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INTENSIFIED LINKAGE BETWEEN ARCTIC CLIMATE CHANGE AND MIDLATITUDE EXTREME EVENTS: ROLE OF ATMOSPHERIC CIRCULATION AND STORM TRACK DYNAMICS

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Rapid climate change has occurred in the Arctic, which is representatively evidenced by a decade-long accelerating decline of sea ice and the extreme events of sea ice cover loss in summer 2007 and 2012. At the same time, drastic changes have also occurred in broader areas in the Northern Hemisphere or globally, including a spatial shift of the maximum surface air temperature warming trends from the Eurasian continent to the central Arctic Ocean, an enhancement of poleward oceanic and atmospheric heat transport from either the North Atlantic or North Pacific oceans into Arctic, and a widespread of extreme cold weather and snow storms from Eurasia to the U.S. East Coast. Many aspects of these changes are obviously beyond the scope of the conventional climate fluctuations, and also could not be solely accounted for by greenhouse-gas-emissions forcing. In this presentation, we synthesize our recent progresses of data analysis and model simulations towards improving understanding of the rapid changes in Arctic and the intensified linkage between the Arctic and the mid latitude climate. The specific results include how changes in the atmospheric circulation has accelerated declining of sea ice, enhanced poleward atmospheric heat and moisture transport, and circulated polar cold air to the mid latitudes, resulting in an amplified warming in the central Arctic Ocean and unexpected cooling over Eurasian mid latitudes. Our study also indicates that, embedded in the changed large-scale atmospheric circulation dynamic setting, regionally integrated synoptic-scale cyclone activity has weakened and anticyclone activity has enhanced, causing an increased occurrence of extreme cold winter weather events. Physical mechanisms responsible for the changes in the atmospheric circulation and storm track dynamics have also been investigated through dynamic diagnosis and modeling experiments. Our results provide skillful information for improving predictive capability and assessing future occurrence of Arctic rapid changes and extreme midlatitude events.