



## **The Nature of the Arctic Oscillation: How Does Its Pacific Center Form?**

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The Arctic Oscillation(AO), described by the first empirical orthogonal function of the sea-level pressure anomalies, is the most important low-frequency variability which causes strong wintertime climate anomalies over the Arctic, North America, and northern Eurasian Continent, and has been studied extensively for the passing three decades. Nevertheless, the physical nature of the AO is still unclear and has been under debate. Based on daily data from NCEP/NCAR reanalysis for 1948/1949-2015/2016 winters (November through March), this study aims to examine the nature of the AO and its associated weather/climate anomalies. It is shown that the AO events derived from the AO index do not consist of a family of events of similar structures, but consist basically of two types of events: the in-phase and out-of-phase events. The two types of AO events have a similar seesaw structure over the Arctic-Atlantic sector, but their Pacific centers are of opposite signs. The structure of the AO pattern is a result of the competition between the types of events. It is also shown that only for the strong in-phase and out-of-phase events with the Pacific centers of amplitude larger than 1.0, their Pacific centers may be dynamically linked to the Arctic and Atlantic centers and play a crucial role in the formation of the Pacific center of the AO pattern though these strong events account for only a small percentage of the total days of the study period. Furthermore, this study demonstrates that the in-phase and out-of-phase events, particularly the strong in-phase and out-of-phase events, cause strong but different surface air temperature anomalies in the United States, Russian Far East and the neighboring Arctic region, and the East Asia. This fact should be taken into consideration when making the prediction of the AO-associated weather/climate anomalies.