



Recent Progress of Atmospheric Profiling Synthetic Observation System (APSOS) in Tibet

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For decades, satellites have been monitoring the atmosphere for supporting the research on global climate, weather, and environment. However, strong demands still exist for ground-based observations of the whole atmosphere. The Atmosphere Profiling Synthetic Observation System (APSOS) is the first ground-based facility over Tibetan Plateau (TP) for profiling atmospheric variables and multiple constituents in the whole (neutral) atmosphere from the surface up to the lower thermosphere. It consists of a cluster of state-of-the-art remote sensing instruments and enables simultaneous observations of the atmospheric vertical structure and constituent transport. By providing range-resolved measurements of the troposphere, stratosphere, mesosphere, and the lower thermosphere in the TP region, APSOS aims to investigate the dynamics, physicochemical processes, and the layered coupling mechanism in the whole atmosphere. Based on a unique combination of active and passive remote sensing techniques, APSOS operates at multiple wavelengths, ranging from ultraviolet to infrared, from terahertz to millimeters and can achieve vertical and temporal resolutions on the order of meters and minutes, respectively. The key instruments of APSOS are five lidars (for profiling temperature, wind, $H_2O/O_3/CO_2/SO_2/NO_2$, aerosol, and cloud), a cloud radar, a terahertz radiometer, and a telescope assembly of four $\Phi 1200$ mm mirrors. In addition, there is a data management and validation platform for data retrieval, comparison, and validation. APSOS was deployed at Yangbajin (YBJ) International Cosmic Ray Observatory (4300 m ASL), located near Lhasa, Tibet in China and is now in full operation. Recent progress of APSOS in Tibet will be reported and long-term measurements and new APSOS system are scheduled in the next 5 years for establishing the first whole-atmosphere database over the TP. APSOS was funded by NSFC and developed by the Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences (CAS), in collaboration with the Wuhan Institute of Physics and Mathematics, CAS, the University of Science and Technology of China, the Anhui Institute of Optics and Fine Mechanics, CAS, the Purple Mountain Observatory, CAS, Wuhan University, and Anhui Sun Create Electronics.