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Extensive fires in southeastern Siberian permafrost linked to preceding Arctic Oscillation

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Terrestrial Arctic is a critical region for positive carbon-climate feedback because of the release of considerable organic carbon from the permafrost buried in the soil. Fires rapidly transfer carbon to the atmosphere. Thus, carbon release through boreal fires could considerably accelerate Arctic warming; however, boreal fire occurrence mechanisms and dynamics remain largely unknown. Here, we analyze fire activity and relevant large-scale atmospheric conditions over southeastern Siberia, which has the largest burned area fraction in the circumboreal and high-level carbon emissions due to high-density peatlands. It is found that the annual burned area increased when a positive Arctic Oscillation (AO) takes place in early months of the year, despite peak fire season occurring 1 to 2 months later. A local high-pressure system linked to the AO drives a high-temperature anomaly in late winter, causing premature snowmelt. This causes earlier ground surface exposure and drier ground in spring due to enhanced evaporation, promoting fire spreading. Recently, southeastern Siberia has experienced warming and snow retreat; therefore, southeastern Siberia requires appropriate fire management strategies to prevent massive carbon release and accelerated global warming.