Study of aerosol properties stratification in West Siberia by means of multi-wavelength lidar

S.V. Samoilova[1], I.E. Penner[1], Yu.S. Balin[1], M.A. Sviridenkov[2] and G.P. Kokhanenko[1]

[1]Institute of Atmospheric Optics, Tomsk, 634055, Russia
[2]A.M. Obukhov Institute of Atmospheric Physics, Moscow, 119017, Russia
Keywords: atmospheric aerosols, lidar sensing, size distribution.
Presenting author email: ssv@seversk.tomsknet.ru

Results of analysis of temporal variations of the tropospheric aerosol characteristics assessed from the data of sensing with "LOZA-S" lidar at wavelengths of 355, 387 (Raman scattering), 532, 607 (Raman), and 1064 nm are presented. Measurements were carried out in Tomsk (56^0N, 85^0E) in the frameworks of continuation of the Comprehensive Aerosol Experiment (Matvienko *et al*, 2014) in summer of 2015 at not-disturbed conditions.

Night-time sounding sessions were selected for processing. An analysis included (i) retrieval of the vertical distributions of backscattering and extinction coefficients from the raw data and (ii) solution of the inverse problem of the aerosol scattering.

Time base of the lidar signals is shown in Figure 1.

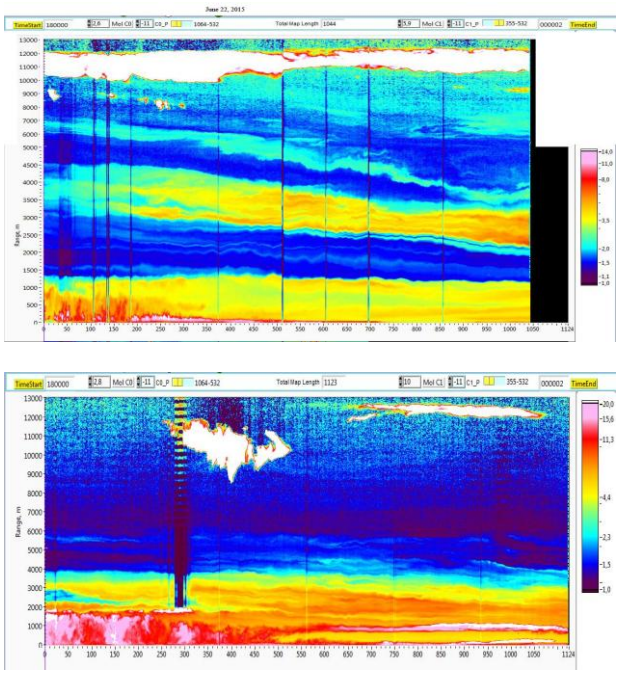

Figure 1. Spatial-temporal variations of the scattering ratio at 1064 nm.

Analysis of the backward trajectories showed that at the beginning of sounding, air masses in boundary layer (up to 1.2 km on June, 22, and 3.85 on June, 23) and in free troposphere have come from North Europe, Atlantics, Canada (south-eastern direction of transport). Further, after the rain fall, air mass in boundary layer came from Arctic region (southern direction of transport), but in upper layers (free troposphere and stratosphere), no change of air mass occurs. Some mean values of aerosol quantitative and qualitative characteristics are presented in Table 1 (PBL – planetary boundary layer; MTL – middle troposphere layer).

Table 1. Mean values of aerosol optical depth *Ta*(532), Angstrom exponents for extinction and backscattering and lidar ratio for wavelengths of 355 and 532 nm.

	June 22 PBL / MTL	June 23 PBL
Height, km	0.5-1.2 / 2-3.6	0.5-3.85
Ta(532)	0.010 / 0.071	0.26
Angstrom exponent for:		
extinction (355/532)	1.29 / 1.02	1.07
backscatter		
(355/532)	1.25 / 0.95	0.99
(532/1064)	0.94 / 0.81	1.15
Lr(355), sr	59 / 49	61
Lr(532), sr	53 / 46	68

Inverse problem was solved using modified Tikhonov's algorithm. Modification concerns the selection of constraints different for fine and coarse aerosol fractions.

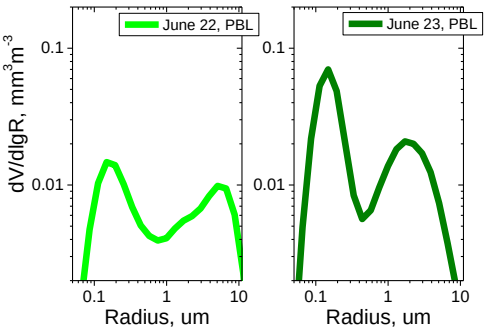

Figure 2. Aerosol size distributions with different ratios between fine and coarse aerosol fractions .

This work was supported in part by the RSF (No. 14-27-00022).

Matvienko, G., Belan, B., Panchenko, M., *et al.* (2014) *International Journal of Remote Sensing*. **35,** 5651-5676.