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The Importance of the Vertical Location of Aerosol Layers on Convective Storms

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Enhanced aerosol concentrations appear to influence a number of the aspects of convective storms including the strength of the convective updraft, the intensity of the cold pool, and the microphysical and radiative characteristics of the convective anvil. However, in order for such influences to occur, aerosols need to be effectively ingested by the storm system of interest. The vertical location of an aerosol layer impacting a convective storm may influence how effectively aerosol are ingested by the storm system, and hence the degree to which the ingested aerosol subsequently influence storm microphysical and radiative processes. Furthermore, if the aerosol species impacting the storm are effective at absorbing solar radiation, heating within the aerosol layer enhances atmospheric stability, the level of which will be dictated by where the aerosol layer is located. Enhanced static stability may have negative impacts on the initial development of the convection of interest. Convective storms developing within environments of the same aerosol optical depth may therefore respond differently to aerosol indirect forcing by virtue of where the aerosol layer is vertically located. In this talk, the results of various high-resolution, cloud-resolving simulations will be presented, in which the sensitivity to the vertical location of the aerosol source on the convective development, aerosol ingestion efficiency, and subsequent microphysical and radiative properties are investigated. Microphysical budgets and storm trajectories will form an integral part of the analysis.