PAMIP Webinar Series

Atmospheric River Response to Arctic Sea Ice Loss in the Polar Amplification Model Intercomparison Project

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Abstract

Arctic Amplification (AA) and its associated sea ice loss have been hypothesized to influence mid-latitude weather extremes through modulation of the large-scale circulation. While previous studies have investigated the influences of AA on weather extremes, such as cold surge, snow cover change and blocking, how Atmospheric river, which is intense moisture transport in the atmosphere and is usually associated with extreme precipitation and wind events, responds to AA remains unknow. Using atmosphere-only simulations from the Polar Amplification Model Intercomparison Project (PAMIP), we investigated the boreal winter AR response to Arctic sea ice loss in the Northern hemisphere. Results show that mid-latitude AR responses are mostly governed by the changes in circulation. Poleward of about $60^{\circ}N$, the weakening of the westerlies and the increases in moisture exert opposite effects on the AR activities there, resulting in relatively small responses over the high-latitude regions. The response uncertainties due to either internal variability or model differences can be characterized by the leading uncertainty modes. We further found that the AR responses over both the North Pacific and North Atlantic can be described by their respective leading uncertainty modes: the AR responses over the North Pacific and North Atlantic project strongly onto the northeastward extension and equatorward shift modes, respectively. The relationship between AR response and how well models simulate AR climatology was also explored. AR response to Arctic sea ice loss seems to exhibit some mean state dependency, suggesting potential emergent constraints for reducing AR response uncertainties.