4.208 Probing the Asian Tropopause Aerosol Layer and North American Tropospheric Aerosol Layer during Summer Monsoons Using in situ Measurements .

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Abstract:

The monsoon deep convection provides a potential pathway for the transport of surface-emitted pollutants to the upper troposphere and lower stratosphere (UTLS). These pollutants are then trapped by the anticyclone forming a sustained pollution layer. Recent satellite studies have revealed enhanced aerosol mass in Asia (Asian Tropopause Aerosol Layer, ATAL) and North America (North American Tropospheric Aerosol Layer, NATAL) during the monsoon season. The enhanced aerosol layer, however, has not been extensively measured by in situ measurements, in part due to the limitation of instrumentation that is capable to be deployed on balloons. With the development of a light-weight, high-sensitivity particle counter (printed optical particle spectrometer, POPS), we are able to measure the vertically-resolved aerosol number density and size distribution in real time. We deployed the POPS on balloons in August of 2016 in Lhasa on the Tibetan Plateau, a site within the Asian summer anticyclone region. Additional balloon-borne and aircraft measurements were conducted in Houston in September of 2016 to probe the NATAL. The measurements showed an ATAL spanning from 14 to 19 km vertically. The particles in the ATAL were dominated by submicron particles, with their total number concentration reaching 50 cm^{-3} for aerosols with diameter of 140 nm to 3 μm. In contrast, the particle number concentration in the NATAL ranged from 10 to 15 cm^{-3}, consistent with satellite measurements showing that NATAL is weaker than NATAL. A global sectional aerosol model coupled with the Community Earth System Model is being conducted to simulate the aerosol properties of ATAL and NATAL. Initial results show

reasonable agreement between modeled and measured aerosol vertical profiles. The sources and composition of the ATAL and NATAL will be discussed.