



## TIME VARIATIONS OF DYNAMICAL PROCESSES IN THE MIDLATITUDE UPPER MESOSPHERE – LOWER THERMOSPHERE

Fahrutdinova A.N., Stepanov A.M., Fedorov D.V., Yasnitsky D.S.

*Kazan State University, Physical department, Kremlevskaya 18, Kazan, Russia,  
E-mail: Antonina.Fahrtudinova@ksu.ru*

### ABSTRACT

Complex studies with the use of spectrum and harmonic analysis allow determination of wave disturbances in the prevailing and tidal wind, and also mesoscale short period oscillation intensity per unit mass. We particularly find enhanced periods of 4-6, 9-12, 15-20, 25-30 days, which are typical for planetary waves in the lower and middle atmosphere of the Earth. We also reveal the non-linear character of vertical amplitude and phase profiles for wave disturbances with planetary wave scales in the prevailing, tidal and short period oscillation intensity. This non-linearity is interpreted as a consequence of the non-linear interaction of waves such as internal gravity waves, tides and planetary waves among themselves and with background movements.

© 2001 COSPAR. Published by Elsevier Science Ltd. All rights reserved.

### METHOD OF MEASUREMENTS AND PROCESSING DATA

Regular observations of the wind regime in the upper mesosphere – lower thermosphere including height determining have been conducted in Kazan State University (56N, 49E) by the method of meteor track location. The main technical characteristics of the meteor radar (Sidorov and Fahrutdinova, 1991) are: carrier frequency 32 MHz, duration of pulse 100 mcs; pulse-repetition frequency 400 Hz, pulse power of the transmitter 100-150 kW (1993-1999- 20 kW): baselines of phases interferometer, equal to  $4\lambda$ ,  $4.5\lambda$ , are oriented along the North-South, the East-West directions, root-mean-square error of height is 1 km.

By using the method of harmonic decomposition on the time series we have defined the prevailing zonal and meridional wind, amplitude and phase of the diurnal, semi-diurnal and 8-hourly tidal wind, as well as amplitude and phase of the annual and semi-annual harmonics and mean-annual values of prevailing and tidal winds.

### PREVAILING, TIDAL MOVEMENTS AND SHORT PERIOD OSCILLATION INTENSITY

Studies of prevailing and tidal movements of the zonal and meridional circulation were conducted using the data from radiometeor measurements for 1986-1995 and, additionally, for December 1998, January – March and July – August 1999. Values of prevailing zonal and meridional wind amplitudes and zonal semi-diurnal tide amplitudes are presented in Fig.1 as a function of height in the 80-110 km altitude interval. The zonal eastward wind in the height interval from 80 to 110 km is typical for the winter regime. A small negative height gradient in the prevailing zonal wind,  $dU_0/dh = -0.17 \text{ ms}^{-1}/\text{km}$ , is also observed.

It is observed in summer that the wind is westward up to heights of ~87 km (July - August). The wind is eastward higher, up to the height 110 km. A significant height gradient of the prevailing wind is observed in the interval 80-95 km, and a weak change of eastward wind was found above 95 km. The