

Horizontal temperature gradients in the polar upper mesosphere and lower thermosphere above Tromsø, Norway

*Satoru Nozawa¹, Takuya Kawahara², Takuo T. Tsuda³, Hitoshi Fujiwara⁴, Norihito Saito⁵, Satoshi Wada⁵, Yasunobu Ogawa⁶, Toru Takahashi⁶, Yasunobu Miyoshi⁷, Chris Hall⁸, Asgeir Brekke⁸

1. Institute for Space-Earth Environment Research, Nagoya University, 2. Faculty of Engineering, Shinshu University, 3. Department of Computer and Network Engineering, The University of Electro-Communications, 4. Faculty of Science and Technology, Seikei University, 5. Photonics Control Technology Team, RIKEN Center for Advanced Photonics, 6. National Institute of Polar Research, 7. Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, 8. UiT, The Arctic University of Norway

Based on about 2700 hours of temperature data obtained with the Tromsø sodium LIDAR, we have investigated horizontal temperature differences (i.e. temperature gradient) in the polar MLT region between October and March. The sodium LIDAR operated at the EISCAT Tromsø site (69.6 deg. N, 19.2 deg. E) has a capability of simultaneous five-beam observations; i.e. temperature and sodium density data are obtained simultaneously with good time and altitude resolutions (3 min/500m). In addition to vertical observations, the sodium LIDAR observed volumes of four different directions with azimuth and elevation of (0 deg., 77.5 deg.), (90 deg., 77.5 deg.), (180 deg., 77.5 deg.), and (270 deg., 77.5 deg.) between October 2013 and March 2017, while the elevation angle of 60 degree was set between October 2012 and March 2013, and between October 2017 and March 2018. These configurations allow us to derive horizontal temperature difference between about 80 and 107 km.

We have analyzed (so far) about 184 nights of temperature data sets. The horizontal temperature gradient is found to be in range from about 0.5 K/km to -0.5 K/km for northward and eastward directions, and on average (nightly mean) in range from about 0.05 K/km to -0.05 K/km. We will report temporal and altitude variations of the temperature gradient, changes of nightly mean temperature gradients in accordance with SSWs, and comparison with GAIA calculations.

Keywords: Horizontal temperature gradients, polar MLT, sodium LIDAR, EISCAT, Tromsø