

DETECTION OF DUST PARTICLE LAYERS AT 60-90 KM ALTITUDE BY ROCKET-BORNE SPECTROPOLARIMETER

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Abstract

Rocket-borne measurements of mesospheric scattered radiation polarisation rate performed in 1978 and 1986 detected scattering dust particle layers at 78 and 85 km altitude. These data were compared with measurements performed in the presence of noctilucent clouds. Registered rate of polarisation differs greatly from noctilucent cloud radiation rate of polarisation.

Two MR-12 rocket launches intended for the exploration of the upper atmosphere scattered radiation were performed 18.10.1978 16.15 Moscow Time and 24.10.1986 17.05 Moscow Time at 48°41'N 42°21'E. Both experiments were performed during evening twilight. Solar zenith angle was 82° and 94°. Both rockets were launched into near zenith direction.

Atmospheric radiation was investigated by spectropolarimeter 185 SR-P which was installed along the rocket axis. The design of this device is similar to the design of spectroradiometer described in [1]. Polaroid is installed before the photomultiplier tube. The rotation of polaroid was produced due to rotation of the rocket around its axis. The time constant of spectropolarimeter is smaller than time constant of spectroradiometer and is equal to 10 ms. The photone counting technique was used in the electronic block of spectropolarimeter in order to compensate the decrease of threshold sensitivity caused by the increase of quickness of action and by the presence of polaroid.

During the first launch radiation was studied in three spectral bands centered at 391.4, 451.0, 575.0 nm having 15 nm full width at 0.1 level and in 300.0-600.0 nm interval. Radiation scattering angle was 77-98°. Polarisation rate equal to 65% was registered at altitudes higher than 81 km.

In 1986 radiation was studied in 15 nm wide bands centered at 369.0, 457.0, 530.0, 557.7 nm and in 300-600 nm interval. Radiation scattering angle was 85-102°. Polarisation rate of scattered radiation was not higher than 67% at 70-110 km. Two layers where polarisation was 35-40% were registered at 78 and 85 km.

These figures are surprisingly low because polarisation rate of Raleigh scattered radiation at this scattering angles should be not less than 90%. Our results differ greatly from the results of measurements performed in the presence of noctilucent clouds published in [2,3] where polarisation rate was considerably higher. Low polarisation rates registered in our experiments can be explained by the presence of particle layers of unidentified origin with particle size greater than 1000 nm.

References

1. Спектрорадиометры СР-184 и СР-185 для измерения яркости верхней атмосферы Земли./ Ю.Ш. Блинков, В.С. Давыдов, А.Е. Микиров, А.Н. Нарожный, В.А. Хрусталеv. -Труды ИПГ, 1979г., вып. 36,с. 74-86.
2. Tozer W.E., Beeson D.E., Optical Model of Noctilucent Clouds Based on Polarimetric Measurements from Two Sounding Rocket Campaigns, J.Geophys.Res., 1974, v.79, N 36, p.5607-5612.
3. Witt G., Dye J.E., Wilhelm N., Rocket-borne Measurements of Scattered Sunlight in the Mesosphere, J.Atmos.Terr.Phys., 1976, 38, p.223-238.