

An analysis on observed and simulated PNA associated atmospheric diabatic heating

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This study examines the PNA associated atmospheric diabatic heating by linearly isolating the influence of ENSO. The analysis is based on the NCEP-NCAR and ERA-40 reanalyses and a 1000-year long integration of the CCCma coupled climate model. Both the vertically integrated and three-dimensional diabatic heating are examined. The Rossby wave sources in association with the PNA are also diagnosed.

The PNA related heating is confined outside the tropics and is dominated by anomalies in the eastern Pacific, with a north-south dipole structure in mid-latitudes and the northern subtropics. The heating anomalies change sign with height in mid-latitudes but have the same sign throughout the troposphere in the northern subtropics. Relatively weak heating anomalies also appear in mid-latitudes, downstream of the heating dipole over North America and the western North Atlantic. The heating anomalies are largely supported by the advections related to the mean state throughout the troposphere, and partially damped by the advections related to the eddy effect, particularly at the upper troposphere over the North Pacific. Broadly similar patterns are seen from the NCEP-NCAR and ERA-40 reanalyses. Yet anomalous heating centers are generally located at relatively lower troposphere for the ERA-40 with respect to the NCEP-NCAR. The heating anomalies in the tropics are rather weak, remarkably different from those related to ENSO variability. In addition, the Rossby wave source collocates with the atmospheric diabatic forcing in the mid-high latitudes over the PNA sector, and shows no forcing source in the tropics. The results demonstrate possible forcing in the mid-high latitudes, regardless of tropical heating for the PNA teleconnection. The modeled heating and wave forcing anomalies in association with the modeled PNA compare reasonably well with the observations, increasing confidence in the observational results. The analysis provides further evidence of the independence of the PNA on ENSO from the diabatic heating point of view.