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The impact of aerosols on lightning activity in thunderstorms

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Natural and anthropogenic aerosols play a major role in the development of convective clouds, and more specifically thunderstorms. On the one hand, it is possible that aerosol loading can change the microphysics of clouds, and hence the convection intensity (lightning activity), while on the other hand, aerosols can impact the stability of the atmosphere itself. Using biomass burning in the Amazon dry season as a case study, we have studied the impact of biomass burning aerosols on the development and intensity of thunderclouds. Using the ground-based World-Wide Lightning Location Network (WWLLN) lightning measurements together with Aqua-MODIS aerosol and cloud data we present evidence for the transition between two opposing effects of aerosols on thunderstorms. The first is the microphysical effect which is manifested in an increase in convective intensity (and lightning activity), followed by the radiative effect that becomes dominant with increasing aerosol loading leading to an eventual decrease in thunderstorm activity. Similar effects may occur in the Mediterranean region with increasing aerosol loading of the atmosphere.