Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PEM032-P27 Room:Convention Hall Time:May 27 10:30-13:00

Small scale disturbance in the wind field in the polar mesopause region inferred by successive images of a meteor train.

Hidehiko Suzuki[1*], Takuji Nakamura[1], Sharon L. Vadas[3], Masaki Tsutsumi[1], Makoto Taguchi[2], Yasunori Fujiwara[4]

[1]National Institute of Polar Research, [2]Rikkyo university, [3]NorthWest Research Associates, [4]Nippon Meteor Society

A fireball meteor with a visual magnitude of over -6 followed by a persistent trail was observed by two all-sky cameras for detecting the aurora and sodium airglow at Syowa Station (69.0^{o}S, 39.5^{o}E), Antarctica, on 6 June 2008. Orbit and other parameters of the fireball were estimated by an all-sky television camera for detecting the aurora. After the passage of fireball, circular train expanded to a diameter of about 50 km in 9 minutes. This omnidirectional expansion allows us to determine the height of each fraction of the meteor train. The combination of 9 sequential images of the meteor train with 1 minute interval and the meteor orbit information estimated from ATV camera has revealed existence of a large atmospheric wave with a vertical wavelength of ˜16km and an amplitude of ˜30m/s in mesopause region during the event. In addition to the expanding motion due to the wave, the meteor train also showed rapid non-uniform motion with 2˜3 minutes frequency along a background wind direction. The amplitudes of these motions are estimated as 50˜60 m/s at 87km. Since this frequency is shorter than a typical buoyancy frequency (˜5minutes), the oscillation can be an acoustic wave. However, ordinary acoustic waves which can reach mesopause region from an impulsive source such as a thunder storm in the troposphere are likely to have an amplitude of ˜10 m/s [eg. Waltersheid et al., 2003]. According to Vadas et al. [2010], the atmospheric wave generated by an impulsive source such as aurora, and meteor impact is also probable. Alternatively, this rapid motion can likely be due to a kind of non-uniformity of winds in the polar mesopause region.

References

[1] Walterscheid, R. L., G. Schubert, and D. G. Brinkman, Acoustic waves in the upper mesosphere and lower thermosphere, generated by deep tropical convection, J. Geophys. Res., 108(A11), 1392, doi:10.1029/2003JA010065, 2003.

[2] Vadas, S. L., H., Suzuki, T. Nakamura, Acoustic and Atmospheric Gravity Waves Excited by a Fireball Meteor, 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec., 2010

[3] Nakamura, T., Morita, S., Tsuda, T., Fukunishi, H. and Yamada, Y., Horizontal structure of wind velocity field around the mesopause region derived from meteor radar observations. Journal of Atmospheric and Solar-Terrestrial Physics 64, pp. 947?958., 2002

Keywords: meteor, mesopause, meteor train, gravity wave, acoustic wave, sodium airglow