# Mechanisms for Maintaining Basin-Scale Atmospheric Response to Decadal Variability of the North Pacific Oceanic Frontal Zone

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Through the following two ensemble experiments with an atmospheric general circulation model (AGCM), mechanisms for the maintenance of a large-scale wintertime atmospheric response to warm sea surface temperature (SST) anomalies associated with decadal-scale poleward displacement of the North Pacific subarctic frontal zone (SAFZ) has been investigated. The ensemble experiments are as follows: one with climatological-mean SST and the other with positive SST anomalies along the SAFZ prescribed on top of the climatological-mean SST.
As actually observed, the simulated January ensemble response over the North Pacific is anticyclonic throughout the depth of the troposphere, although its amplitude is smaller. This response is maintained through energy conversion from the ensemble climatological-mean circulation realized under the climatological SST as well as feedback from anomalous transient eddy activity, suggesting that the response may have a characteristic as a preferred mode of variability (or “dynamical mode”).
Conversions of both available potential energy and kinetic energy from the climatological-mean state are important for the observed anomaly, while the latter is less pronounced for the model response. Net transient feedback forcing is also important for both the observed anomaly and simulated response.
These results imply that moderate horizontal resolution (~1 degree) AGCM may be able to simulate a basin-scale atmospheric response to the SAFZ SST anomaly through synoptic and basin-scale dynamical processes. Weaker PNA-like internal variability in the model may lead to the weaker response, suggesting that misrepresentation of intrinsic atmospheric variability can affect the model response to the SST anomaly.

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