Journal of Atmospheric and Terrestrial Physics, Vol. 54, No. 7/8, pp. 915–926, 1992.
Printed in Great Britain.

0021–9169/92 $5.00 + .00
Pergamon Press Ltd

Seasonal and latitudinal variations of the lower thermospheric tidal winds from meteor radar measurements in the U.S.S.R.

I. A. LYSENKO,* N. A. MAKAROV,* YU. I. PORTNYAGIN,* B. L. KASHCHEEV,† V. V. LIZOGUB,† V. V. SIDOROV‡ and A. N. FAHRUTDINOVA‡

*Institute of Experimental Meteorology, Obninsk, Russia; †Kharkov Institute of Radioelectronics, Kharkov, Ukraine; ‡Kazan State University, Kazan, Russia

(*Received in final form* 27 *May* 1991)

Abstract—Meteor wind results obtained at 93–95 km altitude at seven sites, six in the Soviet Union and one in Antarctica, between 1965 and 1985 are reported. Attention is focussed on the amplitudes and phases of the semi-diurnal tide, showing a 22-yr oscillation, and of the generally weaker diurnal tide. The measurement results are compared with the results of theoretical models.

1. OBSERVATIONS

This paper considers seasonal variations of diurnal and semi-diurnal tidal oscillations in the lower thermosphere obtained from meteor radar wind measurements carried out on Heiss Island, at Obninsk, Volgograd, Khabarovsk, at Molodezhnaya station by the Institute of Experimental Meteorology, at Kazan by the Kazan State University, and at Kharkov by the Kharkov Institute of Radioelectronics. All sites used the pulse-coherent meteor radar, the main parameters of which are given in Table 1.

Five-element Yagi antennas were used for transmission and reception. The measurement techniques at the various sites were different. On Heiss Island and at Molodezhnaya station information on the zonal and meridional wind components was obtained by mechanical antenna direction changing every half an hour. At Khabarovsk and Obninsk wind components were measured practically simultaneously in four directions (N, E, S, W) due to electronic switching between the antennas oriented in these directions. At Kazan and Kharkov, measurements were also carried out in four directions, but changing of antenna directions was realized mechanically, in Kazan every 5 min, and at Kharkov every 20 min. It should be noted that this paper contains measurement results for Obninsk and Khabarovsk obtained only in the northern and eastern directions.

Table 1.

Observation site	Frequency (MHz)	Pulse power (kW)	Pulse duration (μs)	Repetition frequency (Hz)
Heiss Island	33.4	30–40	35	500
Obninsk	33.3	12	60	500
Kazan	32.0	120	100	400
Kharkov	36.9	40	40	500
Volgograd	35.5	30	30	500
Khabarovsk	27.7	12	100	300
Molodezhnaya station	33.7	35	35	500

All observation sites used the equipment without height resolution. Therefore, the presented data are the data averaged over the meteor zone which refers to some mean height h_0 of 93–95 km. It is known that the h_0 value varies during the day and that this is caused mainly by the astronomical factor. However, according to the data obtained at Kharkov (KALCHENKO *et al.*, 1984) the amplitude of h_0 deviations from the mean value is 2–3 km; the maximum h_0 is registered at 06–07 LT, the minimum at 18–19 LT.

Table 2 presents the coordinates of the observational sites, the periods and the number of days of measurements in a month, the results of which have been used to estimate the mean values of the tidal parameters. These were calculated by averaging the harmonic analysis data for each observational day. The method of vector averaging was used for Heiss Island, Obninsk, Volgograd, Khabarovsk and Molodezhnaya station, and arithmetic averaging for Kazan and Kharkov.

2. SEMI-DIURNAL TIDE

Figures 1 and 2 show data on the seasonal variation of the amplitudes and phases of the semi-diurnal tide.