Study reveals how delayed Antarctic melt season reduces albedo feedback

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The ice-covered continent of Antarctica is not free from climate change. On the contrary, a rise in temperatures at high latitudes is much stronger than that in global mean temperatures, a phenomenon known as the polar

amplification effect.

A research team led by Prof. Guo Huadong from the International Center of Big Data for Sustainable Development Goals (CBAS) and the Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences (CAS) and their collaborators investigated the ocean-ice-atmosphere interaction mechanism of the region. Their findings were published in the *National Science Review*.

The team developed an ice sheet surface snowmelt detection method based on machine learning and passive microwave remote sensing data as well as temperature observation data from automatic weather stations. They discovered the overall delay in the melting season of the Antarctic ice sheet in the past 40 years from 1978 to 2020.

They found that the Antarctic summer is not only "coming late" but also "ending late." Specifically, most Antarctic snowmelt regions have experienced delays in the onset and end of melt, wherein 67% of the snowmelt regions experience delays in onset, and 65% experience delays in termination. The accumulated delays in both melt onset and end dates over the 40-year observational period amount to 10%–15% of the whole summer melt period.

Moreover, the research team clarified the delay mechanisms of the melting season of the Antarctic ice sheet surface: in late spring and early summer in Antarctica, affected by the movement of the westerly jet to the poles, surface temperature near the poles dropped, delaying the start time of the Antarctic ice sheet melting. At the end of the Antarctic summer, due to the shrinking sea ice, heat released from the ocean to the atmosphere increased, resulting in a delay in the end of the ice sheet surface melting.

The researchers evaluated how the delayed melting season of the

Antarctic ice sheet surface impacted changes in surface net solar radiation and found that the melting season delay in snowmelt regions could change the annual surface net solar radiation by $-5\pm3\times10^{18}$ J/year (or -0.26 ± 0.14 W/m^2). Compared with the change of surface net solar radiation (-0.19 ± 0.31 W/m^2 per year) caused by the increase of sea ice, the delay of the melting season has more influence on the total change of radiation balance.

This study suggests that incorporating ice sheet surface melting processes into climate and ice sheet models will help improve predictions of regional climate change, ice sheet mass balance, and sea level rise.

More information: Lei Liang et al, Delayed Antarctic melt season reduces albedo feedback, *National Science Review* (2023). DOI: 10.1093/nsr/nwad157

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