

Prolific TLE Production Over Argentina and Forest Fires

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ABSTRACT: Transient Luminous Events (TLEs) are short lived low-light-level optical emission in the upper atmosphere above thunderstorms. They are a consequence of thunderstorm electrical activity and signal the electrical coupling of the atmospheric layers, from the troposphere to the ionosphere. More than 400 TLEs, 86% sprites, were observed above a prolific Mesoscale Convective System (MCS) over Argentina, on 22-23 February 2006, as part of the third sprite campaign in Brazil. The MCS had an exceptionally high TLE rate, presented a multicellular structure with cloud tops $\sim 10\text{-}20^\circ\text{C}$ warmer than regular TLE producing MCSs over the Americas. It presented moderated convection that did not extend up to or overshoot the tropopause, as normally observed for TLE producing MCS. TRMM data indicated significant ice content at the early development of the MCS, important for cloud electrification. We suggest that the unusually high incidence of TLEs may be related to large tropospheric forest fire aerosol concentration. Satellite fire count data inputted in a transport simulation with the CATT/BRAMS model showed a large PM_{2.5} aerosol concentration where the MCS developed. The aerosols may have been a source of ice nuclei affecting the production of positively charged ice particles, accounting for the estimated charge transfer rate threshold of $\sim 4,300\text{ C/h}$ necessary for the observed TLE production.

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