



Observation of volcanic aerosol in the stratosphere over Western Siberia

Alexander Cheremisin (1,3), Valery Marichev (2), and Pavel Novikov (3)

(1) Siberian Federal University, Krasnoyarsk, Russia (aacheremisin@gmail.com), (2) Institute of Atmosphere Optics SB RAS, Tomsk, Russia (marichev@iao.ru), (3) Krasnoyarsk Railway Institute, Krasnoyarsk, Russia (novikov-pv@yandex.ru)

As a result of aerosol observations in the stratosphere after very powerful eruptions of El Chichon and Pinatubo in 1982 and 1991, a global type hypothesis about a volcanic origin of the optically active fraction of the stratospheric aerosol has been formulated by a number of scientists. This paper presents the results of the investigation of volcanic eruptions impact on the aerosol content in the stratosphere of Western Siberia, obtained over the last decade.

The presence of volcanic aerosol was registered by a stratospheric lidar station in Tomsk after the eruptions of volcanoes Kasatochi, Okmok, Sarychev Peak, Eyjafjallajokull, and Nabro. Aerosol layers, resulting from volcanic activity have been observed at different altitudes in the upper troposphere and the stratosphere over Tomsk. The confirmation of the volcanic origin of the aerosol layers has been obtained by back trajectories method. In this investigation the original procedure of back trajectory calculations based on wind velocity satellite data from BADC has been applied.

The lidar observations of aerosol in the stratosphere over Tomsk also showed the presence of a weak diffuse scattering peak at altitudes of 16-18 km during the warm season from May to September in 2008-2011. This layer was absent within measurement error limits in 2012-2015. The trajectory analysis of air masses transfer has shown that the highest intensity of stratospheric aerosol peak mostly resulted from the air masses transfer from altitude of 20-21 km of the tropics. According to the climatology of stratospheric aerosol by Hitchman et al. (1994), there is a reservoir of stratospheric aerosol in the equatorial zone with the aerosol content maximum at heights of 20-21 km. In fact, the aerosol at these altitudes could be traced only in 2008-2011, 1-2 years after relatively large eruptions in the northern hemisphere: Kasatochi in 2008 and Sarychev Peak in 2009.

Therefore, the observed aerosol peaks at 16-18 km over Tomsk may be associated with a global circulation of volcanic aerosol, its accumulation in the tropical reservoir and subsequent transfer to northern latitudes, gradually decreasing in its intensity.

This work was supported by the Russian Foundation for Basic Research (project no.16-05-00901).

The authors would like to thank the UK Meteorological Office for providing the data on wind velocities.