Atmospheric Thermodynamic indexes during GoAmazon2014/5 from atmospheric soundings

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Objective

The thermodynamic indexes LCL, LFC, CINE and CAPE largely synthesize atmospheric conditions in relation to cloud formation and precipitation. The objective of this work is to study the diurnal and seasonal cycle of these indexes, with respect to the radiosonde profiles released during the GOAmazon2014/5 campaign.

Materials and Methods

In this work, we analyze four approaches to determine the thermodynamic indexes using different ranges of height above the surface (0-500 m, 50-500 m, 0-350 m 50-350 m) to determine <*T*> and <*RH*> in the layer , which is the input information required for the determination of LCL. For these 4 LCL values, the LFC, CAPE and CINE indexes were then calculated subsequently. As a reference measure, we used the thermodynamic indexes already calculated on the University of Wyoming electronic page, and the equations documented on this page were used to carry out the calculations of the thermodynamic indexes.

Results

On the different height ranges, it was observed that there was greater difference in the nocturnal period for $h < 500\ m$ and $h < 350\ m$. This is due to the fact that the nocturnal boundary layer in Amazonia is typically less than *500 m*, which is not accounted for in a generic algorithm applied to all the radiosonde sites in the world. Even the cloud base at night (observed with a ceilometer), which is on the order of *100-200 m*, is not associated with convective movements, which makes LCL an ambiguous physical concept under these conditions. Regarding the seasonal cycle analyzed, the typical LCL/LFC/CINE/CAPE values increased during the dry season in 2014, which is compatible with the work developed by Collow et al. (2016). On the other hand, CAPE in 2015 declined in the dry season. During this period, typical values for this variable (in 18Z) increased by about 41 % in 2014 and decreased by 23 % in 2015. This was due to the strong drought in the region compared to the previous year.

Conclusions

The thermodynamic indexes were efficient to determine the height of the cloud base during the afternoon (18:00 UTC), but at night, its values differed from those observed by the ceilometer. Important differences were observed in 2015, due to the greater severity of the dry season. CAPE decreased in relation to the rainy season this year. The reason for this to have occurred was the El Niño phenomenon that occurred between 2015 and 2016.

References

Collow, A. B. M., M. A. Miller, and L. C. Trabachino (2016), Cloudiness over the Amazon
rainforest: Meteorology and thermodynamics, J. Geophys. Res. Atmos., 121, 7990–8005, doi:10.1002/2016JD024848.