Are the Mesoscale Convective Systems the Major Precipitating Sources in Amazon Basin?

Amanda Rehbein¹, Tercio Ambrizzi and Sergio Ibarra Espinosa

Institute of Astronomy, Geophysics and Atmospheric Sciences, University of São Paulo, Brazil

¹amanda.rehbein@iag.usp.br

Introduction
Mesoscale Convective Systems (MCSs) are known to cause large cumulative rainfall in different regions of the world, and represent the largest existing convective storms (Houze, 2004). They are intense and extensive and can last many hours. A climatology of the MCSs over the Amazon basin was recently obtained (Rehbein et al., 2016a). However, many questions about the MCSs and its impact in the precipitation over the Amazon basin are still unanswered...

- How the intensity of MCSs can vary across the Amazon basin and according to the year?
- Which is the amount of rain caused by MCSs over the Amazon basin?
- Are the Mesoscale Convective Systems the major precipitating sources in the Amazon basin?

Therefore, the objective of this study is to verify the contribution of the MCSs for precipitation in the Amazon basin.

Materials and methods
Algorithm: Forecast and Track the evolution of Cloud Clusters (ForTraCC; Vila et al., 2008) was applied to infrared satellite images with spatial and temporal resolution of 4×4km and 30 minutes, respectively (Janowiak et al., 2001), to identify and track the MCSs. The threshold 150 pixels (2,400km²) with brightness temperature of 235K or less defines the MCSs. More details in Rehbein et al. (2016a).

Precipitation: Monthly Tropical Rainfall Measurement Mission (TRMM-3B43) \( \rightarrow \) spatial resolution of 0.25°×0.25°

Region: The geographical domain and topography of the Amazon \( \rightarrow \) Observatorio de Recherche en Environnement (ORE-HYBAM).

Results
Fig. 1a shows that the monthly distribution of MCSs follows the annual cycle of the precipitation over the Amazon basin.

Also, between 2012 and 2015, the MCSs showed a marked tendency reduction in number.

Correlation tests were made and it was observed:

- There is not a linear correlation between the rainfall and MCSs over the Amazon basin during the wet season, Figs. 2a and 2b, and transition months \( \rightarrow \) wet season the distribution of the MCSs is more homogenous along the Amazon.
- There is better correlations (about 0.7) during the winter (dry season) \( \rightarrow \) in the dry season, the MCSs and rainfall are displaced and concentrated to the north part of the basin, Figs. 2c and 2d;
- The spatial correlations between MCSs and topography are more evident over the region of precipitation hotspots close to the Andes Mountain.

Conclusions
There is clear correlation for the dry season, but not during the wet season. This relatively low correlation occurs because each algorithm identify differently the related phenomena. In one hand ForTraCC identifies cloud cluster tops and the other, TRMM-3B43 is designed to measure and estimate precipitation. Both measurements are complementary and with a general overview they have good agreement, but not in a pixel-by-pixel correlation. Despite that, MCSs density is still a good tool for evaluating possible hotspots of deep convection.

References


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