EGU2020-13095, updated on 01 Aug 2021
https://doi.org/10.5194/egusphere-egu2020-13095
EGU General Assembly 2020

Estimation of possible impact of black carbon emissions from 2019 large Siberian forest wildfires on the Arctic region

Veronika Ginzburg[1,2], Sergey Kostrikin[1,3], Vladimir Korotkov[1], Anastasia Revokatova[1,4], Polina Polumieva[1], Alexey Chernenkov[5], and Maria Zelenova[1]

[1]Yu.A. Izrael Institute of Global Climate and Ecology, Russian Federation (veronika.ginzburg@gmail.com)
[2]Institute of Geography of the Russian Academy of Sciences, Moscow, Russian Federation
[3]Marchuk Institute of Numerical Mathematics of the Russian Academy of Sciences, Moscow, Russian Federation (s_kostr@mail.ru)
[4]Hydrometcenter of Russia, Moscow, Russian Federation (revokatova@gmail.com)
[5]Moscow Institute of Physics and Technology, Moscow, Russia

The presented study is aimed to estimate the probability of black carbon transportation from large forest wildfires in Russian boreal taiga occurred in the summer 2019 to Arctic region and to estimate its deposition to ice surface and contribution to shortwave radiative forcing.

The extreme forest fires were observed in 2019 over the territories of Krasnoyarskiy region and Yakutia republic. The Russian Informational Remote monitoring System of the Federal Forestry Agency provides data on the areas of forest lands damaged by different types of fires. These data were used to choose ten most intensive and ten most continuous fires for each region. Estimation of fuel mass available for combustion including biomass, litter and deadwood were made using the growing stock data of the State Forestry Register differentiated for the regions of the Russian Federation applying country specific conversion coefficients [Schepaschenko et al. 2018]. Emission of black carbon from forest fires was carried out using the methodology and combustion coefficients from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the coefficient of black carbon emissions from Akagi et al. [2011].

The main factor determining the transfer of particles is the synoptic situation. Blocking anticyclones and cyclonic series affects the circulation regime and conditions for the transport of particles to the Arctic. For these regions climatic frequency of occurrence of Southern and South-Western winds in summer is about 30-40%. The probability of atmospheric trajectory transfer from each chosen fire event to the Arctic region was estimated by the trajectory model HYSPLIT, also real synoptic data for each chosen fire event were used to analyze the probability of emission cloud transfer to northern latitudes.

The black carbon effect including concentrations in the atmosphere, deposition on the ice surface, modification of surface albedo in the ice region of Arctic and influence of additional radiation forcing associated with BC emissions from forest fires were estimates using the climate model INMCM5 [Volodin et a.l., 2017]. Aerosol sources, advection, gravitational sedimentation, surface

absorption, and scavenging by precipitation are taken into account to compute aerosol concentration variations. Radiation forcing caused by BC emission from forest fires was calculated using the SNICAR model.

The study is supported by RFBR project No.18-05-60183.

REFERENCES

Volodin E. M., Mortikov E. V., Kostrykin S. V., Galin V. Ya., Lykossov V. N., Gritsun A.S., Diansky N. A., Gusev A. V., Yakovlev N.G. Simulation of the present-day climate with the climate model INMCM5, Climate Dynamics, 2017, doi:10.1007/s00382-017-3539-7.

2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4: Agriculture, Forestry and Other Land Use (IPCC, 2006

K. Akagi, R. J. Yokelson, C. Wiedinmyer, M. J. Alvarado, J. S. Reid, T. Karl, J. D. Crounse, and P. O. Wennberg, "Emission factors for open and domestic biomass burning for use in atmospheric models," Atmos. Chem. Phys. 11 (9), 4039–4072 (2011).

Schepaschenko D., Moltchanova E., Shvidenko A., Blyshchyk V., Dmitriev E., Martynenko O., See L., Kraxner F. (2018) Improved Estimates of Biomass Expansion Factors for Russian Forests // Forests. – 9, 312. P. 1-23. – https://doi.org/10.3390/f9060312