



## Extreme Weather in Northern Mid-latitudes Linked to Arctic Ice and Snow Losses

Qiuhong Tang (1), Xuejun Zhang (1,2), and Jennifer A. Francis (3)

(1) Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China, (2) University of Chinese Academy of Sciences, Beijing, China, (3) Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, New Jersey, USA

The past decade has seen an exceptional number of unprecedented extreme weather events in northern mid-latitudes, along with record declines in both Arctic sea ice and snow cover on high-latitude land. The underlying mechanisms that link the shrinking cryosphere with the extreme weather in the mid-latitude continent, however, remain unclear. Previous studies have linked changes in winter atmospheric circulation, anomalously cold extremes and large snowfalls in mid-latitudes to rapid decline of Arctic sea ice in the preceding autumn. Using observational analyses, we show that the winter atmospheric circulation change and cold extremes are associated with winter sea ice reduction through an apparently distinct mechanism from those related to autumn sea ice loss. The associations between the increased summer extreme heat events in mid-latitudes and losses of snow and sea ice are also demonstrated using satellite observations of early summer snow cover and summer sea-ice extent. Although there is still much to learn about the interactions between a rapidly changing Arctic and large-scale circulation patterns, our results provide further evidence linking cryospheric loss with the mid-latitude extreme weather.