

Data analysis of recent warming pattern in the Arctic

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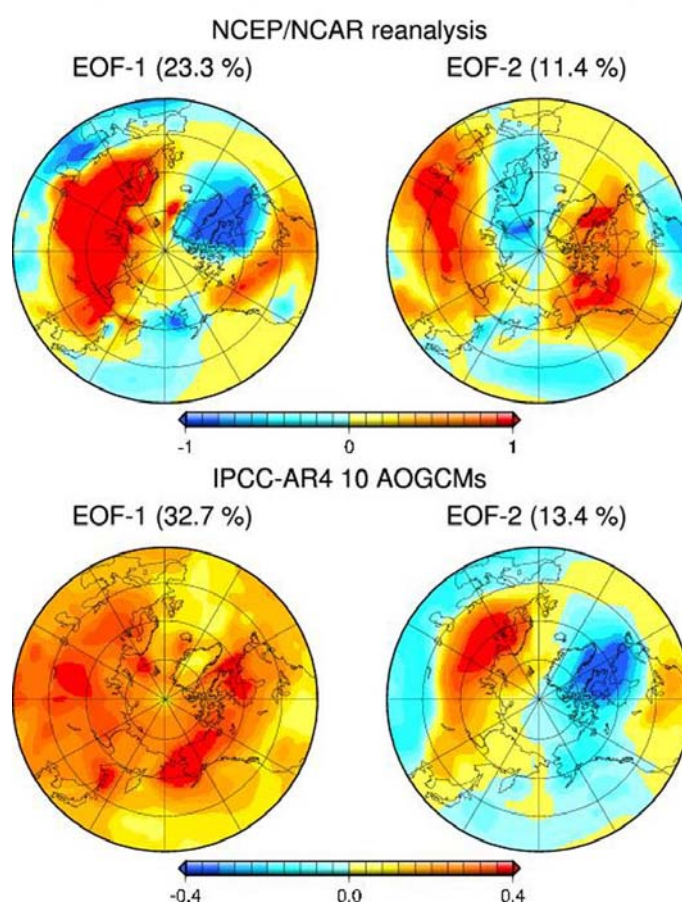
The climate change associated with the recent global warming is the most prominent in the Arctic and Subarctic. As the Arctic Oscillation (AO) known as the most dominant atmospheric phenomenon in the Northern Hemisphere showed high correlation with the surface air temperature (SAT) and sea ice pattern in the Arctic, the AO has attracted more attention as a crucial factor in explaining global warming. However, the increasing trend of the AO Index (AOI) since 1970 has stopped over the last two decades, and the AO began to deviate from the global warming trend.

In this study, we analyze the arctic climate change pattern in SAT and sea ice, and investigate its mechanism over the last two decades when the positive trend of the AOI has stopped. In addition, I confirm whether the speculated mechanism is simulated by Intergovernmental Panel on Climate Change Fourth Assessment models, and examine the contributions from the internal variability and the response to the external forcing in the arctic climate change.

As a result, we speculated the mechanism of arctic warming as following. The pattern of SAT and sea ice before 1989 are mostly determined by the AO in winter. In contrast, arctic warming pattern after 1989 is characterized as both of the AO pattern in winter and ice-albedo pattern in autumn. As the positive trend of the AOI and Pacific Decadal Oscillation index shift to negative since 1989, the Beaufort High has been intensified. The intensified Beaufort High in summer tends to transport more ice toward Greenland, reducing the sea ice concentrations over the Beaufort Sea in September. By means of the positive ice-albedo feedback, the SAT in autumn has increased prominently. The ice-albedo feedback pattern was not seen before 1989. The arctic warming before 1989 especially in winter was explained by the positive trend of the AOI, and also the intensified Beaufort High and the drastic decrease of the sea ice concentrations in September after 1989 were associated with the recent negative trend of the AOI.

It was suggested that time series of the AOI and the Beaufort High intensity vary without the

Eigenvector (1951–1999 winter SAT in K)



human effects such as the increasing greenhouse gases. Since the AO and the Beaufort High in the Arctic may be the stochastic natural variability in the atmospheric pressure field, the decreasing trend of sea ice in the Arctic may not be irreversible.

Keywords: Arctic Oscillation, Arctic warming, Beaufort High, Sea ice