

#Hu Jinyi¹⁾, 津田 卓雄¹⁾, 木暮 優²⁾, 小川 泰信³⁾, 野澤 悟徳⁴⁾, 川端 哲也⁴⁾, 斎藤 徳人⁵⁾, 川原 琢也⁶⁾, 高橋 透⁷⁾

(¹⁾ 電気通信大学, (²⁾ 延世大学, (³⁾ 国立極地研究所, (⁴⁾ 名古屋大学, (⁵⁾ 理化学研究所, (⁶⁾ 信州大学, (⁷⁾ 国立研究開発法人 海上・港湾・航空技術研究所

Vertical structure of atmospheric waves from the mesosphere to the thermosphere observed by Na lidar and EISCAT radars at Tromsø

#Jinyi Hu¹⁾, Takuo TSUDA¹⁾, Masaru KOGURE²⁾, Yasunobu OGAWA³⁾, Satonori NOZAWA⁴⁾, Tetsuya KAWABATA⁴⁾, Norihito SAITO⁵⁾, Takuya KAWAHARA⁶⁾, Toru TAKAHASHI⁷⁾

(¹⁾University of Electro-Communications, (²Yonsei University, (³National Institute of Polar Research, (⁴Nagoya University, (⁵RIKEN, (⁶Shinshu University, (⁷National Institute of Maritime, Port and Aviation Technology

Atmospheric waves play a crucial role in atmospheric dynamics, and numerous observational studies have been conducted on those in the lower and middle atmosphere. On the other hand, investigations on atmospheric waves above 100 km altitude are still limited. In particular, there are a few observations on the vertical structure of atmospheric waves from the mesosphere to the thermosphere. To understand such a wider vertical structure, this study combined observations by the sodium (Na) lidar and the European Incoherent Scatter (EISCAT) radars at Tromsø, Norway (69°N, 19°E). We analyzed 69 hours of simultaneous observations by the Na lidar and EISCAT radars from 20 to 23 January 2012.

The Na lidar observations provided high-resolution temperature profiles in the altitude range from 75 to 105 km, while the ionospheric parameters, such as electron density, electron temperature, ion temperature, and ion velocity, were obtained in the ionospheric E and F regions from the EISCAT radar observations. In the data analysis, we focused on Na lidar temperature data between 80 and 100 km and EISCAT ion temperature data between 100 and 400 km to investigate the vertical structure of atmospheric waves from the mesosphere to the thermosphere. By combining these datasets, we identified prominent wave-like structures with periods of 6-9 hours, and their phase progressions seemed to be downward. In addition, their vertical wavelengths were 10-20 km in the mesosphere, and those became longer in the thermospheric heights.

We also derived daily mean profiles of potential energy of the observed atmospheric waves. The potential energy showed an increasing trend with increasing altitude from 80 to 175 km. Then, a decreasing trend was observed from 175 to 210 km. After that, an increasing trend was seen above 250 km. This non-monotonic behavior would indicate some energy dissipations in upward propagating waves and/or some additionally generated waves at some altitudes. In the presentation, we will show these results, and the characteristics of the observed wave-like structures will be discussed in more detail.