

# Climate change and its impacts in the rainfall and precipitating systems over the Amazon basin

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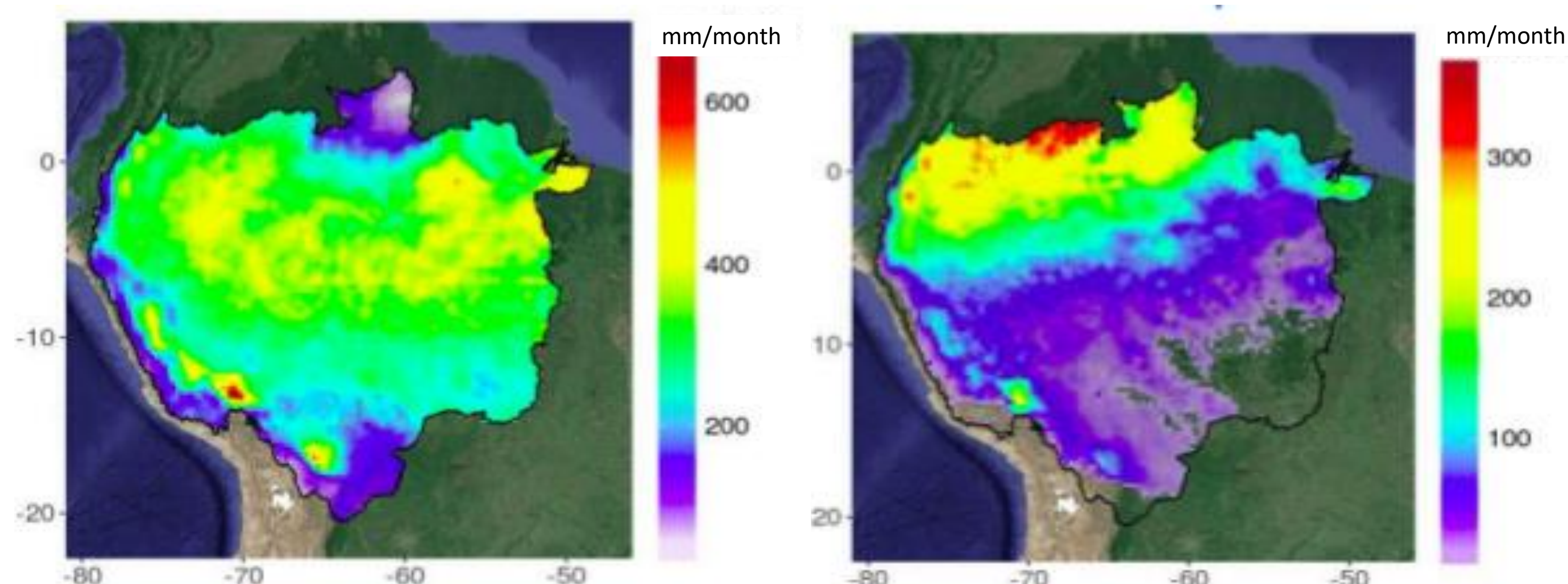
## INTRODUCTION

- Amazon basin is the largest watershed in the world;
- The rainfall, a vital meteorological variable for the maintenance of its ecosystems, is caused by different weather systems;
- Most of them belongs to the mesoscale ( $L < 1000$  km and  $t < 1$  day);
- Climate predictions over the Amazon were made on a global scale, with very little or none representation of the smaller scales;
- We have few or none knowledge about the future of the precipitating systems over the Amazon basin.

## OBJECTIVES

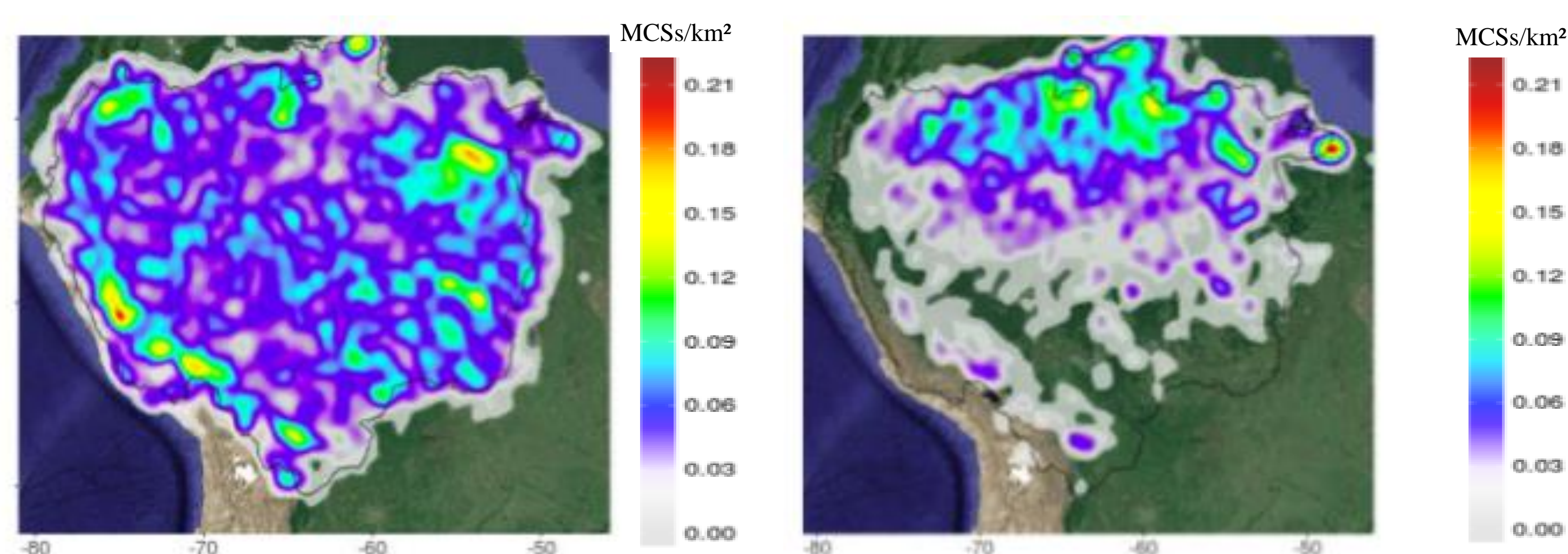
To investigate the behavior of the most important precipitating systems over the Amazon basin in the future warm climate.

## RESULTS AND DISCUSSIONS



**Fig. 1** – Average precipitation over the Amazon basin during (a) March, and (b) August, respectively. Source: Tropical Measurement System (TRMM - 3B43).

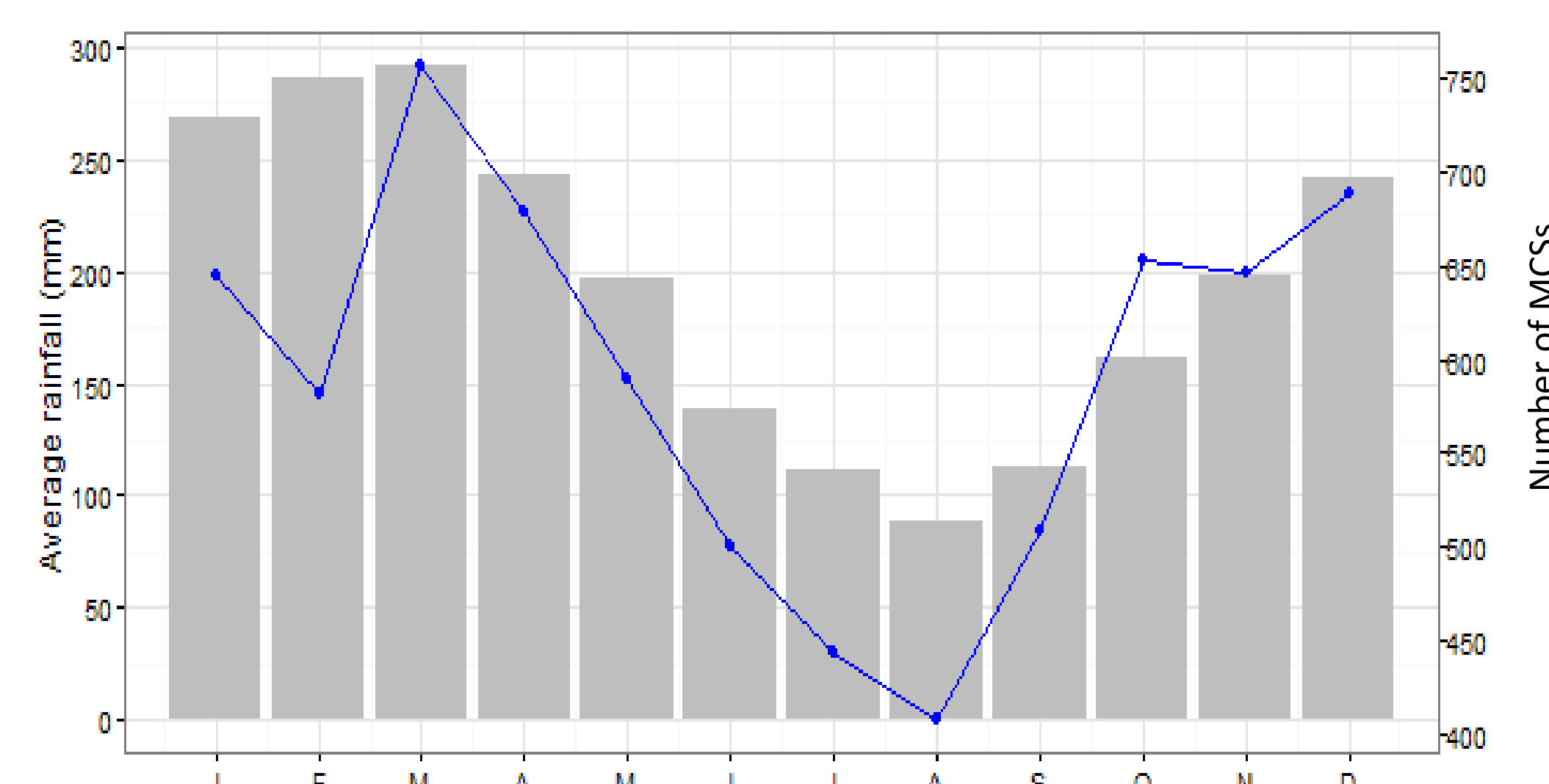
Figs. 1 and 2 shows that the distribution of the precipitation are in accordance to the MCSs occurrence over the entire basin for different months.



**Fig. 2** – Density of genesis of the mesoscale convective systems over the Amazon basin during (a) March, and (b) August. Adapted from: Rehbein et al. (2017).

- MCSs are large and intense cloud clusters, and can cause high precipitation rates and intense thunderstorms where they occur (Houze, 2004).
- Their formation and maintenance is directly linked to available heat and moisture, this is why they are abundant over the Amazon basin.
- Fig. 3. shows that the MCSs occurrences are in accordance to the precipitation along the year over the Amazon basin. The extremes of precipitation are followed by extremes in the MCSs occurrences.

- In a scenario of warmer climate and atmosphere rich in moisture, it should be expected that MCSs will be much more likely to form and be more intense than present conditions.
- However, this impacts can be not homogeneous along the Amazon basin.



**Fig. 3** – Monthly distribution of the MCSs (line) and monthly mean rainfall (bars) over the Amazon basin. Adapted from: Rehbein et al. (2017). Precipitation data from Tropical Measurement System (TRMM - 3B43)

Just for illustrate, over the Sahel, the number of the MCSs by year and the total precipitation are increasing since last 35 years (Taylor et al., 2017). The authors supposed this can be related to the increasing gradient of temperature led by the increase temperature over the Sahara (not over the Sahel).

Over the Amazon basin, the climatic prognoses show that there will be a reduction in the precipitation in the eastern part of the Amazon, while in the western part the extremes of rainfall will increase.

Therefore, there is a large complexity involved in the future of the MCSs, because it depends on many factors, such as: availability of moisture, temperatures gradients, aerosols and fires, deforestation, local and large scale circulations, etc.

Actually, we are performing experiments to investigate the future occurrence, intensity and behavior of the MCSs over the Amazon basin. This experiments consists on identify and track MCSs over the Amazon basin using outputs from CMIP models and different RCPs (Representative Concentration Pathways). From the outputs of the GCM it is necessary to make downscaling to obtain high resolution data necessary to identify and track the MCSs.

## CONCLUSIONS

1. We have few or none knowledge about the future of the precipitating systems over the Amazon basin;
2. In a scenario of warmer climate and atmosphere rich in moisture, it should be expected that MCSs will be much more likely to form and be more intense than present conditions. But, there is a large complexity and a lot of processes involved;
3. Simulations can help us to predict the occurrence, behavior and intensity of the MCSs; This involve a large amount of data and time.

## REFERENCES

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