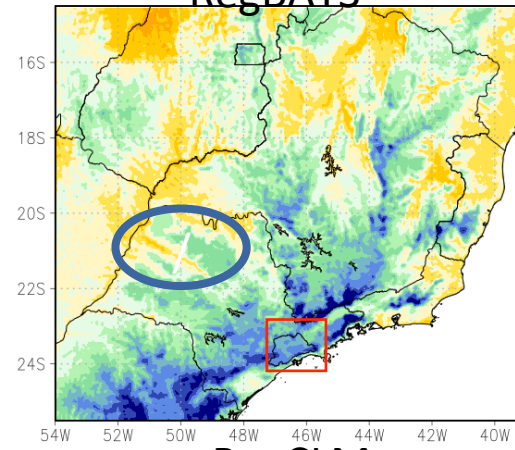
## land surface temperature

### MODIS

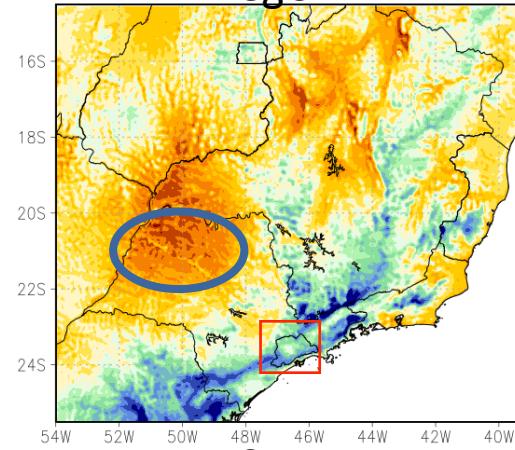
MODIS Month = 4



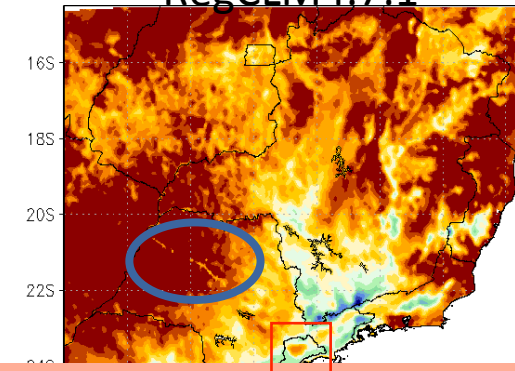
### RegBATS



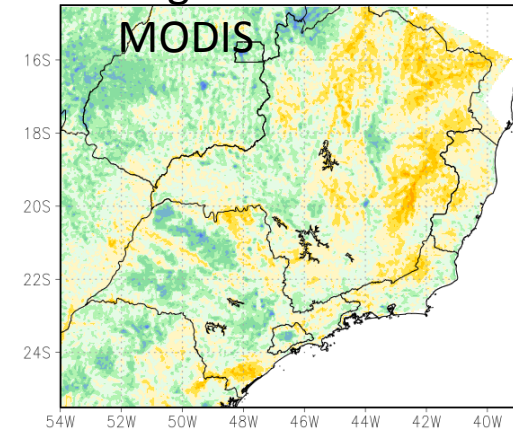
### RegCLM



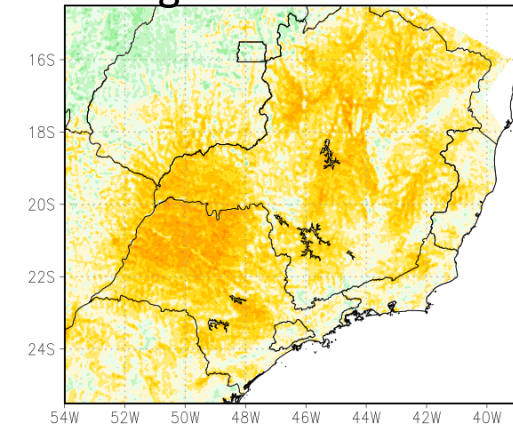
### RegCLM4.7.1



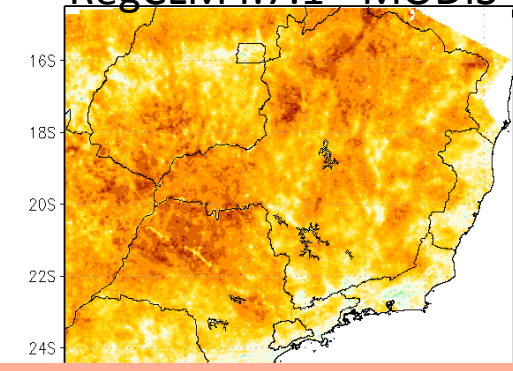
### RegBATS - MODIS



### RegCLM - MODIS



### RegCLM4.7.1 - MODIS



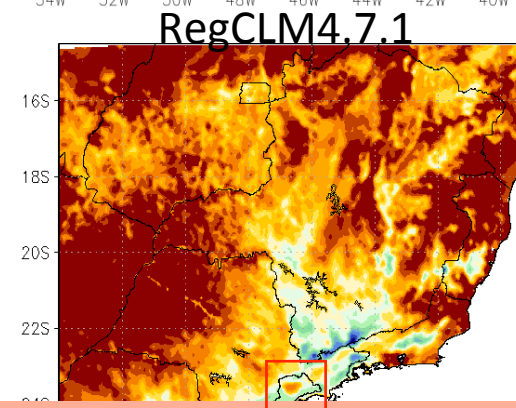
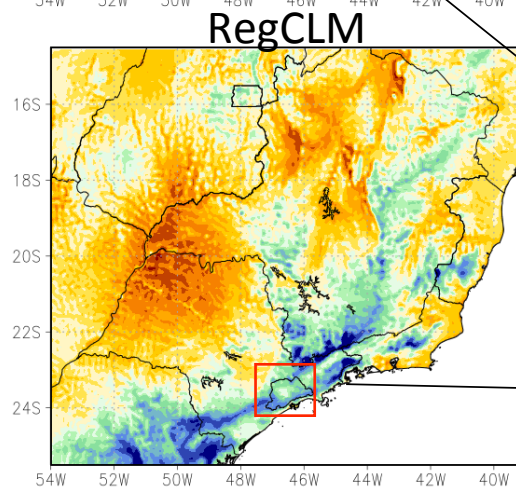
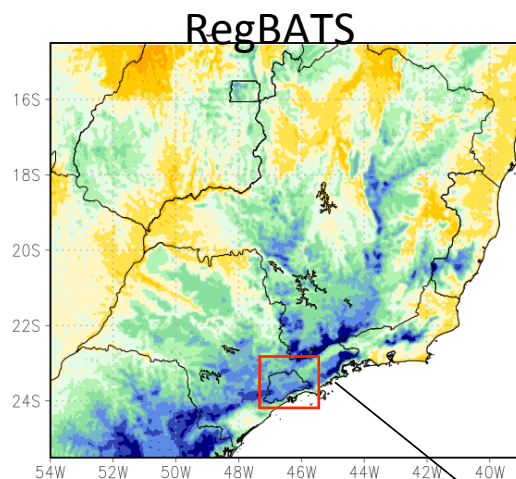
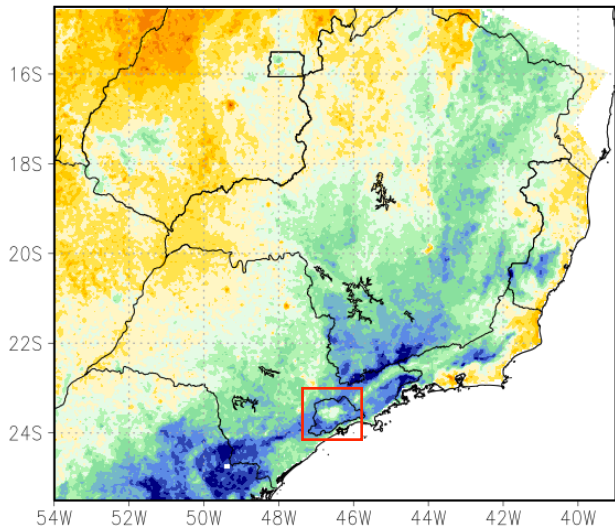
Tietê River appears in the simulations and not in MODIS.

Heat island of the metropolitan region of São Paulo is better simulated by CLM scheme than BATS

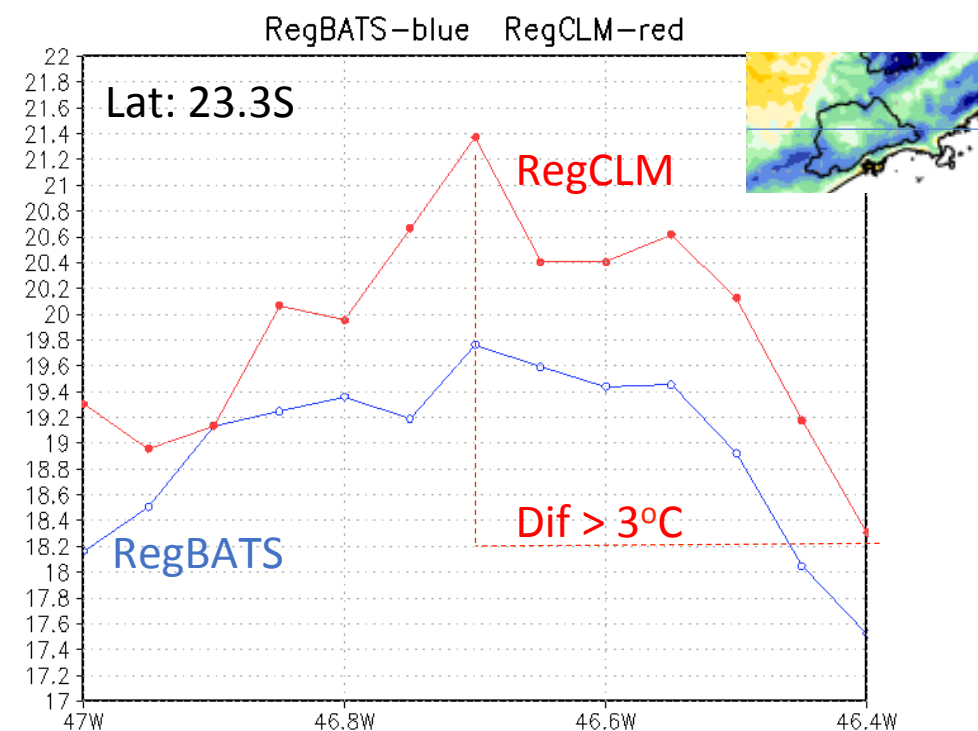
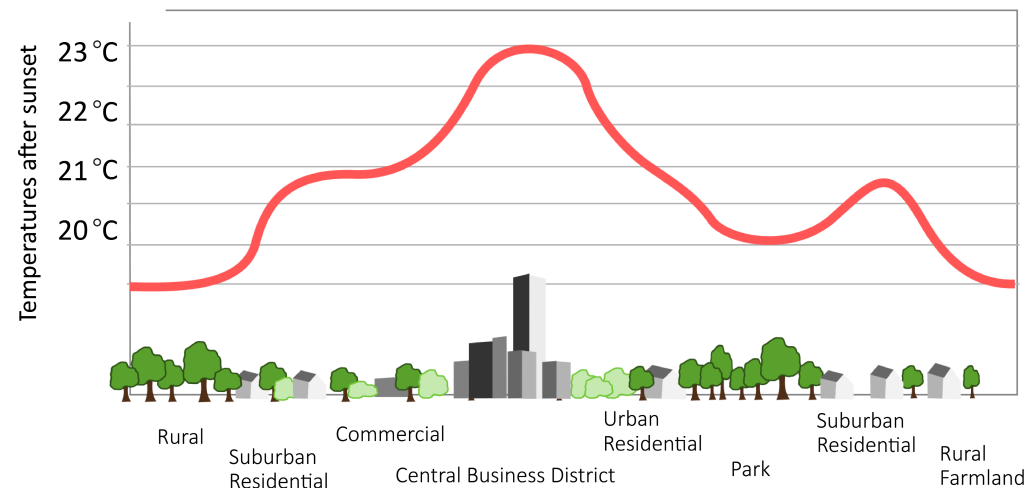
# April land surface temperature

MODIS

MODIS Month = 4



## URBAN HEAT ISLAND PROFILE



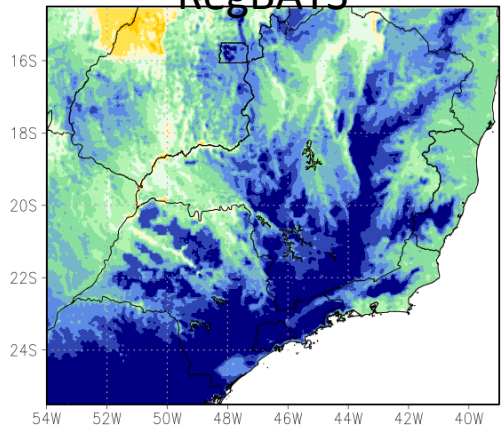
Heat island of the metropolitan region of São Paulo is better simulated by CLM scheme than BATS



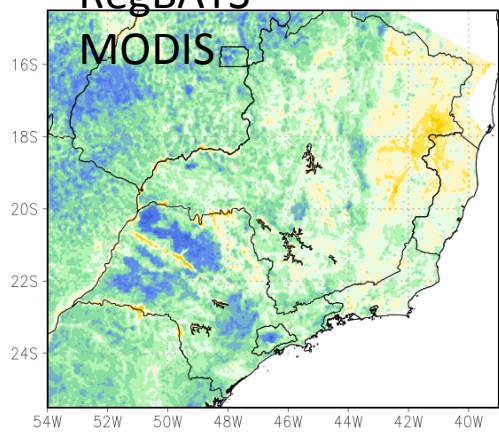
# July

## land surface temperature

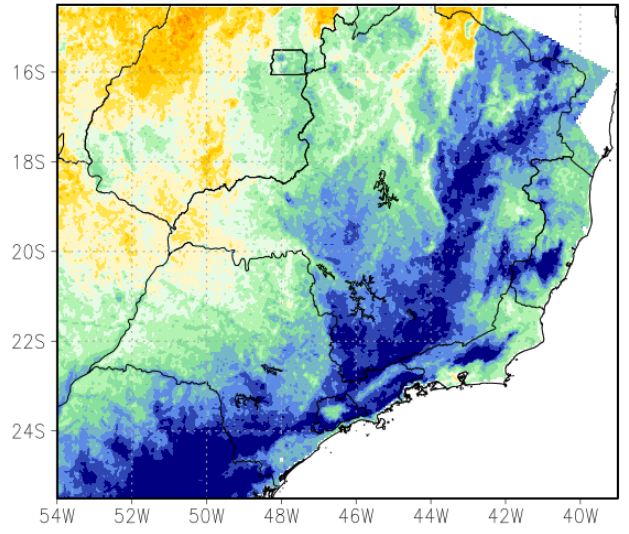
### RegBATS



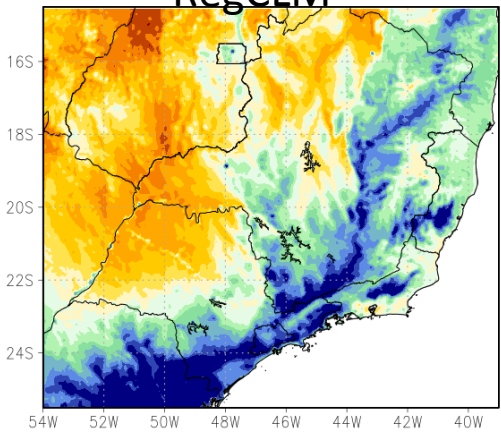
### RegBATS - MODIS



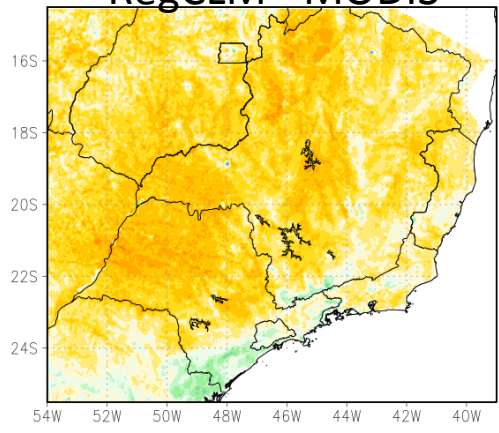
### MODIS MODIS Month = 7



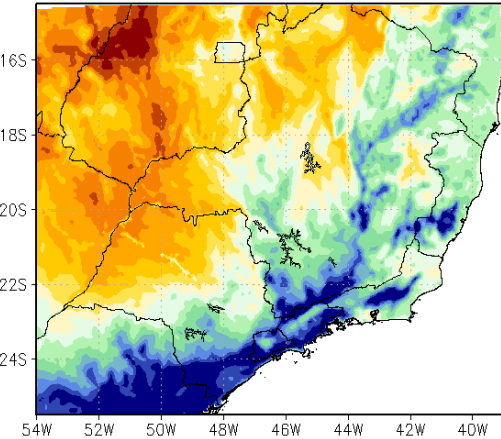
### RegCLM



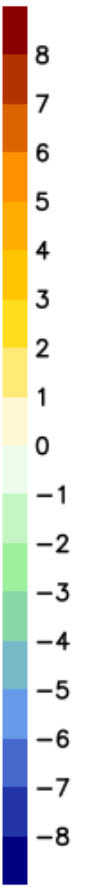
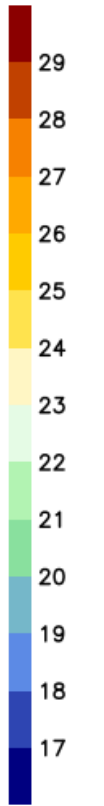
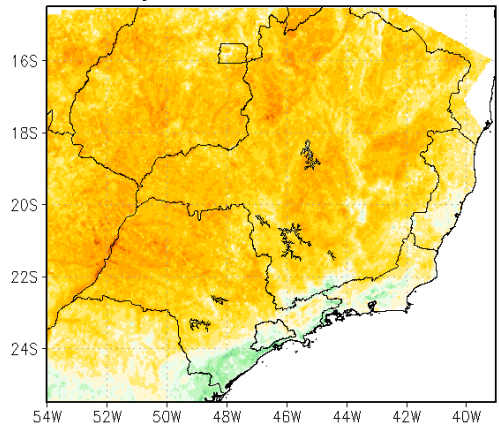
### RegCLM - MODIS



### RegCLM4.7.1

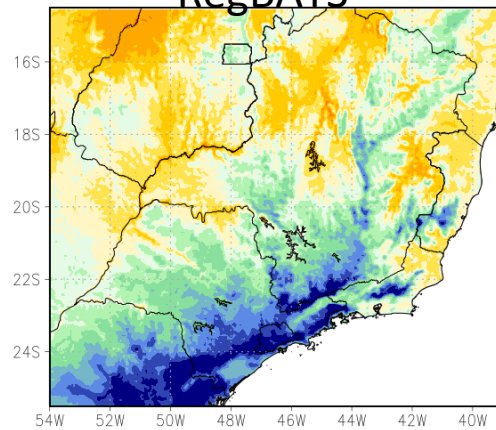


### RegCLM4.7.1 - MODIS

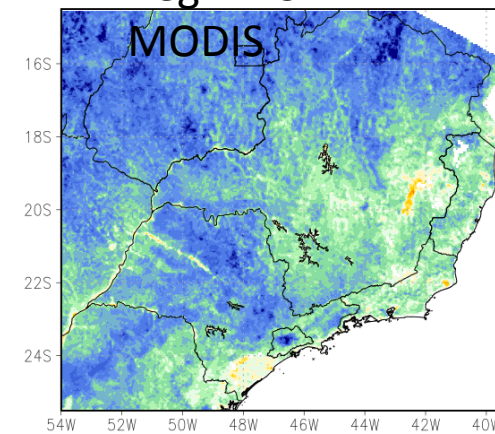


# October land surface temperature

### RegBATS

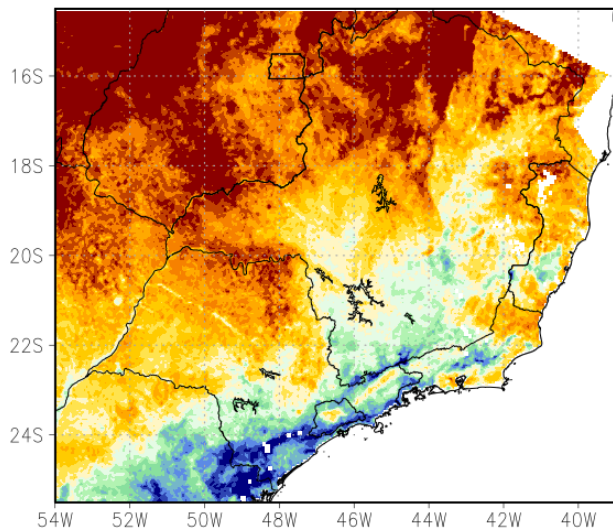


### RegBATS - MODIS

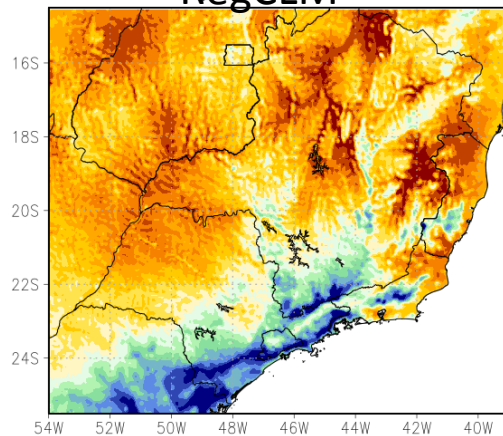


### MODIS

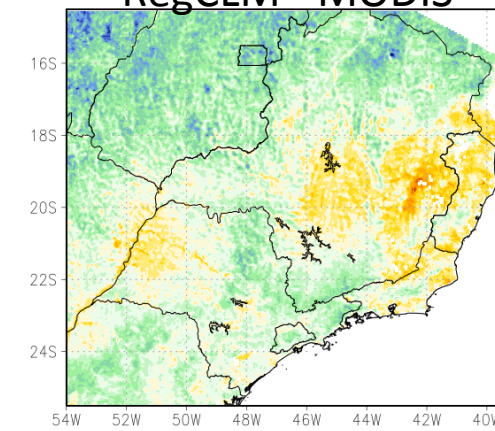
MODIS Month = 10



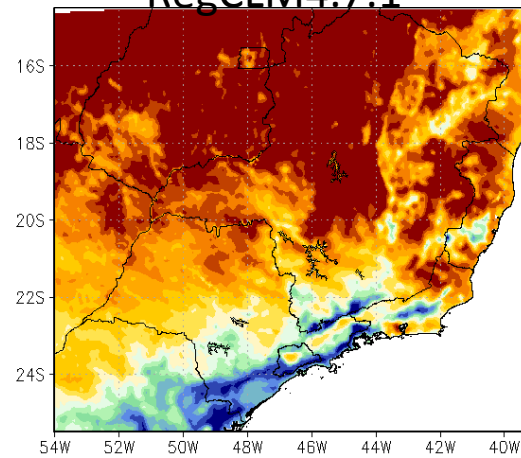
### RegCLM



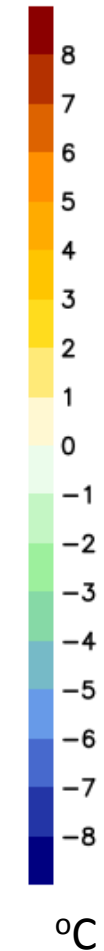
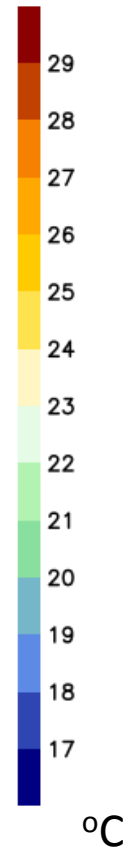
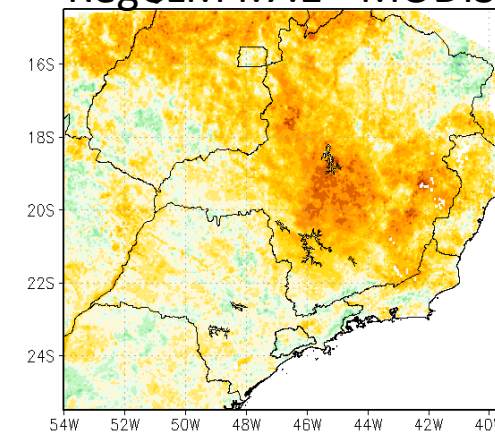
### RegCLM - MODIS



### RegCLM4.7.1

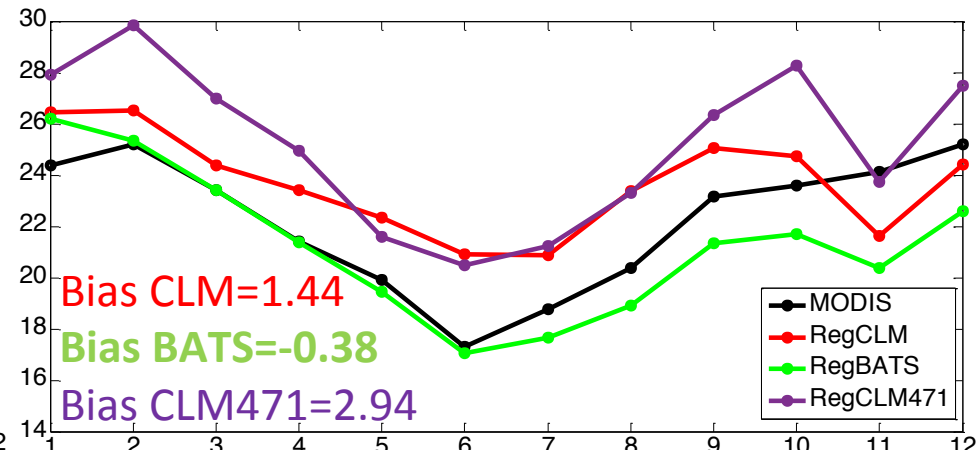
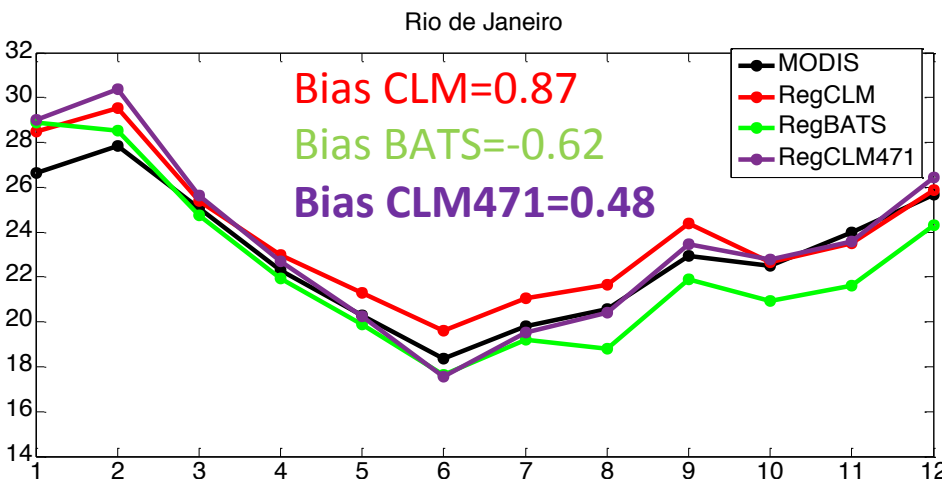
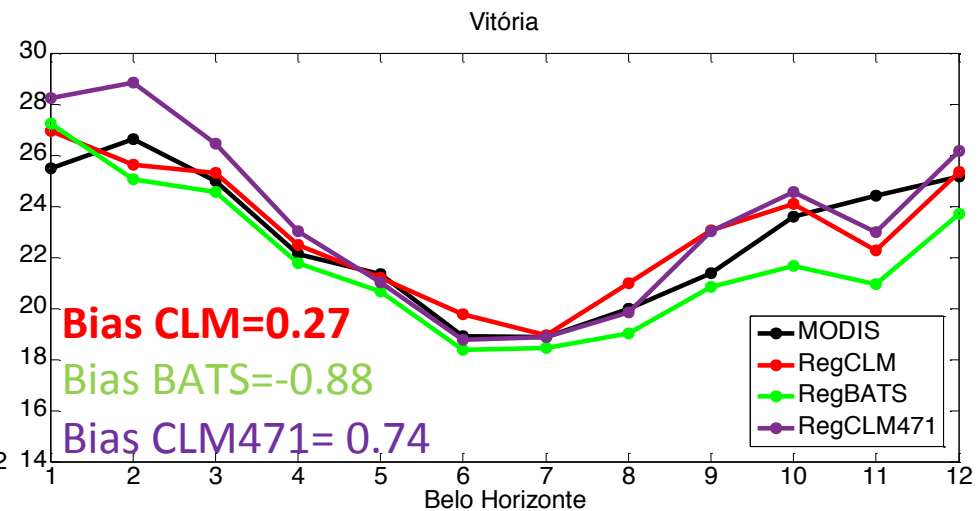
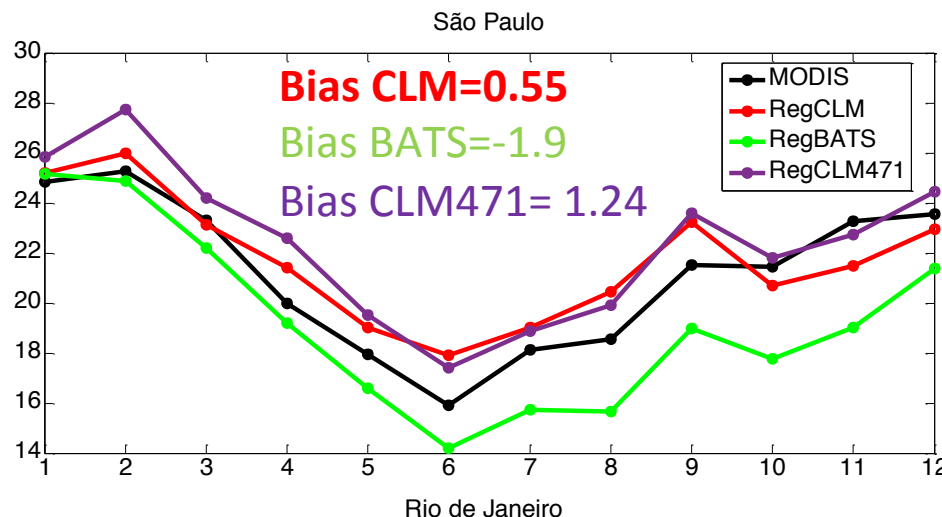
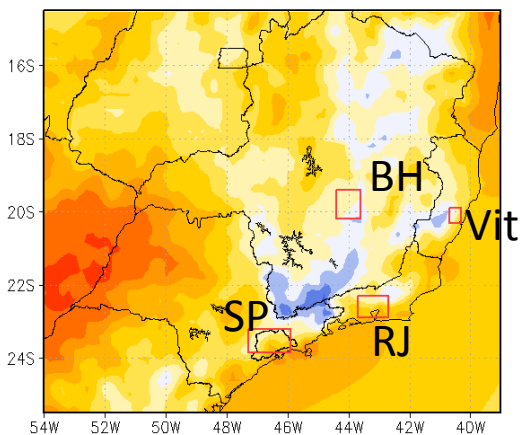


### RegCLM4.7.1 - MODIS



# Annual Cycle of Large Urban Centers

Sub-domains



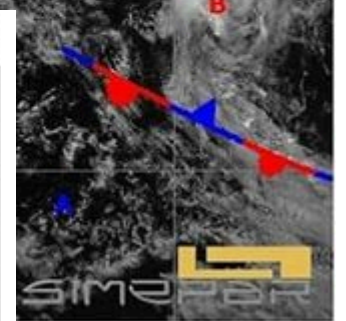
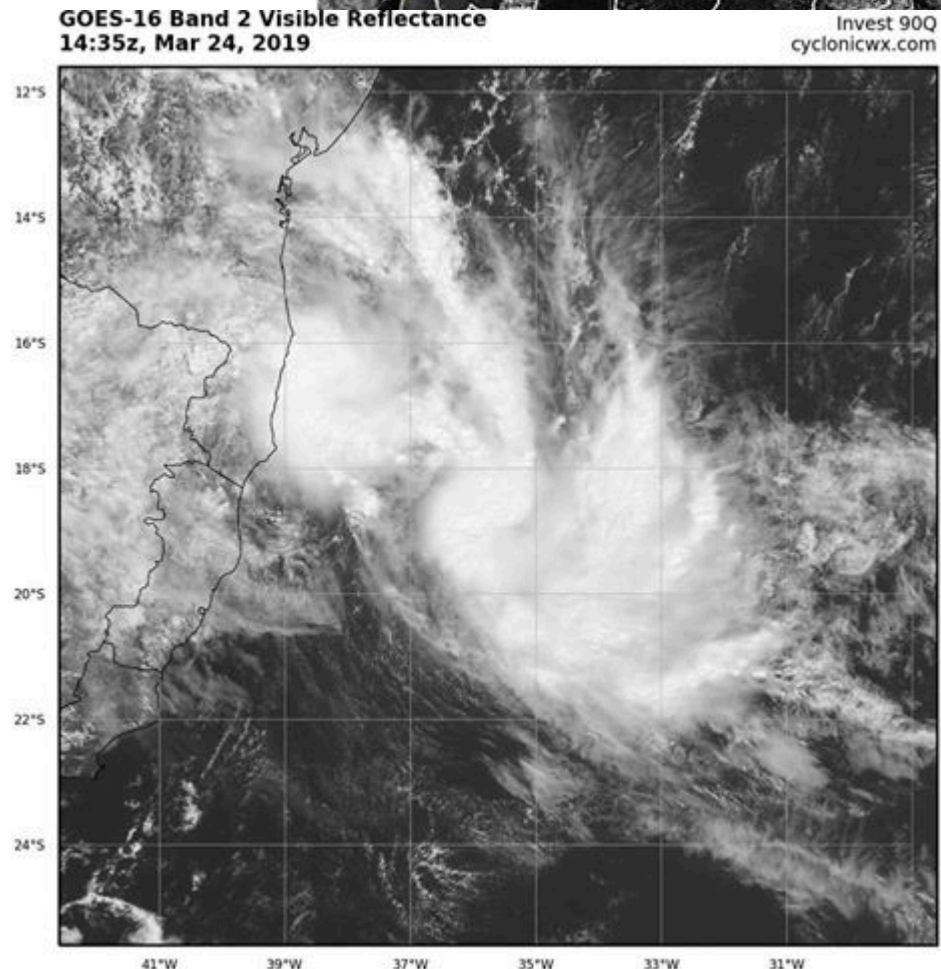
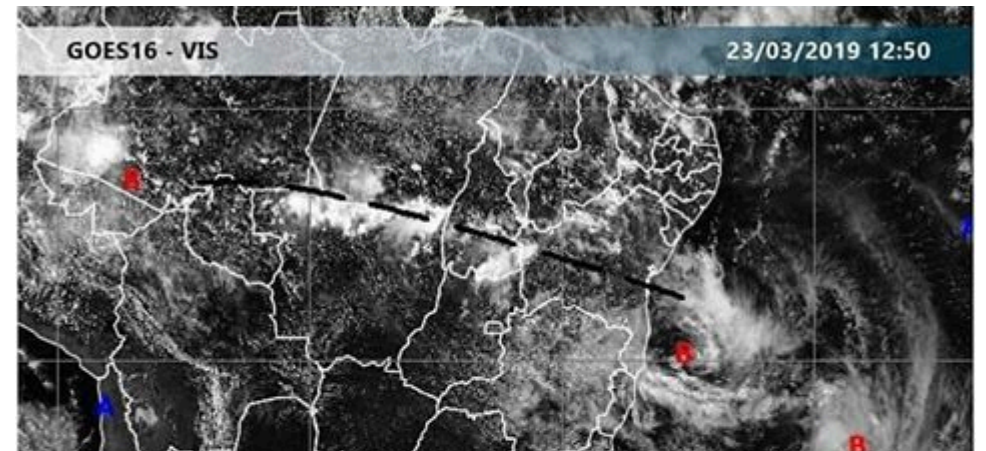
**Conclusions:** RegCM has a good performance in high resolution model and it is able to capture the features of the local climate (e.g., heat islands).

Better results can be obtained including convective permitting.

MODIS   RegBATS   RegCLM   RegCM4.7.1

# IBA Cyclone

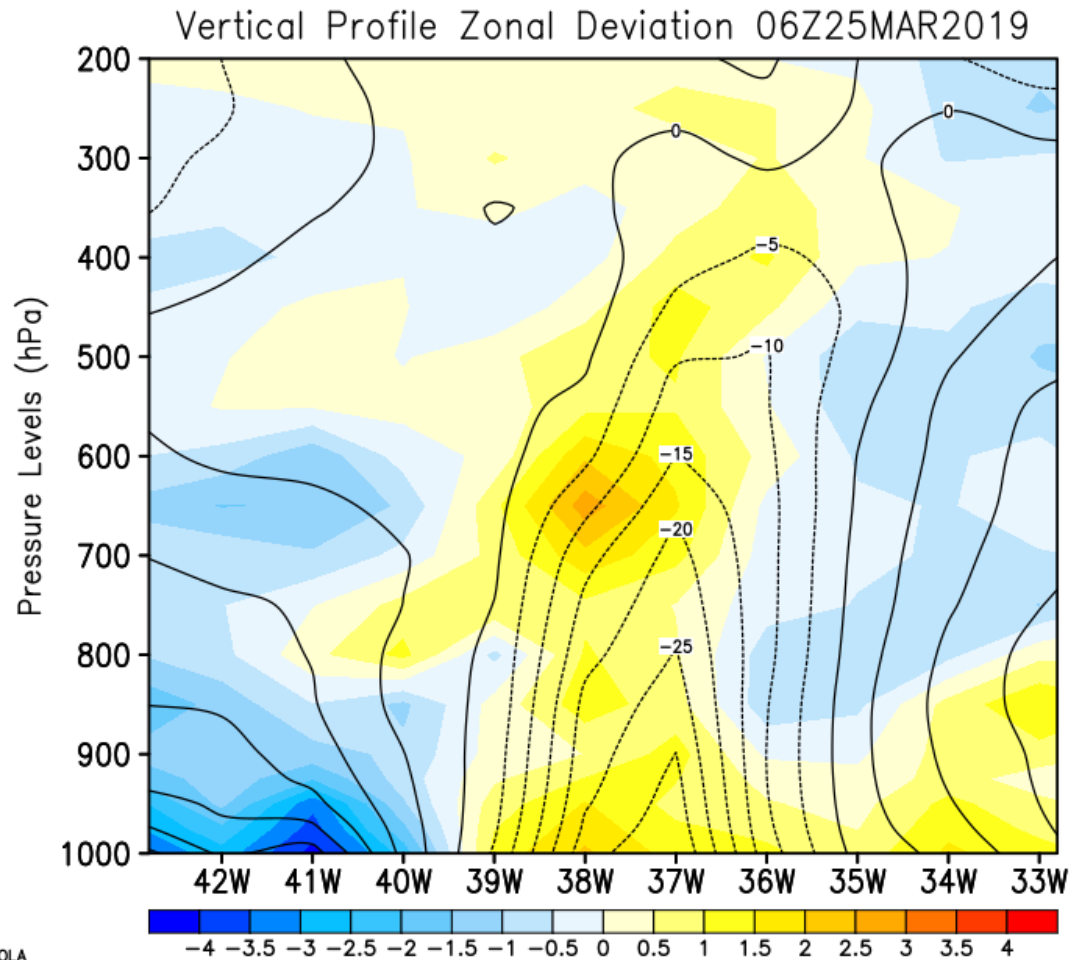
- Recently, a tropical cyclone developed near the Brazilian coast.
- Here, the purpose is to show if RegCM4.7 is capable to simulate this system in the seasonal forecast mode.



# IBA Cyclone

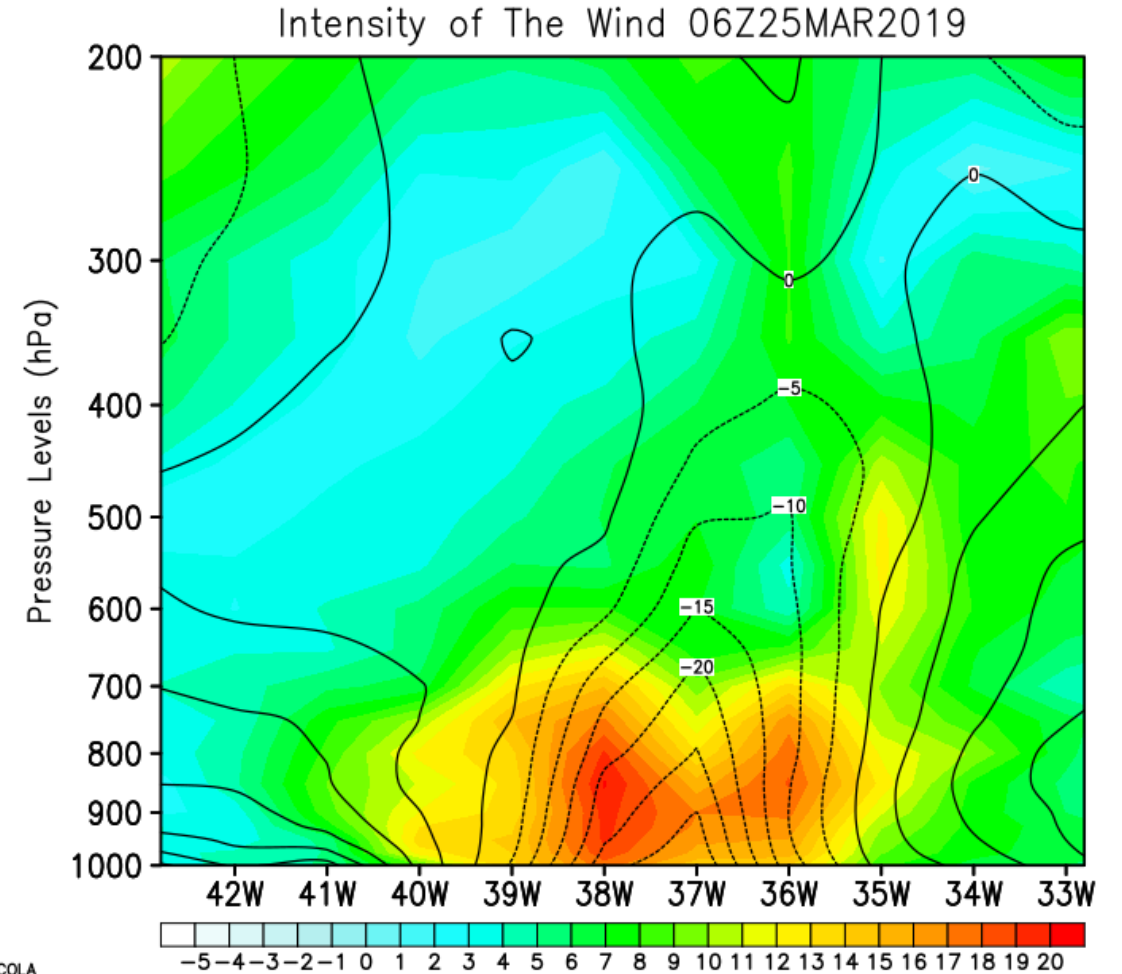
GFS analysis

## Warm Core



Zonal departure of air temperature

## Stronger winds at low levels



Zonal departure of wind intensity

# Characteristics of Simulations

**RegCM version: 4.7**

**Boundaries: CFSv2**

**Horizontal resolution: 36 km**

**Cumulus convection (O/L): Kain**

**Fritsch**

**Surface Scheme: CLM4.5**

## Different initialization times

01 Jan 2019

01 Feb 2019

01 Mar 2019

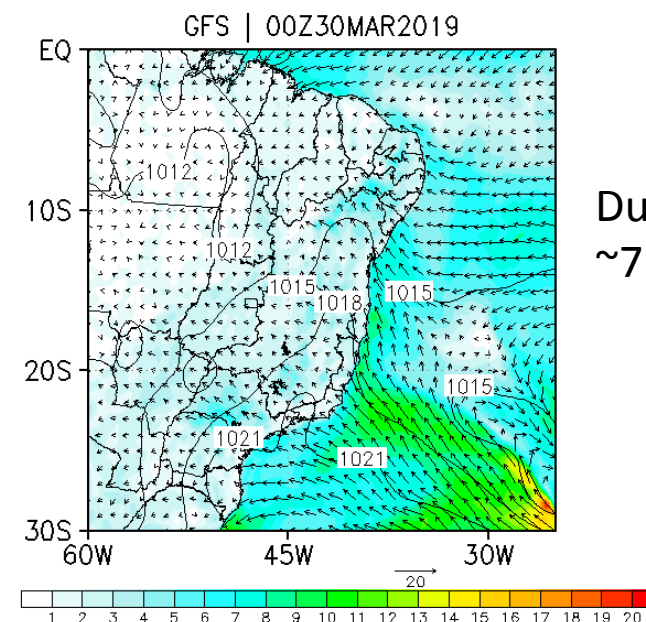
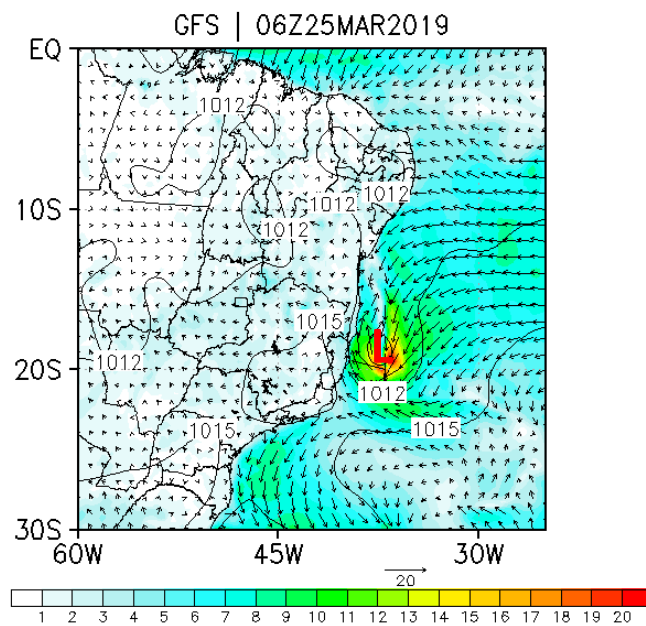
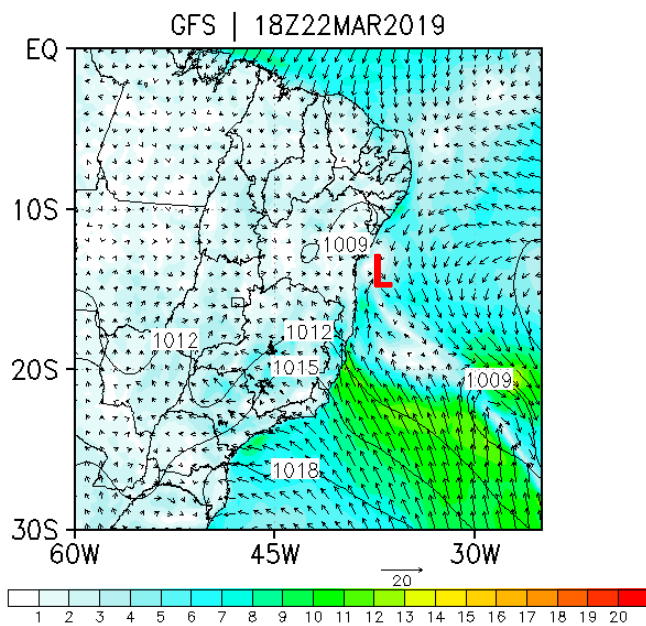
15 Mar 2019

Analyzed variable: wind at 10 meters and SLP

GFS 0.25 x RegCM

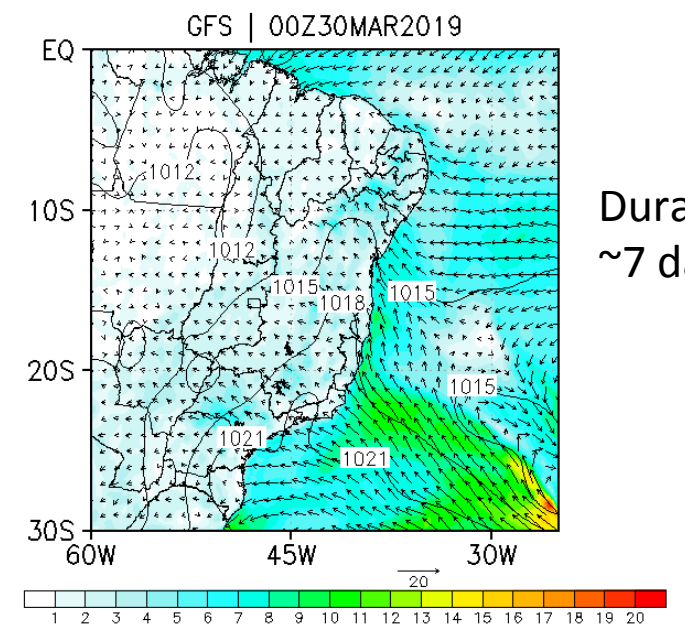
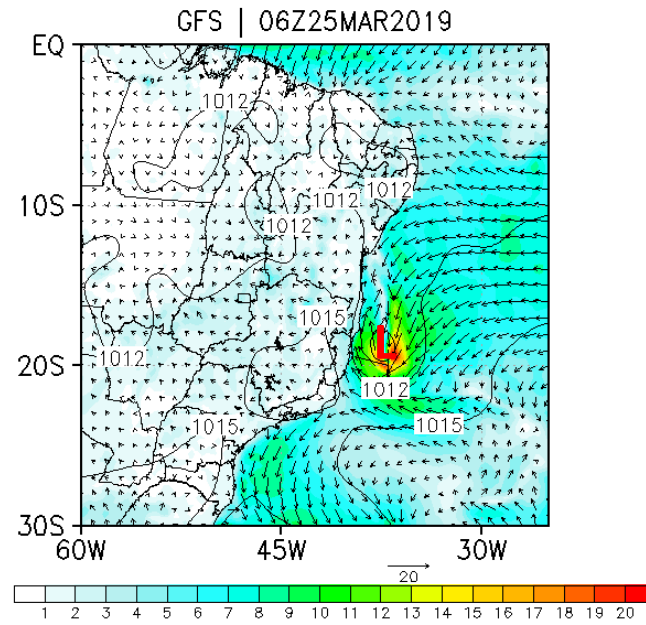
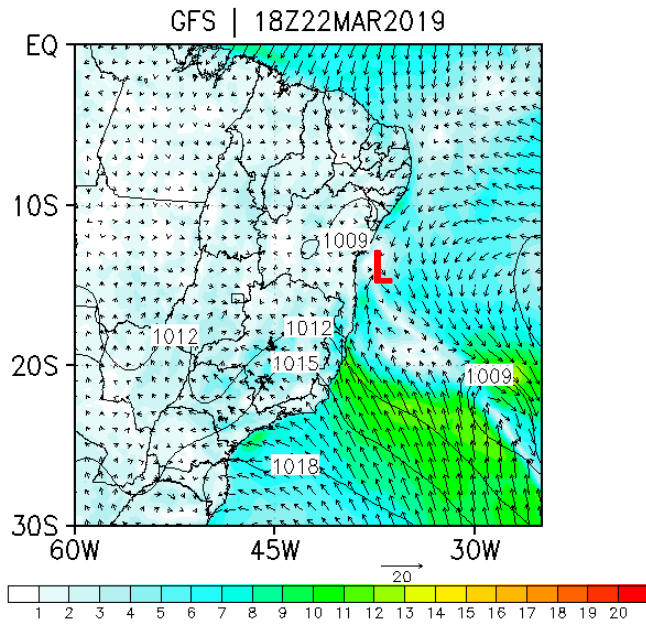
# Wind at 10 m and Sea Level Pressure

GFS



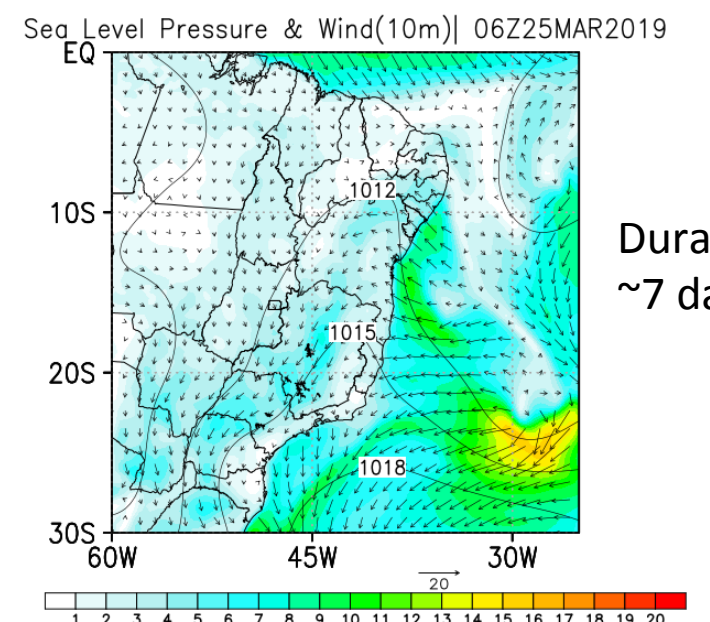
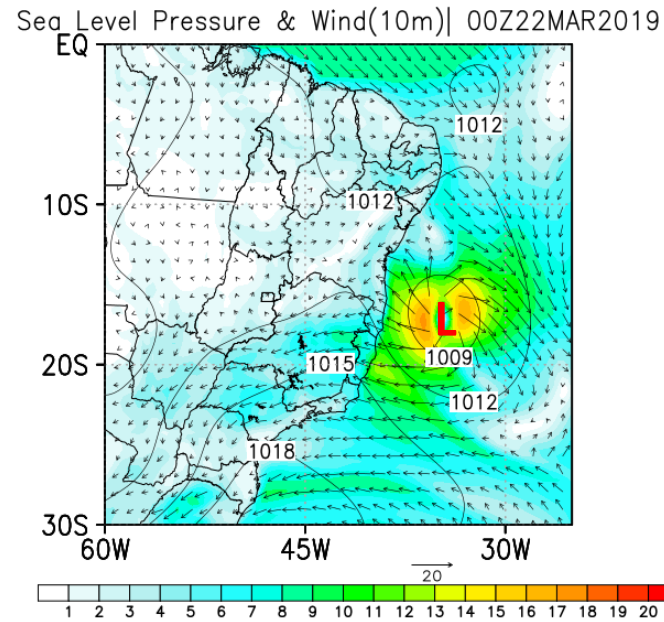
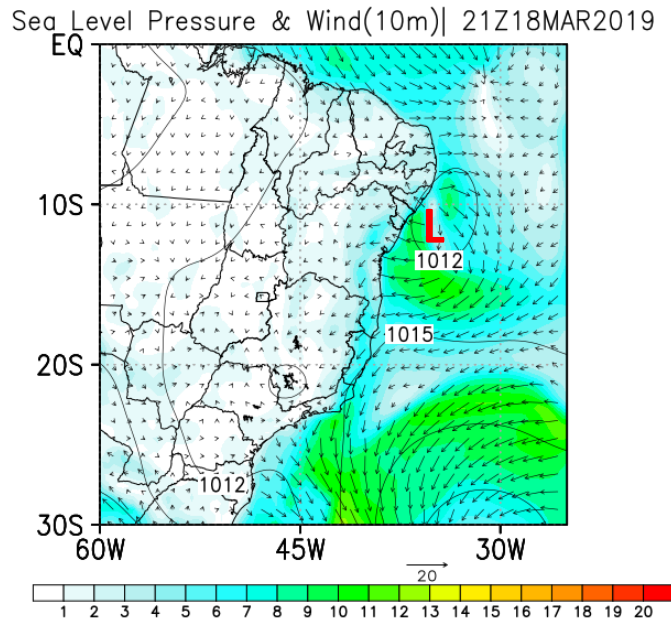
Duration  
~7 days

GFS



Duration  
~7 days

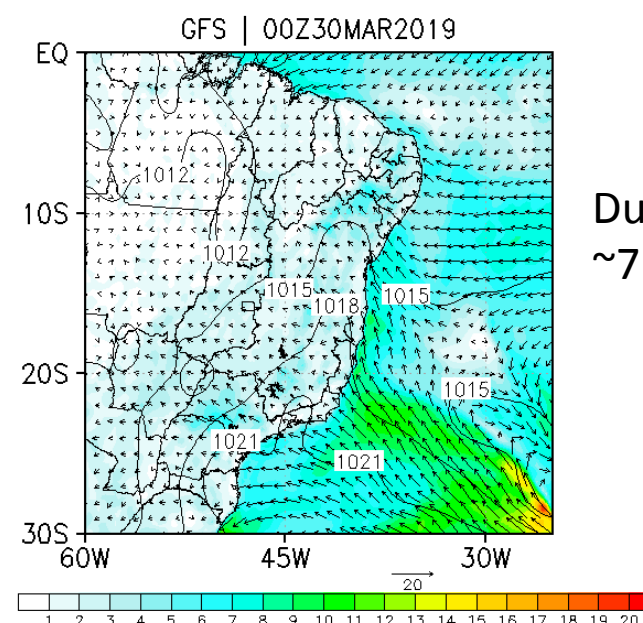
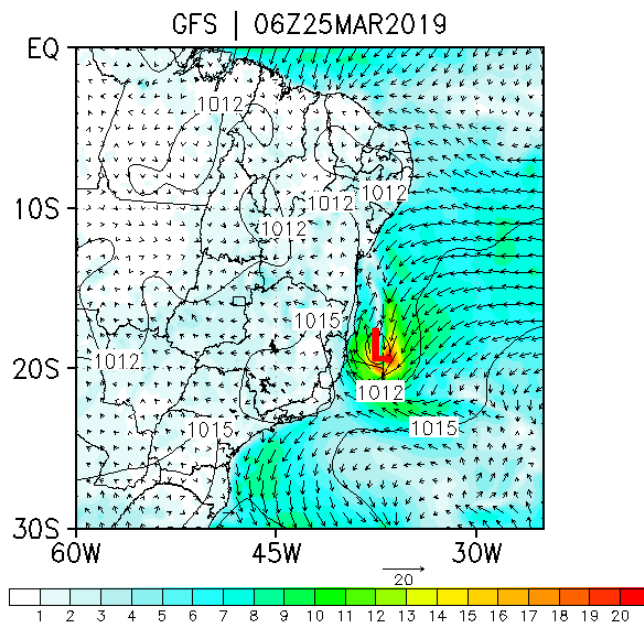
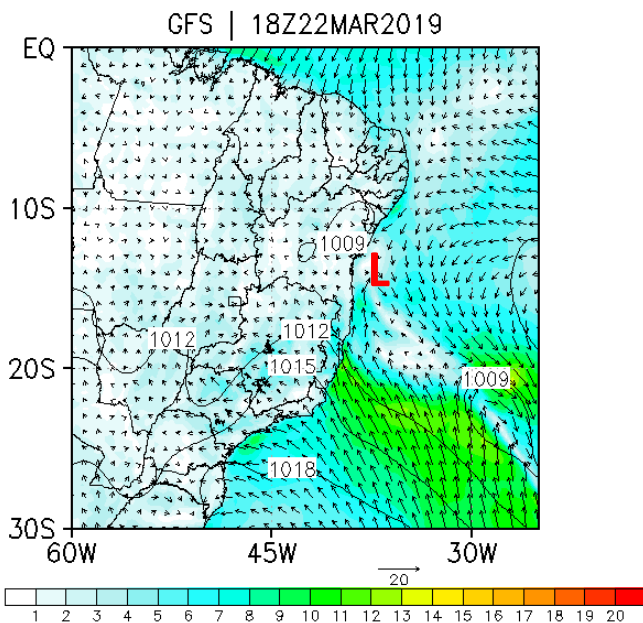
01 Jan 2019



Duration  
~7 days

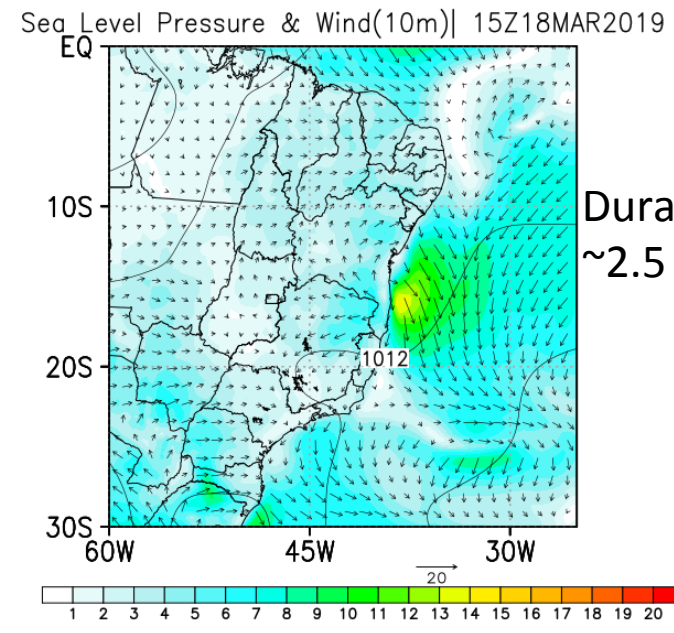
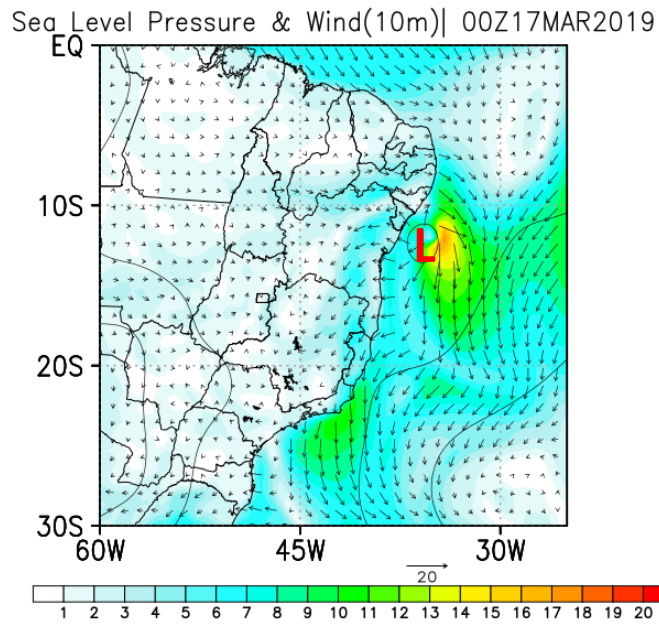
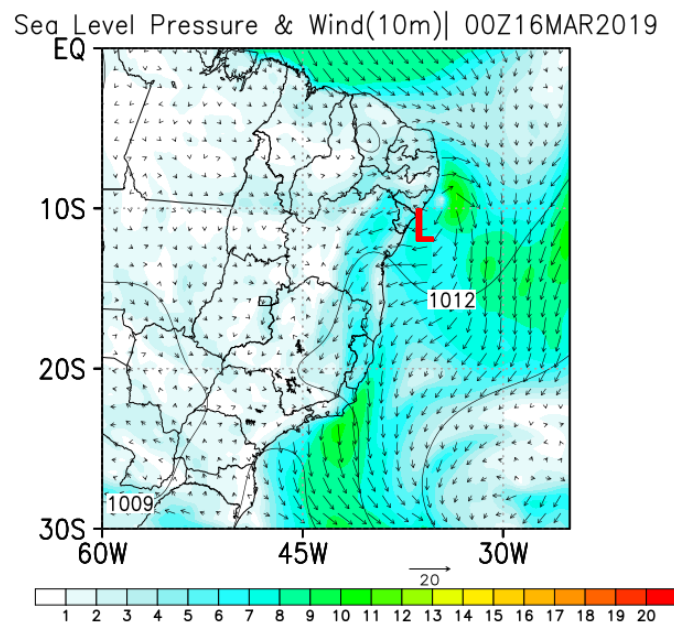


GFS



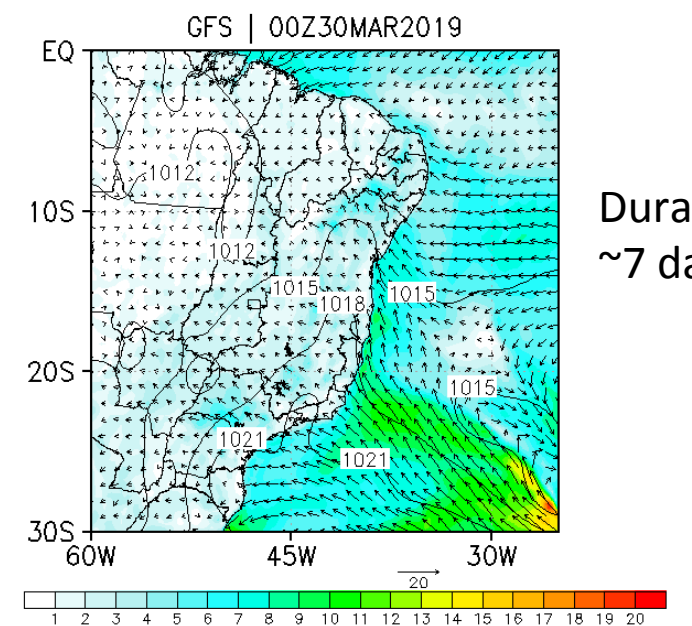
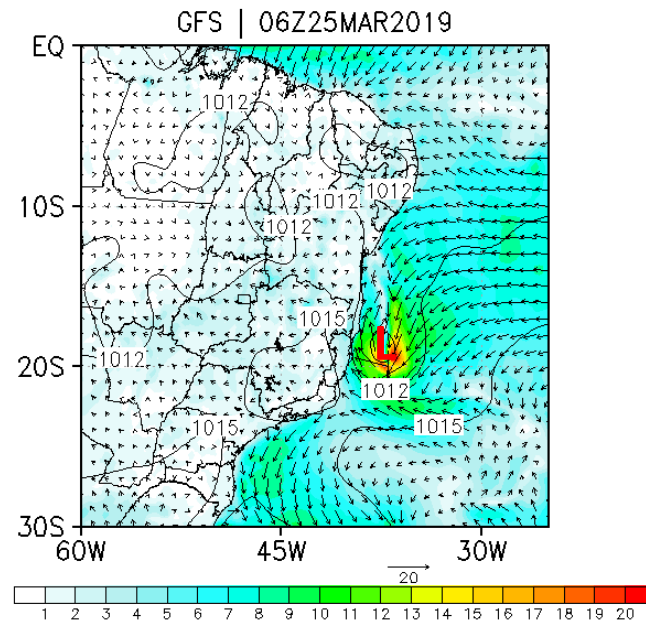
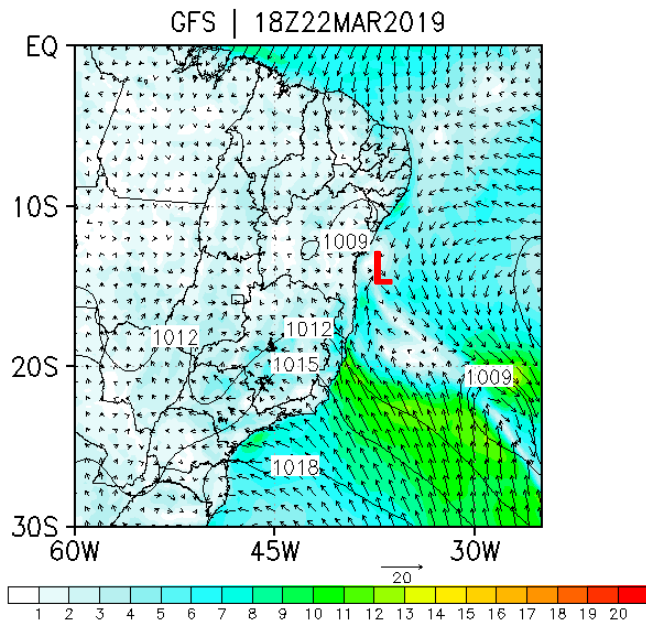
Duration  
~7 days

01 Feb 2019



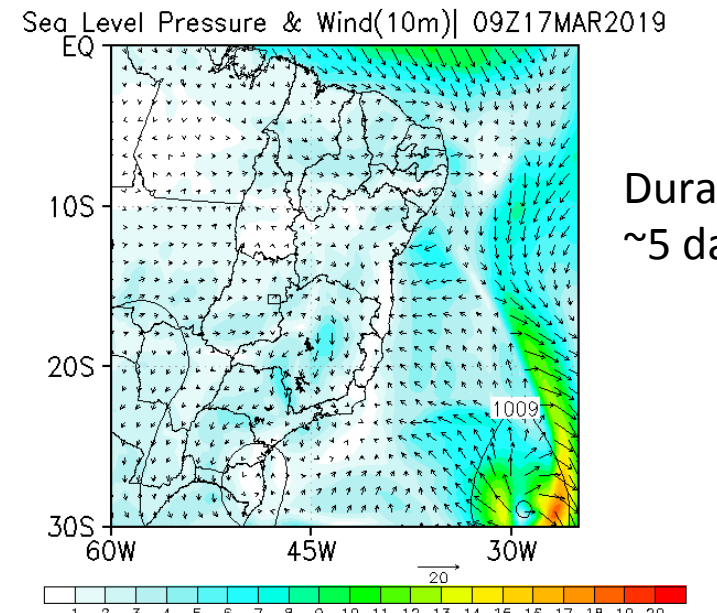
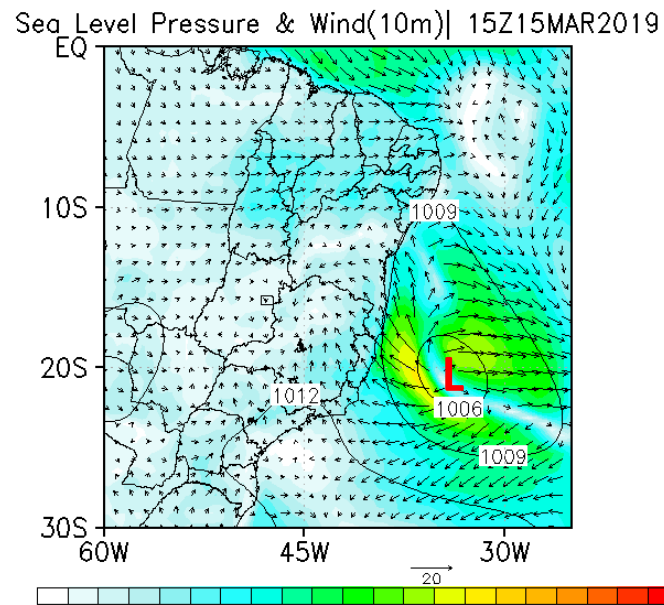
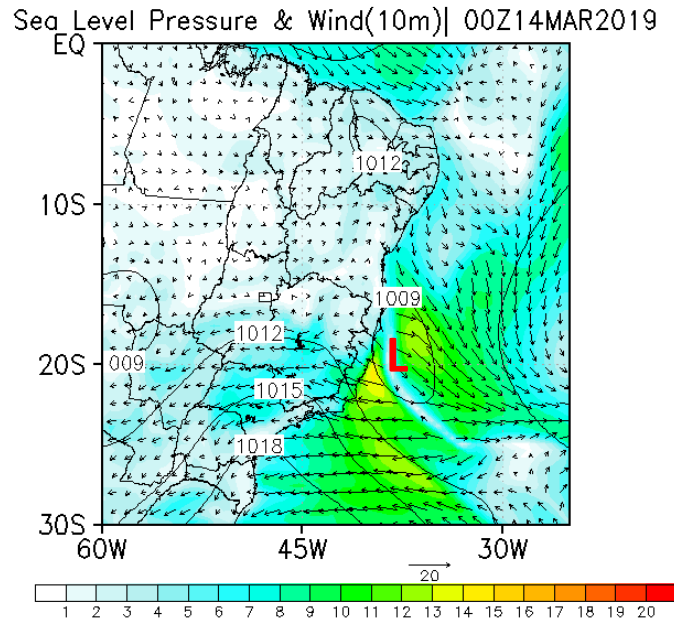
Duration  
~2.5 days

GFS



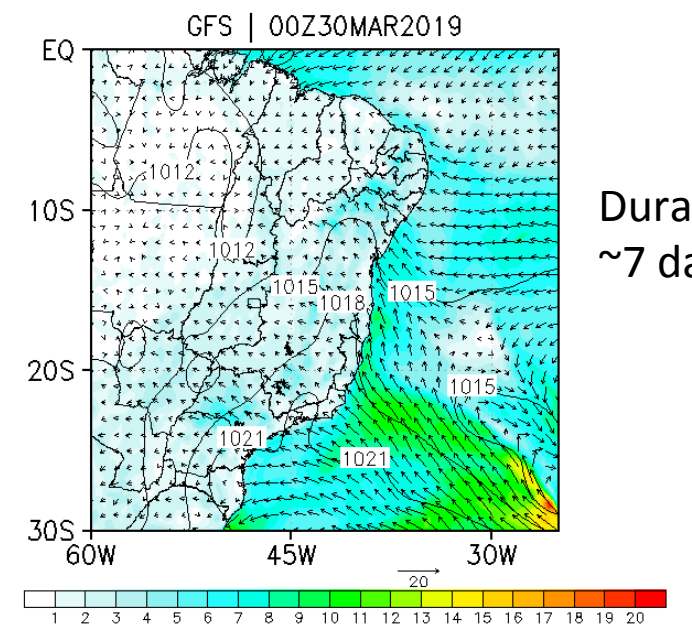
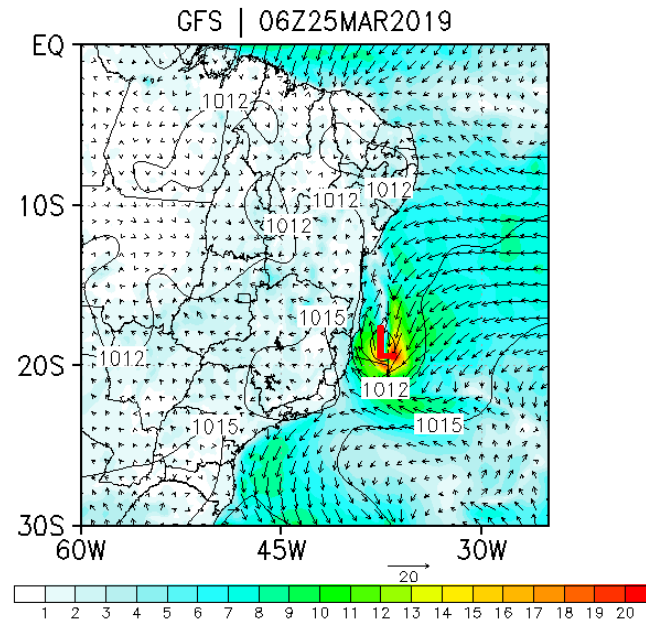
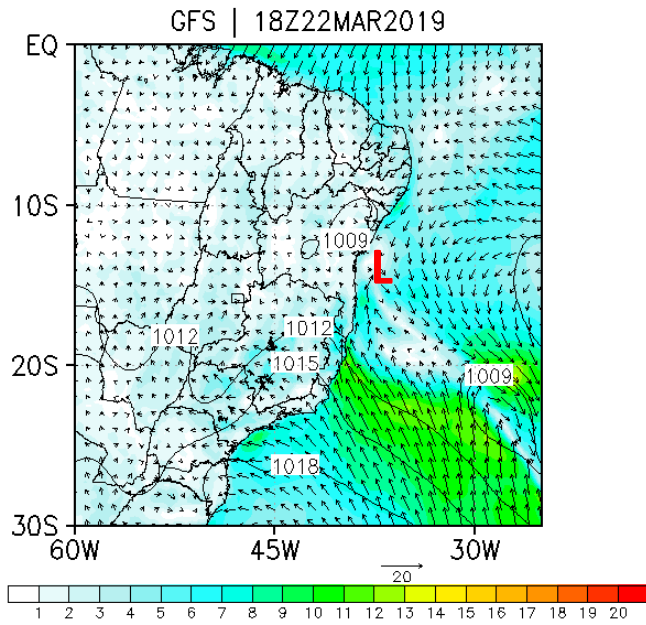
Duration  
~7 days

01 Mar 2019



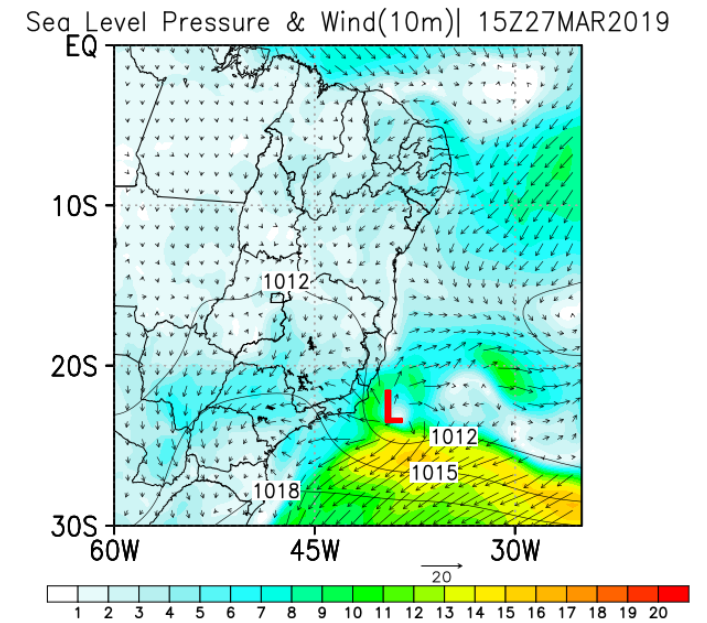
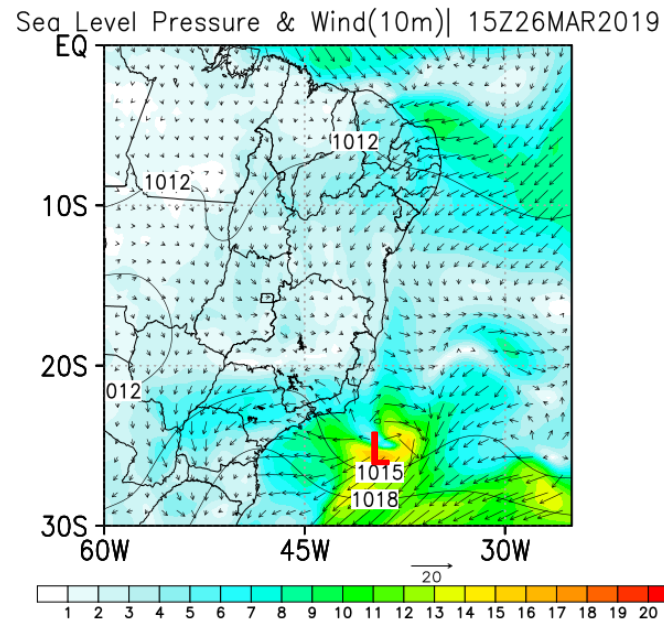
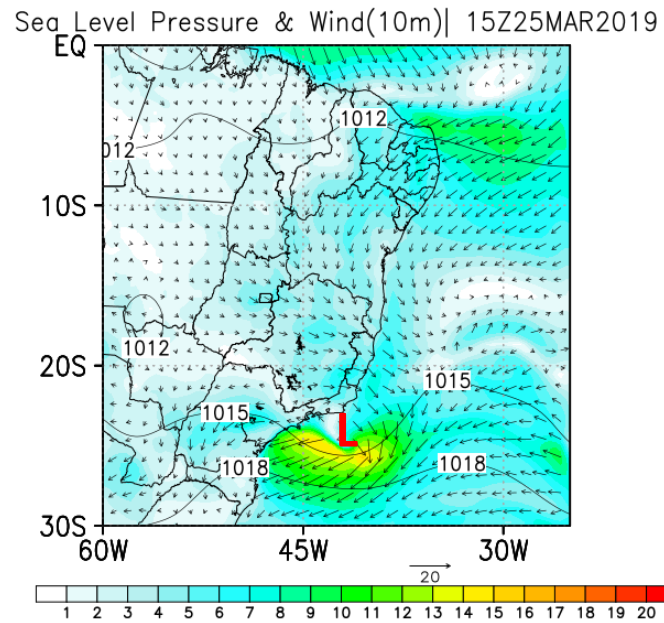
Duration  
~5 days

GFS



Duration  
~7 days

15 Mar 2019



**The best representation occurred with the  
initialization on**

01 Jan 2019



*Thank you for the attention!*