THE IMPACT OF ANTHROPOGENIC AEROSOLS ON TROPICAL DEEP CONVECTION AND UPPER TROPOSPHERIC CHEMISTRY

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Large amount of aerosols from anthropogenic sources such as biomass burning potentially can influence the development and lifetime of tropical deep convective clouds and associated anvils. This effect thus may further lead to a change in the tropospheric chemical compositions, especially in the upper troposphere. The above-mentioned processes have been theoretically investigated using a three-dimensional cloud-resolving model with integrated dynamics; multiple mode and moment cloud and aerosol microphysics; gaseous, aqueous, and heterogeneous chemistry; and radiation. The model is initialized using observational data over tropical oceans. A number of model runs with various initial chemical compositions and concentrations of various types of aerosols have been carried out. Comparing the upper tropospheric evolution of various physical and chemical parameters given by different model runs, including ice crystal concentrations and surface areas, concentrations of key chemical species in gas or on the surface of ice particles, as well as concentrations and partitions of aerosols, etc, hence derives the impact of initial input of aerosols on the upper tropospheric physical and chemical evolution in the regional scale. In particularly, we found that clear differences exist in the upper tropospheric concentrations of aerosols with different initial sizes undergoing scavenging by cloud and precipitation particles, this seems to be supported by the field data. Also, the physical and chemical evolution of deep convection-transported aerosols effectively continues under the influence of chemical precursors from the outflow in the upper troposphere. The results of this study suggest significant impacts of anthropogenic aerosols on tropical deep convection and associated physical and chemical processes, which are expected to further affect the large-scale evolution of chemically and radiatively important species and thus climate.