

Transfer of soot aerosol of Siberian forest fires in the stratosphere of 2019

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Currently, significant attention is being paid to the issues of stratospheric pollution by aerosols of volcanic origin and soot aerosol from aircraft due to possible climatic consequences. In the last decade, another source of stratospheric pollution has been discovered — pyrocumulative emissions arising from powerful and extensive forest fires.

In the summer of 2019, numerous severe forest fires were recorded on the territory of Eastern Siberia. Along with this, lidar observations in Tomsk in summer and autumn showed that there are dense aerosol layers in the stratosphere at an altitude of 10 to 16 km. Analysis of air currents showed that the smoke from the fires, even if they got to such high altitudes, had to be carried east in the opposite direction from Tomsk. Initially, preference was given to the hypothesis that this aerosol appeared over Western Siberia as a result of the transfer of volcanic aerosol after the eruption of Raikoke on June 21, 2019. We carried out a more thorough analysis of the origin of aerosol layers observed in the stratosphere over Tomsk in the summer and autumn of 2019.

In the paper is presented the results of calculations of backward isentropic trajectories of air masses, constructed in the HYSPLIT software package, using GDAS meteorological data containing global data of satellite measurements of wind speeds in the atmosphere. Data from the CALIOP space lidar on the CALIPSO satellite was also used, which made it possible to localize the appearance of aerosol plumes along the trajectories of air masses. Radiometric data of the VIIRS system from the Suomi NPP satellite and data on the brightness temperature in the far-infrared region (8.6 microns) obtained from the Himawari-8 satellite were also used. These data made it possible to obtain information about the geographical localization of forest fires in vast areas of the Northern Hemisphere.

As a result of a comprehensive analysis of ground and satellite data, it is shown that aerosols that were observed over Tomsk in the summer and autumn of 2019 were formed as a result of pyrocumulative soot emissions during forest fires in Siberia.