Enrichment of light-absorbing impurities in snow might accelerate snowmelt in southern Altai Mountains

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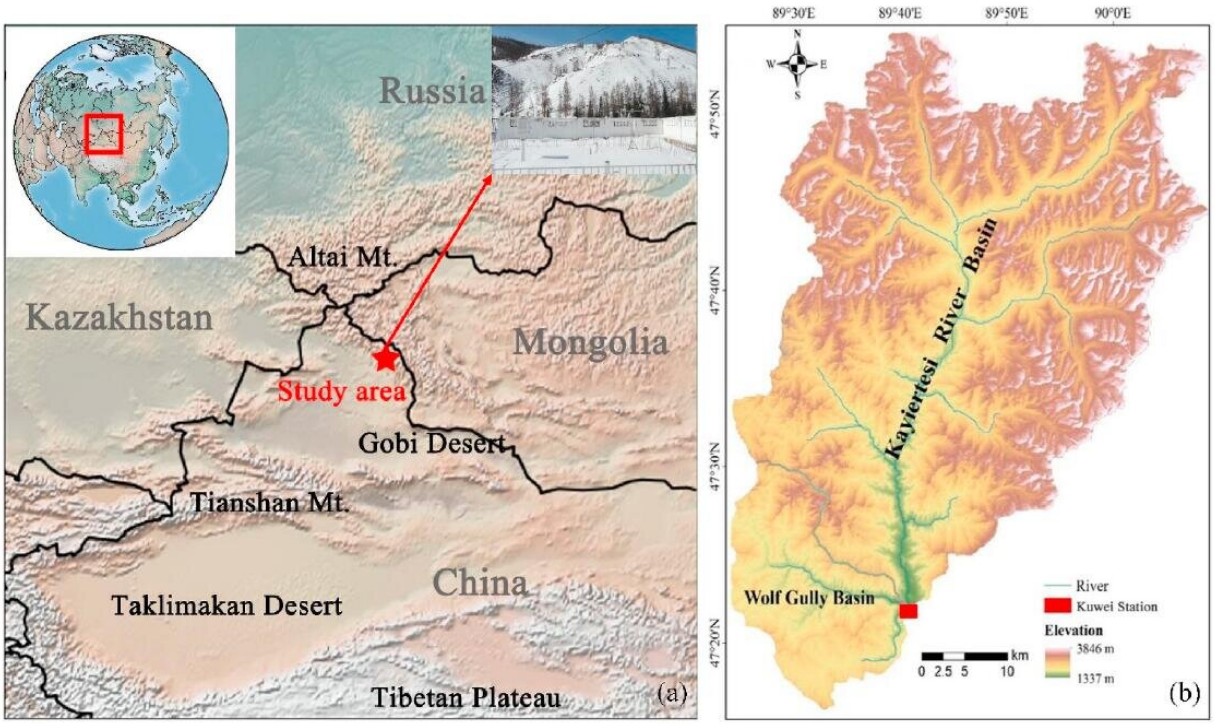

(a). Geographical locations of study area over the Altai Mountains in China; (b). the snow sampling site of Altai Kuwei Snow Station. Credit: ZHONG Xinyue

Light-absorbing impurities (LAIs) (such as black carbon, organic carbon, mineral dust, etc.) deposited onto the snow surface can darken the snow and cause decrease in snow surface albedo, resulting in increasing the

absorption of solar energy, thereby accelerating snowmelt, shrinking snow cover duration and impacting hydrological cycle.

However, there is still a lack of understanding of the LAIs concentration, elution and enrichment process in snow cover in the northern Xinjiang. Besides, the post-depositional enrichment processes of LAIs in seasonal snow cover and their potential impacts on snow across the northern Xinjiang are still unclear.

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) carried out continuously sampling during two years to investigate the concentrations, impacts and potential sources of LAIs in snow cover at Kuwei Station in the southern Altai Mountains.

In this study, the researchers found that the average concentrations of black carbon, organic carbon and mineral dust in the surface snow dramatically increased along with snowmelt intensified, reflecting a significant enrichment process of LAIs at the snow surface.

With the simulation of the Snow Ice Aerosol Radiative model, black carbon was the main dominant factor in reducing snow albedo and radiative forcing (RF), its impact was more remarkable during the snowmelt period. The average contribution rates of black carbon to snow albedo reduction increased in spring compared with that in winter; meanwhile, the corresponding average RFs also increased.

Besides, decrease in the number of snowmelt days caused by black carbon and mineral dust together was 3~8 days. It indicated that surface enrichment of LAIs during snow melting might accelerate snowmelt further.

In addition, Weather Research and Forecasting Chemistry model showed that the resident emission was the main potential source of black carbon and organic carbon in snow. This implied that the mitigation of accelerating snowmelt needs to mainly reduce resident emission of LAIs in the future.

This work has been published in *Environmental Pollution* in a study titled "Continuously observed light absorbing impurities in snow cover over the southern Altai Mts. in China: Concentrations, impacts and potential sources."

More information: Xinyue Zhong et al. Continuously observed light absorbing impurities in snow cover over the southern Altai Mts. in China: Concentrations, impacts and potential sources, *Environmental Pollution* (2020). DOI: 10.1016/j.envpol.2020.116234

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