Calcium ion layer observed with resonance scattering lidar at Syowa Station

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Layers of metal ions in the mesosphere and lower-thermosphere (MLT) are produced by meteoric ablation. The meteoric metal ions have relatively long chemical life time in the MLT region and behave as plasma affected by neutral atmosphere dynamics. In the mid-latitude, the meteoric metal ions in the MLT region are generally accepted as key species for generation of sporadic E (E_s) layer in the wind shear theory. The close link between the E_s layer and metal ion layer has been also clearly by radar and lidar observations [Raizada et al., 2012; Ejiri et al., 2019]. On the other hand, the latitudinal differences in behaviors of the metal ion are still unknown. Recently, the Whole Atmosphere Community Climate Model incorporated a large database of neutral and ion–molecule reaction kinetics of calcium (Ca) species (WACCM-Ca) simulated the seasonal Ca^+ layer globally [Plane et al., 2018]. However, the results cannot be vilified well because observation lacks except at the mid-latitude in the northern hemisphere.

A new resonance scattering lidar system with frequency-tunable alexandrite laser was developed by the National Institute of Polar Research (NIPR) and installed at Syowa Station (69˚S, 40˚E) by the 58th Japan Antarctic Research Expedition (JARE 58). Density profiles of Ca^+ in the MLT region over Antarctic were successfully observed 6 nights in total in 2017 and 2018. In this presentation, we will show temporal variation of the Ca^+ layer in Antarctic for all events and discuss its characteristics.

Keywords: mesospheric Ca+ layer, Antarctic, Lidar observation

