

## The impact of the Summer Asian Monsoon on stratospheric aerosols

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The Summer Asian Monsoon is a major source of aerosols in the Upper Troposphere and Lower Stratosphere in absence of volcanic eruptions. Satellite measurements from the Cloud-Aerosol Lidar and Pathfinder Satellite Observation (CALIPSO) and the Stratospheric Aerosol and Gas Experiment (SAGE) II have shown that UTLS aerosol optical depth has increased by a factor of 2-3 within the SAM region over the past two decades. Since 2014, a series of Balloon measurement campaign of the Asian Tropopause Aerosol Layer (BATAL) was organized from 4 locations, in India and Saudi Arabia, to infer the optical and microphysical properties of UTLS aerosols during the Summer Monsoon and their impacts on stratospheric ozone and cirrus cloud formation. Among the major results of the BATAL campaigns, we found : i) enhanced concentration of ultrafine and volatile particles in the 13-19 km altitude range suggesting the importance of secondary aerosol formation, ii) the dominance of nitrate aerosol through offline chemical analysis of sampled aerosols and finally, ii) the presence of quasi-spherical ice crystals near the tropopause, which could be formed through homogeneous freezing. Satellite observations and balloon InSitu measurements are compared with GEOS-chem simulations to understand the processes involved in the formation UTLS aerosols during the SAM and their source regions. We investigate the contribution of India and China to UTLS aerosols and the role of natural and anthropogenic sources to the formation of nitrate aerosols in the UTLS.

The BATAL project will continue until 2020 with additional balloon campaigns and a potential aircraft deployment in 2020.