Physical processes of thunderstorm development during the dry-to-wet season in southwest Amazon

R. I. Albrecht[1], C. A. Morales[2], M. A. F. Silva Dias[2]

1. Instituto Nacional de Pesquisas Espaciais (INPE/CPTEC), Cachoeira Paulista, SP, Brazil
2. University of Sao Paulo, Sao Paulo, SP, Brazil

ABSTRACT: Amazonian convective systems have unique microphysical characteristics, varying from a maritime-convective-behavior (rainy season) to a continental-behavior (dry-to-wet transition season). These characteristics modulate the electrification of these systems, however it is still not well understood which are the dominant processes that intensify the frequency of lightning between seasons: thermodynamics, large-scale variability, landscape, topography or aerosol effect? To answer this question, the objective of this study was to identify and quantify the importance of each one of these effects on the electrification of convective systems over the Amazon analyzing the precipitating system during the DRYTOWET field campaign (2002). We have found that the end of the dry season presented higher percentages of positive cloud-to-ground (+CG) lightning due to a relative increase in +CG dominated thunderstorms (positive thunderstorms). These positive thunderstorms initiated preferentially over the deforested areas, where the cloud base height and convective potential available energy were higher, warm cloud depth was lower, clouds were deeper (stronger updrafts) and had more mixed and cold vertically integrated liquid, resulting in stronger thunderstorms observed during the experiment. Not so significant differences between positive, negative, thunderstorms and non-thunderstorms in terms of aerosol size distribution, mean total aerosol concentration and mean mass diameter were observed during the end of dry season and transition to the wet one. However, in the wet season both negative and positive storms occurred during periods of higher aerosol concentration and differentiated size distributions, suggesting that the aerosol effect is dependent on the amount of water vapor available and environment conditions.

*Correspondence to:

Rachel I. Albrecht, DSA/CPTEC, Instituto Nacional de Pesquisas Espaciais (INPE), Cachoeira Paulista, SP, 12630-000, Brazil. E-mail: rachel.albrecht@cptec.inpe.br