

Chemical composition of aerosols in the Upper Troposphere and Lower Stratosphere over India

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The rapid economic growth in Asia has led to severe consequences on air and water qualities. During the Asian Summer Monsoon, deep convection is the main carrier of polluted air to the upper troposphere and lower stratosphere. Enhanced aerosol levels observed by CALIPSO and SAGE II, known as the Asian Tropopause Aerosol Layer (ATAL), coincide with the presence of gas phase pollutants such as Carbon Monoxide in the UTLS region. Global transport model simulations suggest that sulfate, nitrate and organics produced from gas-phase precursors populate the UTLS in various relative fractions depending on models.

We investigate here, the chemical composition of UTLS aerosols over India during the Asian Summer Monsoon using an aerosol impactor mounted on medium-duration balloon flights near the tropopause region as a part of the NASA/ISRO project and launched from the balloon facility of the Tata Institute of Fundamental Research (TIFR) in Hyderabad. The chemical analysis of UTLS aerosols were made during two campaigns (Summer) August 2017 and (Winter) February 2018.

Post sampling, aerosol composition was assessed offline using Ion Chromatographic techniques at the Physical Research Laboratory (PRL) in Ahmedabad. The results of IC analysis of the two flights in summer 2018, showed the dominant presence of nitrate aerosol with traceable amounts of Potassium and Calcium. Surprisingly, the levels of Sulfate were below the detection limit of 10 ng/m³, during this time. In contrast, Sulfate was detected during the winter 2018 with a concentration of 40 ng/m³ together with traces of Calcium. In this presentation, we will discuss those results in light with trajectory modelling to understand the origin of air masses and the influence of convection. In addition, the nitrate partition between natural sources from lightning and anthropogenic emissions will be explored with the GEOS-Chem model.

Key words: Pollution, Asia, Monsoon, aerosol