Tracking mesoscale convective systems in a future warm climate

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The Amazon basin is the largest water shed in the world and its complex ecosystems play an important role on the regional and global climate system. Due to its warm and moist air, thunderstorms are widely frequent over the basin. A group of these individual thunderstorms can compose one larger, intense, persistent and complex thunderstorm, which is called mesoscale convective system (MCS). MCSs occur with high frequency in the Amazon basin. Besides severe weather, hail, strong winds and lightning, MCSs causes elevated rates of precipitation contributing to the local and global climatology. Even with the increases of the global temperature, other factors, such as deforestation and increased pasture area, are expected to influence the formation of rainfall systems over the Amazon basin. Thus, it is very important to investigate how will be the average occurrence and behavior of MCSs in the Amazon basin in climate change scenarios. We will investigate the behavior of the mesoscale meteorological systems in a future warm climate. Simulations with global domain models give few or none information about mesoscale systems. The present study is part of a larger investigation about the impact of the climate changes on the MCSs occurrence over the Amazon basin. To identify and track MCSs in future climate change projections, we used a modified version of the algorithm Forecast and Track the evolution of Cloud Clusters (ForTraCC) adapted to read precipitation files from the climate model in matrix format. As tracking MCSs requires precipitation data at high temporal and spatial resolution, we used outputs from a regional model with 10 km spatial resolution. The Regional Climate Model system version 4 (RegCM4) was nested in the Hadley Global Environmental Model 2 - Earth System (HadGEM2-ES). The following Representative Concentration Pathways (RCPs) is used: RCP4.5 and RCP8.5. The atmospheric component of the model works with horizontal resolution of 1.25° latitude ×1,875° longitude, 38 vertical levels and a time interval of 30 minutes; and the oceanic component is performed at a resolution of 1° latitude ×1° longitude (with increasing resolution near the equator), 40 vertical levels and 1 hour time interval.

Keywords: thunderstorms, mesoscale convective systems, climate change, Amazon basin

