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The influence of Arctic Amplification on mid-latitude summer circulation

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The accelerated global warming signal in the Arctic might have profound impacts on Jetstreams, storm tracks and/or planetary waves and thereby affect mid-latitude weather conditions. Possible processes in summer have generally received less scientific attention compared to winter, despite the potential for synergistic effects that might lead to high-impact extremes: In summer, thermodynamic and dynamic drivers of extreme weather could act in the same direction leading to tail risks, i.e. “very-extreme” extremes. Central arguments that support an AA influence on summer circulation include: (1) The mid-latitude equator-to-pole temperature gradient has seen a pronounced reduction in summer, but not in winter; (2) late-spring to early-summer snow cover extent, which influences summer flow regimes, has dramatically declined; and (3) summer circulation is less affected by tropical ENSO forcing, and thus potentially relatively more sensitive to Arctic changes. In this presentation, we review the scientific evidence behind three leading hypotheses considered to be important for summer: (1) Weakened storm tracks, (2) shifted jet streams, and (3) amplified quasi-stationary waves. We conclude that there is robust evidence for the first mechanism and that there are generally large uncertainties to do with the other two. Nevertheless, possible feedback interactions between amplification of planetary waves and land-atmosphere processes could lead to extremes in the far-tail of the distribution creating risks for society. We identify key knowledge gaps and make suggestions for future research.