The influence of aerosols on deep convection through its life cycle over tropical continents tested by AMF GoAmazon/CHUVA and West Africa field campaign data

Rong Fu[1], Sudip Chakraborty[1], Jose Marengo[2]
[1]Department of Geological Sciences, The University of Texas at Austin
[2]CEMADEN, Sao Paulo, Brazil

Although the effects of aerosol on clouds and precipitation have been shown extensively, whether we can detect them on climate and continental scale, especially on convective life cycle, and how can we isolate such effect from the influences of meteorological conditions, are still unclear. To address these challenges, we have analyzed a large suite of instantaneously collocated geostationary and polar orbit satellite datasets over Amazon, Congo and Southeast Asian for deep convective systems multiple years. The large samples allow us to assess the changes of rainrate, cloud ice water and size the number of convective cores with aerosols under similar atmospheric thermodynamic and dynamic conditions. The results show consistent increases of rainrate, number of convective cores, and radius of the mesoscale convective systems associated with the aerosols for relatively low and moderate vertical wind shears for various lower tropospheric relative humidity conditions. Our results also suggest that, while the vertical wind shear and lower tropospheric relative humidity dominate the variations of convective system lifetime, radius and number of convective cores, especially during the growing and mature stage of the convective systems, aerosols dominate the reduction of small hydrometeors, the increase of large hydrometeors, and convective anvils lifetime especially during the mature and decaying phase of the convective systems. These results derived from a large suite of independent measurements support the hypothesis that aerosols can reduce small hydrometeors and increase hydrometeors, and invigorate convective systems, as shown by their dominant effect during the mature and decay phase of the convection. The meteorological conditions dominate the size and number of convective cores of the convective systems, especially during the growing phase of the convection.

We also use GoAmazon/CHUVA, DOE Atmospheric Radiation Measurement Mobile Facility (AMF) West Africa field campaign data to evaluate these results from satellite data. The results of the GoAmazon data analysis are generally suggest that aerosols have a comparable influence on cloud ice and small hydrometeors to those of the lower tropospheric relative humidity, although less than that of the vertical wind shear. We will also report our results from analyses of CHUVA-GoAmazon, AMF West Africa field campaign data to further evaluate our satellite based results in this presentation.