

Progress of the lower and middle atmosphere lidar system at Zhongshan Station, Antarctica

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Abstract

As an important part of global atmosphere system, polar atmosphere is closely related to the whole atmosphere system and the polar atmosphere alone has many unique phenomenon and variation processes. Therefore, it is significant to observe and study it. As one of the most powerful active remote sensing technologies, lidar has been widely used in the observation and research of the earth's atmosphere in recent decades, and has made outstanding contributions to the development of atmospheric science. A lower and middle atmosphere lidar system has been established at Zhongshan Station (69.4°S, 76.4°E) since Mar. 2020 during the summer part of 36th Chinese National Antarctic Research Expedition (CHINARE). It includes a pure rotation Raman lidar, a Rayleigh/Mie scattering lidar module, and a coherent Doppler wind lidar, which could realize the high-precision measurement of troposphere-stratosphere-mesosphere temperature and boundary layer wind. The pure rotation Raman lidar could observe the nocturnal and diurnal temperature around ~0.5-10 km (night) and ~0.5-3 km (day), while the Rayleigh/Mie scattering lidar module will observe the temperature and density within 40-60 km. Meanwhile, the boundary layer atmospheric wind field from 30 to 800 meters is monitored by the coherent Doppler wind lidar. It is combined with the Na Doppler lidar (capable of measuring the diurnal temperature and 3-D winds around 75-110 km) to form a Polar Atmosphere Lidar Observation System (PALOS), which is the first synthetic lidar observation system covering all layers of neutral atmosphere in Antarctic region. At present, the lower and middle atmosphere lidar system works normally and has accumulated thousands of hours of observation data, which can be used to study the basic characteristics of the polar atmosphere, the characteristics of aerosol and cloud, the thermal / dynamic changes and processes of the middle and upper atmosphere, etc. The report will introduce the detail of the system composition and preliminary observations.

Keywords: pure rotation Raman lidar, Rayleigh/Mie scattering lidar, coherent Doppler wind lidar, temperature, wind, Zhongshan Station