Poleward upgliding Siberian atmospheric rivers over sea ice heat up Arctic upper air

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We carried out upper air measurements with radiosondes during the summer over the Arctic Ocean from an icebreaker moving poleward from an ice-free region, through the ice edge, and into a region of thick ice. Rapid warming of the Arctic is a significant environmental issue that occurs not only at the surface but also throughout the troposphere. In addition to the widely accepted mechanisms responsible for the increase of tropospheric warming during the summer over the Arctic, we showed a new potential contributing process to the increase, based on our direct observations and supporting numerical simulations and statistical analyses using a long-term reanalysis dataset. We refer to this new process as “Siberian Atmospheric Rivers (SARs)”. Poleward upglides of SARs over cold air domes overlying sea ice provide the upper atmosphere with extra heat via condensation of water vapour. This heating drives increased buoyancy and further strengthens the ascent and heating of the mid-troposphere. This process requires the combination of SARs and sea ice as a land-ocean-atmosphere system, the implication being that large-scale heat and moisture transport from the lower latitudes can remotely amplify the warming of the Arctic troposphere in the summer.

