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Transfer of aerosol of different origin over Siberian - Far Eastern lidar network

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At present time a network of stratospheric lidar stations operates in Siberia and Far East: in Institute of Atmosphere Optics, Tomsk, in U.G. Shafer Institute of Cosmophysical Iinvestigations and Aeronomy SB RAS, Yakutsk, and in Institute of Cosmophysical Researches and Radio Wave Propagation, Kamchatka. Monitoring of vertical aerosol structure in the upper troposphere, in the stratosphere, and in the mesosphere is one of the main goals of these stations.

Involvement of UK MetOffice assimilated data on wind velocities and temperature allowed to relate observed aerosol layers with different origins of aerosol in the atmosphere. Analysis of aerosol layer origin was carried out by backward trajectory calculations on the basis of software package which we developed. Results of our calculations were complemented by calculations using GDAS data and HYSPLIT software package available on NOAA site.

The data of lidar observations in Tomsk were analysed from 1996 to nowadays. Several aerosol sources were detected.

1. Appreciable aerosol content of the upper troposphere and the stratosphere at altitudes of up to 30 km was observed in winter-spring period. We analysed the parameters of air masses containing aerosol. Aerosol in the stratosphere was practically absent in summer period. It is typical behaviour of aerosol.

2. Several cases of polar stratospheric clouds (PSC) were registered in winter time. The facts of PSC observations were confirmed by backward trajectory analysis. These PSCs were brought from Scandinavia or region of North Ural and Novaya Zemlya where air mass temperature decreased lower than threshold values of PSC formation. Stratospheric aerosol appearance over these regions was confirmed by data of CALIPSO satellite lidar.

3. Aerosol scattering peaks were observed in the stratosphere episodically at altitudes about 20 km in summer time. Aerosol at these altitudes have been associated with its transport from tropical aerosol reservoir described by Hitchman.

4. Volcanic activity in the northern hemisphere has increased over the last few years. After various powerful eruptions aerosol layers of volcanic origin were observed in Tomsk. Volcanic origin of aerosol was confirmed by backward trajectory calculations.

5. Lidar observations of the upper stratosphere and the mesosphere above Kamchatka were started in 2007, and aerosol layers at altitudes 35-50 km and 60-75 km were found. Position of these layers can be explained by influence of gravito-photophoretic force which can cause levitation of particles at these altitudes. Noctilucent clouds were registered above Kamchatka as well.

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