



A nonlinear link between the tropical Pacific precipitation and the two dominant patterns of extratropical variability

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A convective index (CI) for the tropical Pacific is constructed using the NCEP/NCAR global reanalyses for 51 boreal winters (1948 – 1999). The index is found to match well a similar index based on the U.S. Climate Prediction Center merged analysis of precipitation (CMAP) for the period 1979 – 1999. Composites of the Northern Hemisphere circulation for the extreme positive and extreme negative CI winters take the form of the positive Pacific North American (PNA) pattern and the positive North Atlantic Oscillation (NAO), respectively. The relationship between the convective index CI and the extratropical NH circulation is thus seen to be highly nonlinear.

The same analysis is applied to a 201-year climate simulation performed with a coupled general circulation model. Results consistent with the NCEP/NCAR reanalyses are obtained. The tropical precipitation anomalies in the simulation are of similar magnitude, but smaller in horizontal extent. The associated NH circulation anomalies are also weaker than those of the reanalyses, but consistent in that the most intense positive CI boreal winters are associated with a PNA, whereas the most intense negative CI winters are associated with a positive NAO.

On the basis of a previous study, it is speculated that the asymmetric response of the extratropical NH atmosphere to the tropical thermal forcing results from the sensitivity of the atmospheric response to the change in the atmospheric basic state.