Time and height variability of temparature in Mesosphere and Lower Thermosphere region based on resonance scattering lidar measurement at NIPR (36°N, 140°E)

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The National Institute of Polar Research (NIPR) is leading a six year prioritized project of the Antarctic research observations since 2010. One of the sub-projects is entitled ‘the global environmental change revealed through the Antarctic middle and upper atmosphere’. As a part of the sub-project, a Rayleigh/Raman lidar (RR lidar) was installed at Syowa, Antarctica (69S, 39E) in January, 2011. The operation has been conducted since February 2011 and the RR lidar has kept measuring temperature profiles continuously between approximately 10 and 80 km for almost 3 years. In order to extend the height coverage to include mesosphere and lower thermosphere region, a new resonance scattering lidar system with tunable wavelengths is developed at NIPR in Tachikawa (35.7N, 139.4E).
The lidar transmitter is based on injection-seeded, pulsed alexandrite laser for 768-788 nm (fundamental wavelengths) and a second- harmonic generation (SHG) unit for 384-394 nm (second harmonic wavelengths). The laser wavelengths are tuned into the resonance wavelengths by a wavemeter that is calibrated and validated using a wavelength-stabilized He-Ne laser and a potassium vapor cell for doppler-free spectroscopy. This lidar has capabilities to measure density variations of minor constituents such as atomic iron (Fe, 386 nm), atomic potassium (K, 770 nm), calcium ion (Ca+, 393 nm), and nitrogen ion (N2+, 390, 391 nm) and temperature profiles in the mesosphere and lower thermosphere (MLT) region. It can also estimate temperature profiles from the upper Storatosphere to the lower mesosphere using signals of Rayleigh scattering.
In this presentation, we will presnet time and height variability of temparature in the MLT region based on campaign observation in winter 2015-2016 focusing on Sudden Stratospheric Warming (SSW) impact on dyanmics in the MLT region. In addition, the obtained temperature profiles are validated by comparisons to those obatined from satellites data such as Aura/MLS. In addition, dynamical and/or chemical response to SSW and sporadic E-layer in MLT region are discussed using neutral Fe atom density data.

Keywords: the Mesosphere and Lower Theremosphere, Temperature, Sudden Stratospheric Warming

