

Natural and Anthropogenic Aerosols in the UTLS in Recent Decade: Sources and the Role of Monsoon Transport

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We present a study of decadal variations of aerosols in the upper troposphere and lower stratosphere (UTLS) in terms of the origins and transport mechanisms through modeling and analysis of observations. We use the global model GEOS-5 that incorporates emissions from anthropogenic, biomass burning, volcanic, and other natural sources including dust and sea salt, to simulate the aerosols and track their origins. The model results are compared to satellite observations from CALIOP, OSIRIS, Envisat instruments, and OMPS as well as aircraft observations. It is evident that volcanic sources exert large, sporadic perturbation to the UTLS aerosol composition mainly due to the nature of volcanic eruptions and relatively high-altitude injections, but anthropogenic aerosols are the dominant sources in the UT and lowermost stratosphere that are transported from surface to high altitudes via the monsoonal convective transport with well-organized seasonal cycles. We estimate the relative contributions of natural and anthropogenic aerosols in the UTLS, analyze the chemical and physical processes, and discuss the implication of the continuous increase of Asian anthropogenic emissions.

Key words: Aerosols, UTLS, Monsoon transport, volcanic, anthropogenic