DETECTION OF METEORIC DUST AND STRATOSPHERIC AEROSOL IN THE ATMOPSHERE BY THE POLARIZATION MEASUREMENTS OF THE TWILIGHT SKY. O. S. Ugolnikov[1] and I. A. Maslov[1,2], [1]Space Research Institute, Russian Academy of Sciences (Profsoyuznaya st., 84/32, Moscow, 117997, Russia, e-mail: ougolnikov@gmail.com), [2]Sternberg Astronomical Institute, Moscow State University, Russia

Twilight sky background analysis is the well-known method to investigate the atmosphere of the Earth at different altitudes from near-ground layer to the mesosphere and lower thermosphere. Altitude separation is achieved owing to strong dependency of the effective scattering altitude on the solar zenith angle during the twilight period.

The basic problem of the method is high contribution of multiple scattering [1]. The experimental method of its estimation based on the polarization measurements was offered in [2] and improved in [3,4]. Polarization data also helps to detect the dust and aerosol scattering at different atmosphere layers.

Effects of meteoric dust scattering in the upper atmosphere after the major meteor showers maxima were reported in [5,6]. In this work the polarization measurements of the twilight sky are used to detect the upper atmosphere dust from strong Leonids maximum in 2002. During the first of two sub-maxima at November, 19, 2002, the radiant was high above the horizon at the observation point (Crimea, Ukraine) providing the good conditions for the dust inflow to the upper atmosphere.

As the result of observations with moonlight and multiple scattering reduction the twilight sky depolarization was detected at November, 21, 2002 at the altitudes above 90 km (see the Figure). During the following dates the dust layer shifted down to the stratosphere. Effects of this layer were not seen in the twilight sky intensity data, proving the high sensitivity of polarization measurements [7].

Twilight sky polarization measurements can be also used to detect the stratospheric aerosol. Sufficient increase of its level was detected in the same observation point in Crimea in December 2006. The layer is expanded on the altitude range from 15 and 35 km and probably related with Rabaul volcano eruption in October, 2006 and following expansion of sulfur dioxide in the stratosphere over the large territories above the Earth. Turning to the sulfur acid, it forms the sulphate aerosol in the stratosphere.

Analysis of the observational data gives the value of aerosol scattering polarization by the angle 90° for the wavelength 5250 A: 0.28 ± 0.03. It is more than for aerosol in the troposphere (about 0.2) showing the less size of stratospheric aerosol particles. The ratio of aerosol and molecular scattering coefficients in the stratosphere is about 0.1-0.2, that is in good agreement with post-Rabaul lidar measurements in Tomsk [8].

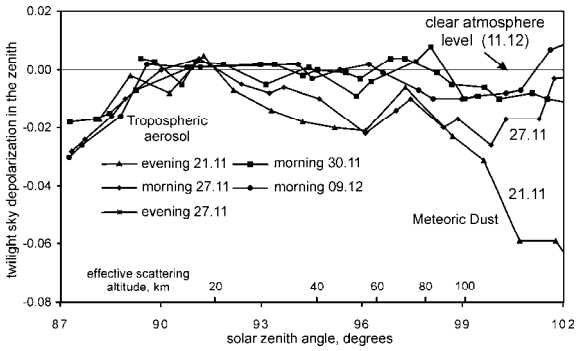

Figure. The depolarization of the twilight sky background (compared with the clear atmosphere conditions of morning, December, 11th) depending on the solar zenith angle and the effective scattering altitude. Observations are conducted at wavelength 5250 A in November-December 2002 after the Leonids maximum.

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