

Scientists investigate black carbon effects on climate in the Arctic during winter and spring

September 30 2020, by Li Yuan



Credit: CC0 Public Domain

As an important light-absorbing aerosol, black carbon (BC) can affect the energy balance of the earth-atmosphere system via direct and

indirect radiative forcing. When BC deposits on snow and ice, it can trigger BC-snow/ice feedbacks, further affecting climate.

The Arctic region is especially sensitive to [climate change](#), and previous studies found that increases in BC emissions may contribute to the amplification of Arctic warming.

Recently, a research team led by Prof. Kang Shichang from the Northwest Institute of Eco-Environment and Resources (NIEER) of the Chinese Academy of Sciences (CAS), in cooperation with researchers from Sun Yat-sen University, explored the responses of meteorology and atmospheric stability to BC-cloud-radiation interactions in the Arctic preliminarily based on a regional climate-chemistry model (WRF-Chem).

WRF-Chem reproduced the temporal variations of meteorological variables and BC concentration well. Results showed that BC concentrations in the Arctic in winter were mostly higher than those in spring, and the BC-induced near-surface temperature changes were also stronger.

The study showed that effects of BC on near-surface water vapor mixing ratio were consistent with the spatial pattern of near-surface temperature changes, which was probably correlated with the local circulation anomaly due to the temperature changes. Additionally, the changes in near-surface temperature and horizontal wind could also affect the atmospheric stability.

Depending on analysis of the surface radiation changes, this study revealed that the downward longwave radiation related to cloudiness changes played an important role in driving near-surface temperature in the Arctic in winter. While in spring, the relatively less changes in near-surface [temperature](#) may be the result of the mutual compensation

between the surface longwave and shortwave radiation effects.

The above findings about the effects of BC on climate in the Arctic during winter and spring (So-called Arctic haze period) will lay a foundation for comprehensive assessments of the effects of BC on Arctic warming.

The study was published in *Science of the Total Environment*.

More information: Xintong Chen et al. Investigation of black carbon climate effects in the Arctic in winter and spring, *Science of The Total Environment* (2020). [DOI: 10.1016/j.scitotenv.2020.142145](https://doi.org/10.1016/j.scitotenv.2020.142145)

Provided by Chinese Academy of Sciences

Citation: Scientists investigate black carbon effects on climate in the Arctic during winter and spring (2020, September 30) retrieved 4 October 2025 from <https://phys.org/news/2020-09-scientists-black-carbon-effects-climate.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
--