Atmospheric Profiling Synthetic Observation System in Tibet

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To advancing the understanding of atmospheric vertical coupling processes over Tibet, a comprehensive observation system with the ability for observing multiple parameters of high temporal and vertical resolution, ranging from the surface to the troposphere, stratosphere, mesosphere and lower thermosphere is necessary to fill the observation gap of existed operational meteorological as well as environmental satellite observation.

Since 2012, funded by the National Natural Science Foundation of China (NSFC), we started to develop an integrated observation system, called Atmospheric Profiling Synthetic Observation System (APSOS) to meet the above mentioned scientific requirements. At the end of 2017, APSOS is finally deployed at the Yang Ba Jing (YBJ) observatory of the Chinese Academy Sciences, a field station located on the center part of Tibetan Plateau, about 90 km north of Lhasa and 4300 m A.S.L.

APSOS is consisted of 5 lidars, 1 W-band Doppler dual polarization cloud radar, and a THz spectroradiometer. The system has the ability to observe atmospheric temperature, wind, water vapor, aerosols, ozone, cloud, as well as CO2, NO2, SO2 i.e, the greenhouse gases and pollutants with respective altitudes ranging from lower atmosphere to 110 km for temperature and wind, 1 to 50 km for ozone, up to 25 km for aerosols and 20 km for clouds, 15 km for water vapor, and to 3 km for CO2, NO2 and SO2. The observation covers the natural and anthropogenic species and to be able to reveal the vertical transport of water vapor, cloud particles, pollutants from surface, troposphere to the stratosphere, as well as upward propagation of gravity waves. Also it is possible to sense the atmospheric response to solar activity. The processes in tropopause layer and mesosphere-lower thermosphere region will be focused. Based on lidars and cloud radar simultaneous observation, the system may obtain atmospheric vertical profiles in part of cloudy situation when cloud is semi-transparent to lidar wavelengths thus expanding observation opportunities. In the mean time, with the multi lidar observation, it will produce more accurate quantitative and cross-checked results.

Preliminary observation with APSOS has been conducted since the spring of 2018. Some case studies will be presented in this paper. APSOS will have long-term operation and collaborative research will be arranged within scientific communities.

Key words: APSOS, Integrated atmospheric observation, Troposphere-stratosphere coupling