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Dynamics of Emissions of Black Carbon in the Region for the Kola Peninsula over the Period of 1960–2015 on the Base of the MACCity Database

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Abstract

The article presents a review of an online service ECCAD on the base of Internet database MACCity, on the base of which the pre-treatment was made and emission dynamics of black carbon was analyzed for the period of 1960–2015 for the region of Kola Peninsula by six types of sources (energetics, industry, industry, surface transport, marine transport, household use of resources and waste treatment). The data on the total black carbon emissions in the region over this period were given. The leading position in emissions of black carbon of the household use of the resources use and insignificance of the contribution of the region as a whole in Russia was noted.

Key words: emission source, black carbon, Kola Peninsula, MACCity database, dynamics, total emissions

INTRODUCTION

For the analysis of the sources of black carbon (BC) emissions in the Kola Peninsula the database MACCity placed on an online service ECCAD (Emissions of atmospheric Compounds & Compilation of Ancillary Data) was selected [1]. Emission sources into ECCAD are inventoried and grouped within the divisions [2]. The access to them can be carried out both by the catalog, and through the database section that provides the information for each source type. Note that the database contains the data on spatial distribution of not only BC, but other pollutants as well, and granting the information about various formats ensures the flexibility of work with both mapping, and assessment directivities.

SOURCES OF BC AND EMISSION ASSESSMENT METHOD

Among potential sources of BC in the Kola Peninsula, the following were selected: energet-

ics, industry, surface transport, marine transport, household use of resources and waste treatment.

The coverage of the service is throughout the world. The incoming data proceed through regriding and are presented to the user with the spatial resolution of $0.5^\circ \times 0.5^\circ$ or $1^\circ \times 1^\circ$. Data association is carried out according to the latitude and longitude in WGS-84 coordinates and corresponds with the center of the cell with prescribed resolution. Thus, taking into regard the spatial resolution it is impossible to talk about precise mapping in a regional aspect, though the database can excellently assist in assessment and statistic regional works. The formats of data submission to the final user are text table ASCII or NetCDF, supported by practically all GIS.

The temporal resolution in this service can be set at the stage of acquiring data and amounts to a month or a year. The year of 1960 is a starting point in the database selected by the authors. The time period of 1960–2015 with a monthly interval was used in the work. This is due to the

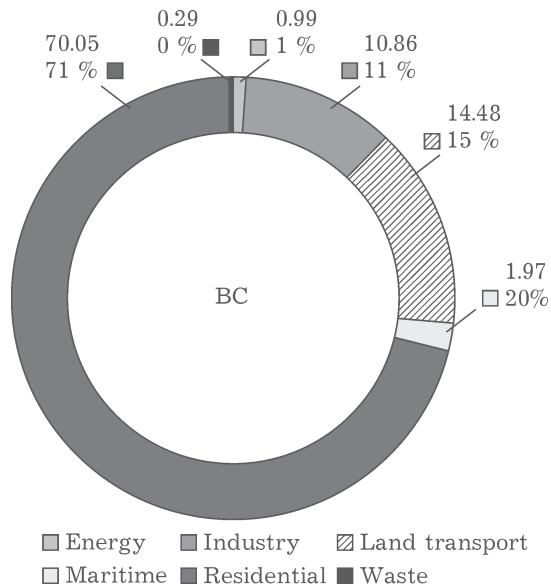


Fig. 1. Contribution of various emission sources (thousand tons and in percent) to BC emissions on the Kola Peninsula over the period of 1960–2015.

fact that the data presented in the database are model values (RCP8.5 scenario, elaborated by an intergovernmental group of experts ICCP) and therefore, are require processing.

To assess the total emissions of BC from the Kola Peninsula each cell was recalculated with regard for the area changing with the latitude.

ESTIMATING BLACK CARBON EMISSIONS

The total picture of BC emissions according to the types of emission sources for the period of 1960–2015 is given in Fig. 1. According to the calculation results, the total emission of BC for the entire selected period amounted to 100 thousand tons.

Figure 1 shows that the domestic activities of the population are the major source of BC emissions on the Kola Peninsula. On the whole, the percentage distribution of emissions on the Kola Peninsula, presented in Fig. 1, is coherent with the study data [3], with no regard for forest fires which are rare in the region.

The annual dynamics of BC emissions for the given period is shown in Fig. 2. It can be seen well that the dominating emission source is the household activity of the population. Next come transport and metallurgy. Rest sources of BC emissions (heat and electricity production,

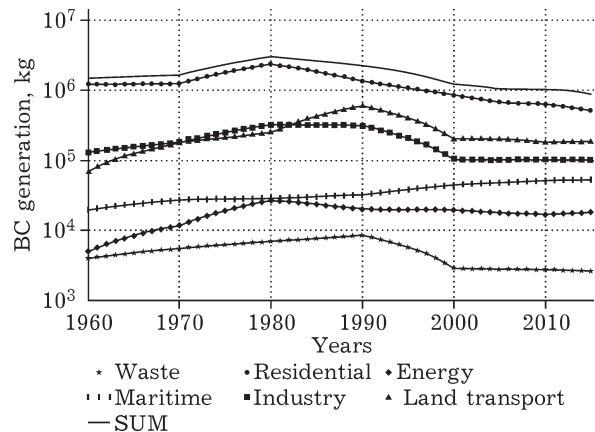


Fig. 2. Dynamics of BC emissions on the Kola Peninsula over the period of 1960–2015.

local seasonal navigation and agricultural activity) do not make any considerable contribution to the Kola Peninsula region.

The comparison of the calculated BC emissions with the data of [3] for the year of 2000 shows that the contribution of the region of Kola Peninsula into the total BC emissions is small and amounts to about 0.4 %.

The study results are presented in the proceedings of the conference [4].

CONCLUSION

The on-line service ECCAD provides vast opportunities for the pollution assessment of a territory of practically any scale (despite rather large mesh spacing in 0.5°). The database contains the data on the spatial distribution of not only BC, but other pollutants as well. The submission of this information in various formats provides the work flexibility in both mapping, and assessment directivities.

The approach chosen by the authors with the use of text files allowed assessing BC emissions not only for the whole the Kola Peninsula, but for its particular points. The authors established the annual dynamics of BC emissions and carried out the preliminary data analysis having allowed making some conclusions:

- the maximum annual emission of BC on the Kola Peninsula was in the year 1980;

– the household sector including cooking and heating is the dominating source of emissions leads on the emissions volume;

– the contribution of the Kola Peninsula into the BC emissions of Russia is minor.

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Динамика эмиссии черного углерода в регионе Кольского полуострова за период 1960–2015 гг. на основе базы данных MACCity

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Аннотация

Представлен краткий обзор онлайн-сервиса ECCAD и интернет-базы данных MACCity, на основе которых выполнена предобработка и проанализирована динамика эмиссии черного углерода за период 1960–2015 гг. для региона Кольского полуострова по шести типам источников (энергетика, промышленность, наземный транспорт, морской транспорт, бытовое использование ресурсов и обработка отходов). Приведены данные по суммарному выбросу черного углерода в регионе за указанный период. Отмечена лидирующая позиция в эмиссию черного углерода сектора бытового использования ресурсов и незначительность вклада региона в целом по России.

Ключевые слова: источники эмиссии, черный углерод, Кольский полуостров, база данных MACCity, динамика, суммарный выброс

