Tethered balloon observation of atmospheric composition over the Tibetan Plateau

J. Bian¹, L. Ran¹, Z. Deng¹, Z. Bai¹, G. Tang¹, Y. Wu¹, Y. Wang¹, P. Yu², N. Ma², ...

¹ Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

² Institute for Environmental and Climate Research, Jinan University, Guangzhou, China

The Tibetan Plateau plays a vital role in the Asian Monsoon and therefore in the regional and global climate. During the past decade, the rapid urbanization and economic growth, and also the ever-thriving tourism over the Tibetan Plateau, have given rise to a marked increase in residential, industrial, and traffic emissions. Many environmental factors could further enhance emissions of air pollutants such as black carbon and organic aerosols, or facilitate the formation of secondary aerosols and gaseous pollutants like ozone. Consequently, serious air pollution, comparable to the levels in more urbanized and developed cities at lower altitudes, has been observed in urban areas over the Tibetan Plateau. To obtain better knowledge on the current status of air quality and to advance our understanding on the influence of anthropogenic activities, in situ measurements of vertically resolved atmospheric composition distributions with a high vertical resolution are very necessary.

microAeth, AE-51, AethLabs

microAeth, MA200, AethLabs

375/470/528/625/880nm, 1s

OPC, Model 11-C, GRIMM

OPC, Model 1.109, GRIMM

OPC, Model 11-S, GRIMM

Ozone Monitor, Model 205, 2B

0.25~32µm, 31 bins, 6s

880nm, 1s



 60 m^3









Ð,



2s

Home-made charcoal tube





Home-made VOC Sampler

Home-made Aerosol Sampler





Profile of fraction of black carbon (BC) thick coated, and profile of refractory BC (rBC) concentration in 2020 August at Lhasa.

The fraction is about 5% at all levels, and the rBC concentration decreases from 0.4~1.0 μ g/m3 at surface to $0.2 \,\mu g/m3$ at 500-600 m.

During the past few years, we have conducted tethered-balloon based observation of atmospheric compositions in three cities, Lhasa in August 2020, Golmud in August 2021, and Xining in August 2022. The 60 m³ helium-filled tethered balloon, was operated by an electric winch that controlled the ascent and descent rate of the fish-shaped balloon. It was scheduled to launch the balloon to at least 1000 m above the ground every 3h from 06:30 to 21:30.

Ran, L., et al., 2022: Measurement report: Vertical profiling of particle size distributions over Lhasa, Tibet – tethered balloon-based in situ measurements and source apportionment, Atmos. Chem. Phys., 22, 6217–6229.