Seasonal differences in fine structures of the Es layer observed by a Ca+ resonance scattering lidar

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Calcium ion (Ca^+) is only metallic ion in the mesosphere and lower thermosphere (MLT) region that can be measured by resonance scattering lidar. Metallic ions, including Ca^+, originating from meteors are gathered in a narrow layer by vertical shear of horizontal neutral wind in the lower thermosphere, forming sporadic E (E_s) layers. Temporal variation of the Ca^+ density profiles observed by a Ca^+ resonance scattering lidar with high time and height resolutions can detect fine structure and time evolution of plasma irregularities in the E_s layer. A frequency tunable resonance scattering lidar to install and operate it at Syowa, Antarctica had been developed by the National Institute of Polar Research (NIPR). The lidar has a capability to observe the MLT temperature profiles and the density variations of minor constituents such as Fe, K, Ca^+, and aurorally excited N_2^+ in the MLT region. In August 2014, it received the first light from Ca^+ in E_s layer. After that, we increased the resolution of the Ca^+ observation and have succeeded in getting the Ca^+ profile with time/height resolution of 5 sec/15 m. Also, background noise was reduced using narrower band-pass filter in an optical receiving system after December 2015. In this study, we show fine structures of the Ca^+ layer corresponding to some E_s layer events observed in March, August, September and December in 2015 and 2016 and will discuss differences between summer and winter and some characteristics seen around equinox.