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Atmospheric black carbon in the Russian Arctic: anthropogenic inputs in comparison with average or extremal wood fires' ones

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Model estimates of atmospheric black carbon concentrations were made for different points of the Russian Arctic. Anthropogenic BC emissions and wood fires' ones were calculated from Russian official statistics for the 2000s. We used the data of Ministry of Natural Resources and Environment of RF on anthropogenic air emissions of pollution in Russian cities and regions [1], as well as the data of Federal Forestry Agency of RF (Rosleshoz) [2] on wood fires. We considered the area within (50-72)N and (20-180)E, which covers about 94% of the Russian territory, where both anthropogenic and fire BC emissions have been arranged through grid cells (1×1) deg.
Anthropogenic BC emissions are estimated as annual values based on the data for 54 regions and more than 100 cities. Total emission is estimated as (220 ± 30) Gg BC in 2010 [3], including emissions from open flares associated with gas/oil extractive industry which are about (25 ± 8) Gg/yr.
We analyzed the data on wood fires (detailing crown, ground and underground fires in forests and fires on non-forest lands) with their spatial and seasonal variations during 15 years (2000-2014). Different combustion factors [4] and BC emission coefficients [5] were used in calculations for different types of burning. Russian total average annual BC emission from fires, occurring mainly in summertime, was estimated as 30 Gg with large variations (4-100 Gg/yr) from year to year. Asian territory emits about 90% of this value.
We estimated anthropogenic (BC_A) and fires' (BC_F) contributions to BC air concentrations at different Russian Arctic points using the approach [6] – decadal back-trajectory analysis combined with spatial distribution of sensitivity pollution emission function (SPEF). Extraordinary atmospheric circulation causing, to a great extent, abnormally intensive fires in the middle latitudes often leads to a decrease in SPEF values for these territories. As a result, fires are not so dangerous for the whole Arctic, as it is believed. But there are distinctions at various points:
Kola Peninsula – annually BC concentrations in air are not sizable and BC_A prevails, but BC_F prevails in summer.
SE of Arkhangelsk region – annually BC_A prevails, but in summer BC_A is equal to BC_F, and in summer 2010 BC_F was 2 times higher.
Nenetsky Nature Reserve – BC_F always prevails.
Gydansky Nature Reserve – BC_A prevails through a year, previously from oil/gas flares.
Ust'-Lensky Nature Reserve – annually BC concentrations in air are not sizable, but in summer 2012 BC_F prevails and is near the same as at Nenetsky Nature Reserve.

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1. Yearbook 2010 on Atmospheric Emissions of Pollution in Towns and Regions of Russian Federation. St.Petersburg, SRI Atmosphere, 2011. – 560 pp. [in Russian].
2. http://www.rosleshoz.gov.ru/; http://www.aviales.ru/
3. Vinogradova A.A. Anthropogenic Black Carbon Emissions to the Atmosphere: Surface Distribution through Russian Territory // DOI: 10.1134/S1024856015020141
4. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html
5. Akagi S.K. et al. Emission factors for open and domestic biomass burning for use in atmospheric models // DOI: 10.5194/acp-11-4039-2011
6. Vinogradova A.A. Distant evaluation of atmospheric pollution influence on the remote territories // DOI:10.1134/S0001433815070099