

Arctic Amplification and Arctic Oscillation

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Recent rapid Arctic warming is regarded as a research frontier in the study of global warming. Arctic amplification in the context of global warming has been a common feature in climate model predictions and in observational facts in 21st century. Arctic sea ice is melting drastically in 2007 and 2012, exceeding IPCC projections. Although ice-albedo feedback plays an important role in the Arctic amplification, it must be just an amplifier of certain warming processes in the Arctic. Enhanced northward heat transport by the atmosphere and ocean may be a response to the anthropogenic global warming. Long-term natural (internal) variability of the climate system may be another candidate of the Arctic amplification. It is difficult to quantitatively evaluate the internal variability from the long-term integration of climate models. When models are fully coupled with all climate subsystems such as ocean, cryosphere, and ecosystem, the internal variability is expected to become larger. Significant negative trend of Arctic Oscillation (AO) index in the recent years is a manifestation of the internal variability associated with the warming in the Arctic Ocean. North Atlantic warming and the increase in the Atlantic water temperature to the Arctic basin are responsible for melting of a significant portion of arctic sea ice. It may be important to realize that such an Arctic amplification is the most efficient cooling mechanism of the earth in response to the anthropogenic global warming. Moreover, the Arctic amplification results in the AO negative, causing warm Arctic and cold mid-latitudes to cool the entire earth system to decelerate the global warming. We need to aware the fact that the global warming is decelerated in conjunction with the enhanced Arctic amplification and AO negative trend in recent years.

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