

The effects of upper mesosphere seasonal transitions the in the nightglow above Yakutsk

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The intensity and rotational temperature of OH molecular emissions and the first atmospheric band of O₂ (0-1) are measured at Maimaga station (63°N, 129,5°E) with the digital infrared diffraction spectrograph registering the two molecular bands simultaneously. The rotational temperature of OH(6,2) and O₂(0,1) bands corresponds to the neutral atmosphere temperature at the 87 and 95 km. Nightly averaged rotational temperatures of hydroxyl are systematically higher than the molecular oxygen ones in winter. A springtime transition of the upper mesosphere is seen well in the temporal series of OH and O₂ nightly average intensities. After the intensity increasing by 2-3 times at the end of March or the beginning of April, the OH intensity decreases up to the initial level. The O₂ intensity continues to be decreased up to the registration noise level at the end of April and does not recover up the finish of observational season.

The analysis of data from August 9 to September 30, 2001 shows that O₂ rotational temperatures are greater than OH ones early in August and are less than OH ones by the end of August. Such a change of the temperature vertical gradient from the positive sign to the negative one implies the shift of the mesopause to the higher level as compared to the excited hydroxyl layer. According to the two-level mesopause concept, developed in the recent years the position of the minimum temperature is varied from the summer state (88 km) to the winter (100 km) state during very short time. In this study it is shown in the first time that the observed change of the vertical temperature gradient corresponds to the transition of the mesopause from the summer to the winter states.