Seasonal variations in the potassium layer over Syowa Station (69.0°S, 39.6°E), Antarctic

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Metallic layers, containing such as Na, Fe, K, etc., originating from meteors are valuable tracers for performing observations of the Earth's upper atmosphere. Through investigations on variations in such metallic layers, it would be important to advance our understanding on the atmospheric dynamical and chemical processes in the region where it is not easy to make observations. As for Na and Fe, many observations have been done for decades, and their variations have been widely investigated. On the other hand, observational data on K are relatively limited. In previous K observations, there are several reports from several resonance scattering lidars located in, such as, Arecibo, Puerto Rico (18.35°N, 66.75°W), Kühlungsborn, Germany (54.1°N, 11.7°E), etc. which are the observational sites in the Northern Hemisphere. In addition, a shipboard-lidar campaign between 71°S and 45°N was carried out, and it provided a limited information on the K layer variations in the Southern Hemisphere. Furthermore, there are investigations based on near-global K data, which were obtained from observations of resonance scattering of the sunlight by a polar-orbit satellite, Odin/OSIRIS. The satellite observations were limited during the daytime, which means that the obtained data are mainly during summer at high latitudes. Thus, there are fewer K observations in winter high latitudes in the Southern Hemisphere, where there is less sunlight.

In the present work, we have investigated seasonal variations in the K layer over Syowa Station (69.0°S, 39.6° E), Antarctic, based on observational data which were obtained by a resonance scattering lidar. The resonance scattering lidar was installed at Syowa Station in 2017, and it was operated from 2017 to 2018. During the period, K density data of 385 hours were obtained from K D_1 (770 nm) observations of 38 days mainly during the Antarctic winter. These data were analyzed to investigate seasonal variations in the K layer over Syowa Station. As a result, the peak heights of K number density were mostly 85 to 90 km. The K peak density reached a maximum in June-July during wintertime, and its number density was approximately 2×10^7 m^{-3}. Then, a minimum of the K peak density was observed in September during springtime, and its number density was approximately 2×10^6 m^{-3}. These results from Syowa Station are compared with the results from Odin/OSIRIS and WACCM. From the comparisons, it is found that the relative K variations over Syowa Station seemed to be fairly consistent with those from Odin/OSIRIS and WACCM. On the other hand, as for the absolute values, the column densities from Syowa Station were roughly two times smaller than those from Odin/OSIRIS and WACCM. In the presentation, we will show these results, together with more details in comparisons to the previous K observations through several analysis, and discuss the importance of K chemical processes for the observed seasonal variations in the K layer over Syowa Station.