P1-2 Nocturnal and Diurnal Lidar Observations of Mesospheric Sodium Layers at Tokyo

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We have performed mesospheric Na lidar observations for 8 years at Tokyo Metropolitan University (TMU) at Hachioji, Tokyo (35.6N, 139.4E) in midlatitude since July 1991. In Table 1, the current specifications of the TMU sodium lidar are shown.

Firstly, we analyze nocturnal qualified sodium data observed during more than 4 hours between November 1991 and December 1997. The data sets are collected over a total observation period of more than 2700 hours on a total of 402 nights. Then, we present the seasonal variations of the total Na column abundance, the rms (root-mean-square) width, and the centroid height of the Na layer as well as observations of sporadic Na layers (Nas). The total column abundance shows seasonal variation which indicates autumn-winter maximum and spring-summer minimum. We take an interest in minimum of total column abundance sometimes appeared in December. The rms width of the averaged Na layer shows semiannual variation.

We have recognized more than 200 events of sporadic Na layers above our lidar site in midlatitude. Before our observations, the sporadic Na layers had been observed commonly at low- and high-latitude sites but rarely observed at mid-latitude sites (Nagasawa and Abo, 1995). We find that the Nas layers appear clearly above 90km altitude.

Since August 1997, we are also starting daytime lidar observations of mesospheric sodium layers using a ultranarrow bandpass Na vapor dispersive Faraday filter that overlays at the Na Fraunhofer line (Chen et al., 1993). Figure 1 shows experimental filter transmission spectrum.

There are only three data sets continuously observed with more than 24 hours, because of weather conditions. Maximum continuous observation time is 46 hours, and the continuous data sets are limited in autumn and winter. Figure 2-4 show diurnal variations of the total Na column abundance, the rms width, and the centroid height of the Na layer at 3-5 January 1999 respectively. The data is averaged for each hour and 12- and 24-hour components of the oscillations is deduced from Fourier transform. Dotted lines in figures are described 12- and 24-hour components. The data show strong oscillations caused by the semidiurnal tide. Diurnal components have maximum values at midnight for all data. Amplitude and phase of the semidiurnal components depend on the layer parameters and the observation day.

We will analyze phase shift of density perturbation for each altitude. The vertical wavelength and the vertical phase speed will be compared with the observation result by the MU radar. We will also analyze seasonal variation of atmospheric tidal activity

Reference

Chen, H., She, C. Y., Searcy, P. and Korevaar, E., (1993), Sodium-vapor dispersive Faraday filter, Optics Lett., **18**, 1019-1021.

Nagasawa, C. and Abo, M., (1995), Lidar observations of a lot of sporadic sodium layers in mid-latitude, Geophys. Res. Lett., **22**, 263-266.

Table 1. Specifications of the TMU Na Lidar

Laser	Nd:YAG SHG pumped Dye
Wavelength	589nm
Pulse Energy	65mJ/pulse
Pulse Rate	10Hz
Linewidth	2.5pm FWHM
Telescope	60cm Diameter Casegrain
Field of View	0.7mrad
Filter bandwidth	3.5nm (night)
(FWHM)	4pm (day)
Range Resolution	100m

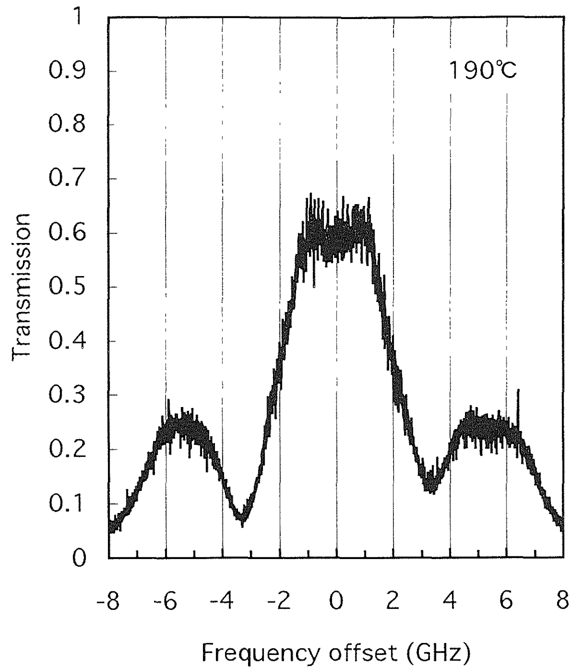

Figure 1. Experimental Na vapor dispersive Faraday filter transmission spectrum.

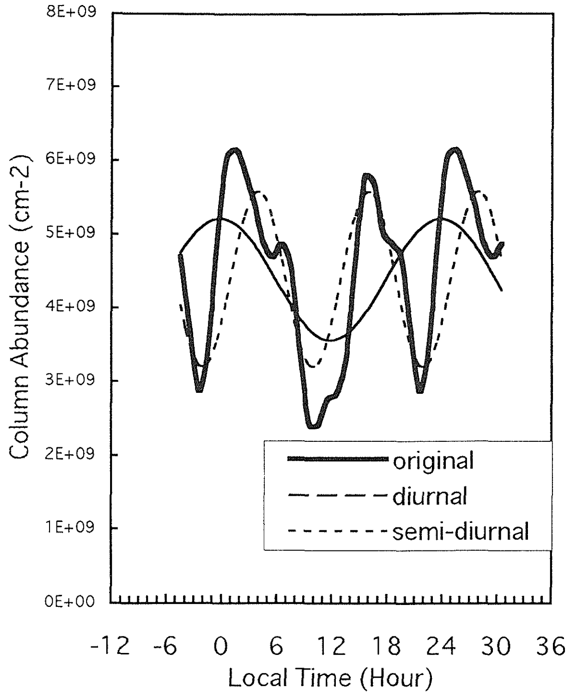

Figure 2. Diurnal variation of the Na column abundance.

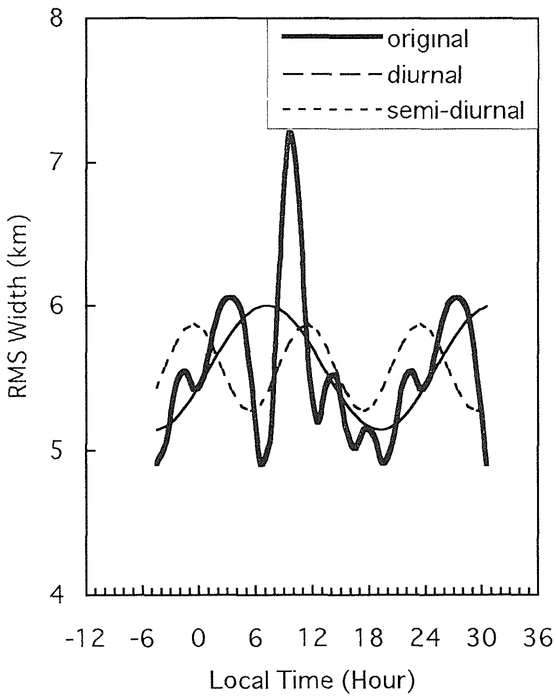

Figure 3. Diurnal variation of the Na rms width.

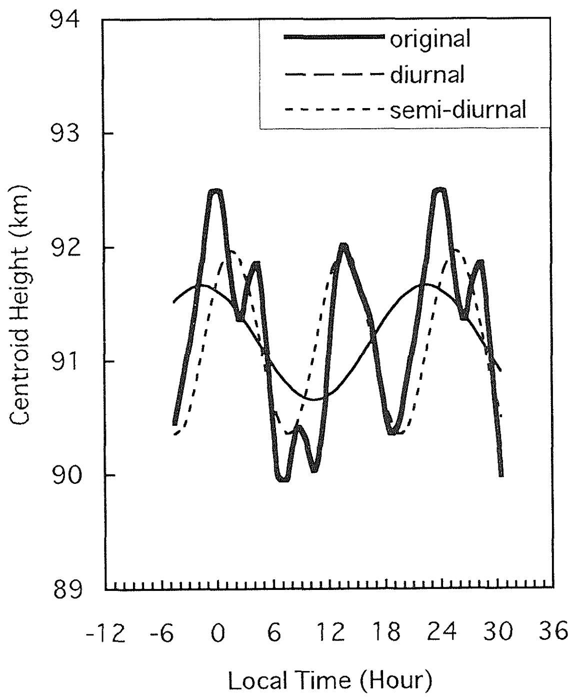

Figure 4. Diurnal variation of the Na centroid height.