ELSEVIER

Journal of Atmospheric and Solar-Terrestrial Physics 66 (2004) 539–565

Journal of ATMOSPHERIC AND SOLAR-TERRESTRIAL PHYSICS

www.elsevier.com/locate/jastp

# Variability of the quasi-2-day wave observed in the MLT region during the PSMOS campaign of June–August 1999

D. Pancheva[a,*], N.J. Mitchell[a], A.H. Manson[b], C.E. Meek[b], Ch. Jacobi[c], Yu. Portnyagin[d], E. Merzlyakov[d], W.K. Hocking[e], J. MacDougall[e], W. Singer[f], K. Igarashi[g], R.R. Clark[h], D.M. Riggin[i], S.J. Franke[j], D. Kürschner[k], A.N. Fahrutdinova[l], A.M. Stepanov[l], B.L. Kashcheyev[m], A.N. Oleynikov[m], H.G. Muller[n]

[a] *Department of Electronic and Electrical Engineering, University of Bath, Bath BA2 7AY, UK*
[b] *Institute of Space and Atmospheric Studies, University of Saskatchewan, Saskatoon, Canada*
[c] *Institute for Meteorology, University of Leipzig, Leipzig, Germany*
[d] *Institute for Experimental Meteorology, Obninsk, Russia*
[e] *University of Western Ontario, London, Canada*
[f] *Leibniz Institute of Atmospheric Physics, Kühlungsborn, Germany*
[g] *Communications Research Laboratory, Koganei, Tokyo, Japan*
[h] *University of New Hampshire, Durham, USA*
[i] *Colorado Research Associates, Boulder, Colorado, USA*
[j] *University of Illinois, Urbana, USA*
[k] *Institute for Geophysics and Geology, University of Leipzig, Collm Observatory, Germany*
[l] *Kazan State University, Kazan, Russia*
[m] *Kharkov State Technical University of Radioelectronics, Kharkov, Ukraine*
[n] *University of Cranfield, RMCS, Shrivenham, Swindon, UK*

Received 10 February 2003; accepted 20 January 2004

**Abstract**

A network of 15 northern hemisphere radars has been used to measure horizontal winds in the mesosphere and lower thermosphere during the PSMOS campaign of Summer 1999. The radars are sited at latitudes ranging from 21°N to 75°N and longitudes from 142°E to 157°W. The data were examined to investigate the Northern Hemisphere structure of the quasi-2-day planetary wave during the interval June–August. The amplitude of the 2-day wave was found to exhibit great day-to-day variability. In particular, significant periodic fluctuations in amplitude occurred with periods of 8–10 and 14–17 days. These modulations were strongest in July and largely absent in June and August. In July, the wave activity can be resolved into three westward-propagating waves with zonal wave numbers of 2, 3 and 4. The periods associated with these wave numbers were 53–56, 48–50 and 42–43 h, respectively. The simultaneous presence of at least two spectral components with periods close to each other may serve to explain the observed amplitude modulations as a result of a beating between different spectral components. An earlier analysis of the planetary-wave field during this interval has revealed a westward propagating ~16-day wave with zonal wave number 1 (Journal of Atmospheric and Solar-Terrestrial Physics 64 (2002b) 1865–1896). A non-linear interaction between this ~16-day planetary wave and the (3,0) Rossby-gravity mode (the 2-day-wave) provides a possible mechanism to generate the above ~42 h/wavenumber 4 wave and the ~55 h/wavenumber 2 waves as sum and difference secondary waves. A bispectral analysis was used to further investigate non-linear interactions between members of the planetary-wave field and suggested a number of interactions occur within

* Corresponding author. Tel.: +44-1225-826310; fax: +44-1225-826305.
*E-mail address:* eesdvp@bath.ac.uk (D. Pancheva).

1364-6826/$ - see front matter 
doi:10.1016/j.jastp.2004.01.008