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Recent Radical Shifts of Atmospheric Circulations and Rapid Changes in Arctic Climate System

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Arctic climate system change has accelerated tremendously since the beginning of this century, and a strikingly extreme sea-ice loss occurred in summer 2007. However, the greenhouse-gas-emissions forcing has only increased gradually and the driving role in Arctic climate change of the positively-polarized Arctic/North Atlantic Oscillation (AO/NAO) trend has been substantially weakened. Although various contributing factors have been examined, the fundamental physical process, which orchestrates these contributors to drive the acceleration and the latest extreme event, remains unknown. We report on drastic, systematic spatial changes in atmospheric circulations, showing a sudden jump from the conventional tri-polar AO/NAO to an unprecedented dipolar leading pattern, following accelerated northeastward shifts of the AO/NAO centers of action. These shifts provide an accelerating impetus for the recent rapid Arctic climate system changes, perhaps shedding light on recent arguments about a tipping point of global-warming-forced climate change in the Arctic. The radical spatial shift is a precursor to the observed extreme change event, demonstrating skilful information for future prediction.