

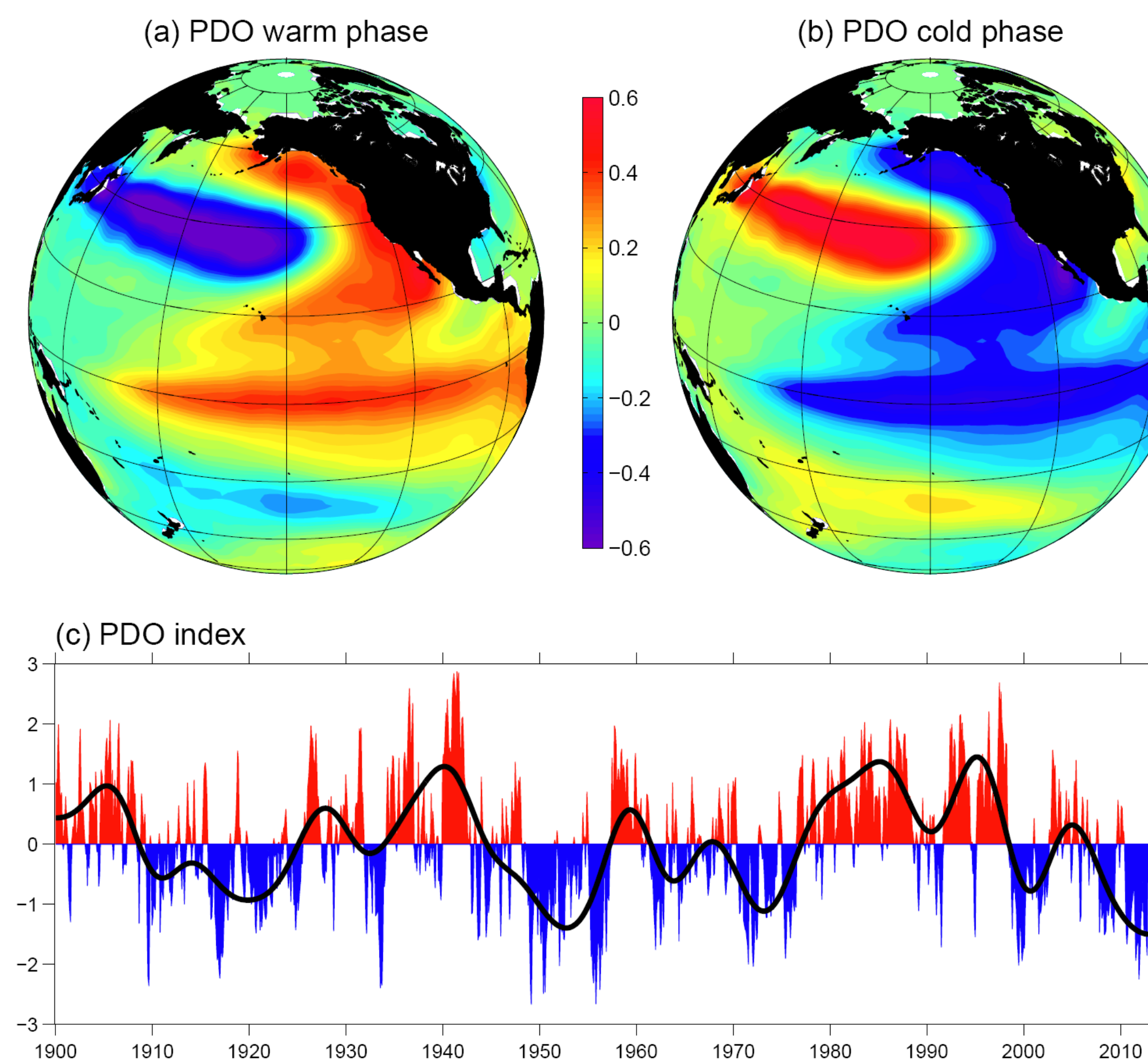
The Pacific Decadal Oscillation and North American Hydroclimate

Liping Zhang¹ and Thomas L. Delworth²

¹ Atmospheric and Oceanic Science, Princeton University, ² NOAA/Geophysical Fluid Dynamics Laboratory, Princeton, New Jersey

1. What is the Pacific Decadal Oscillation (PDO) ?

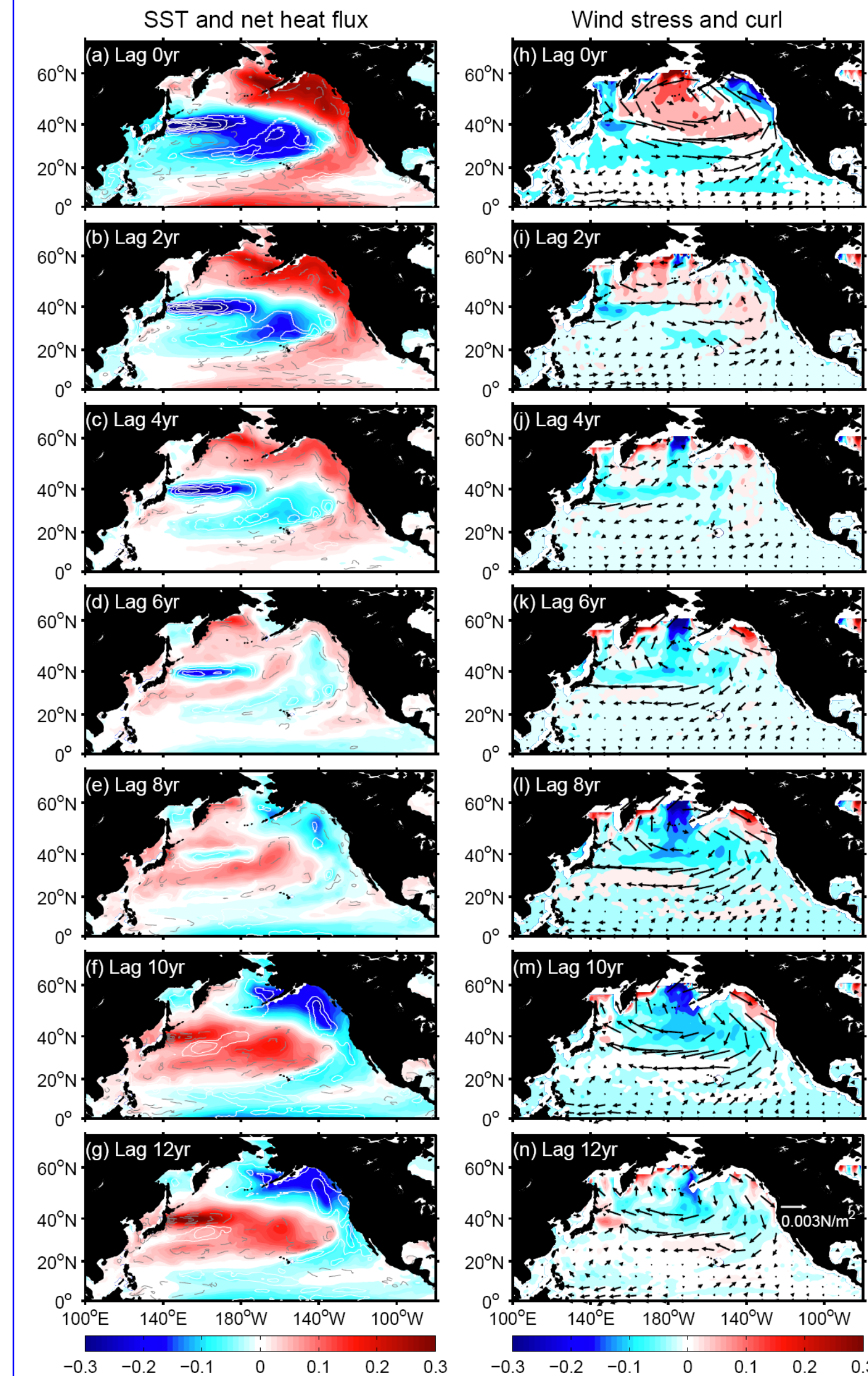
Significant low-frequency variability of sea surface temperature (SST) anomalies at decadal and longer time scales has been observed in the North Pacific and has been termed the “Pacific decadal oscillation” (PDO) (e.g. Mantua et al. 1997). SST anomalies associated with the PDO exhibit a basin wide horseshoe-like spatial pattern, with one sign in the central and western North Pacific surrounded by the opposite sign along the west coast of North America.



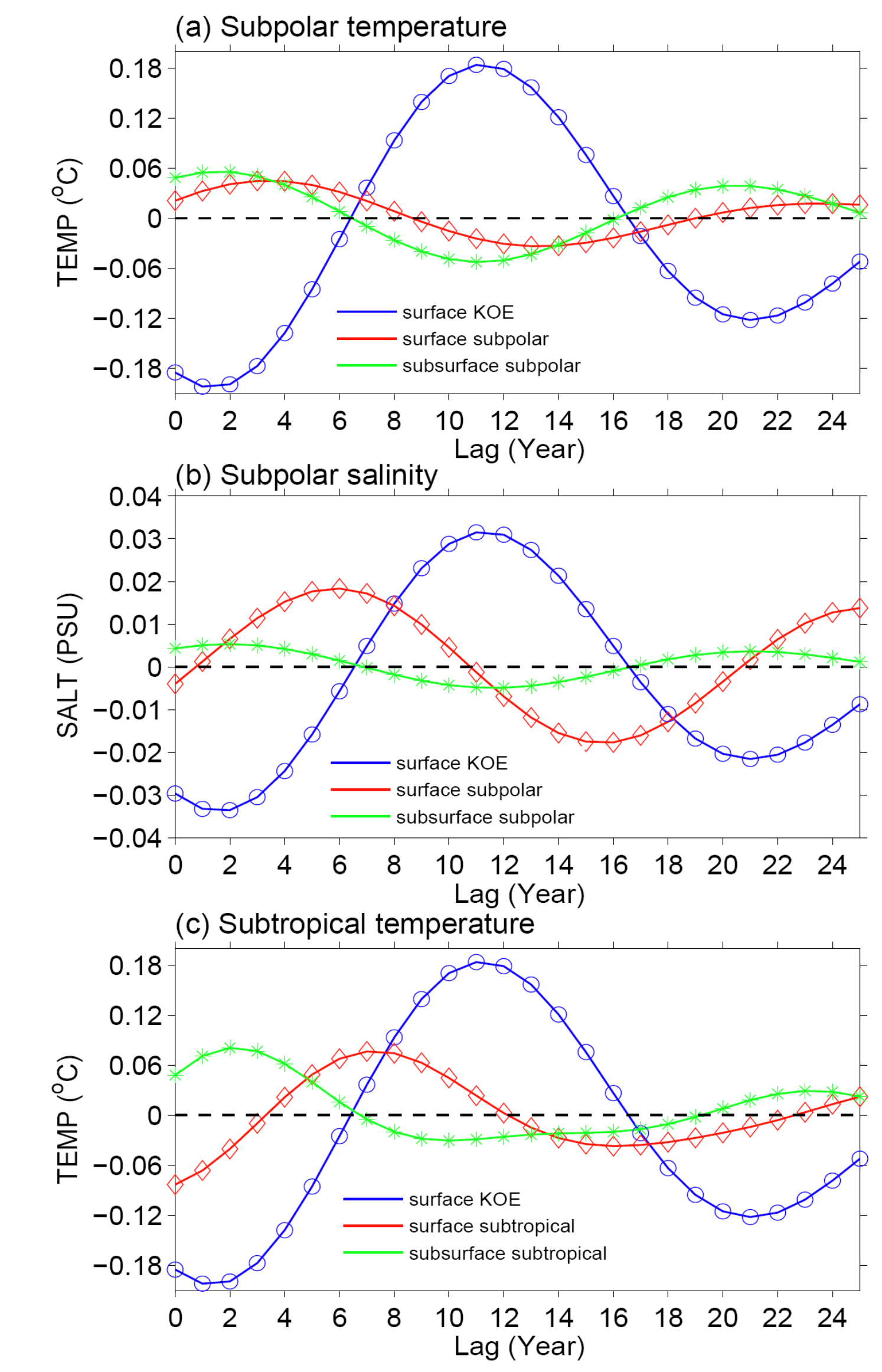
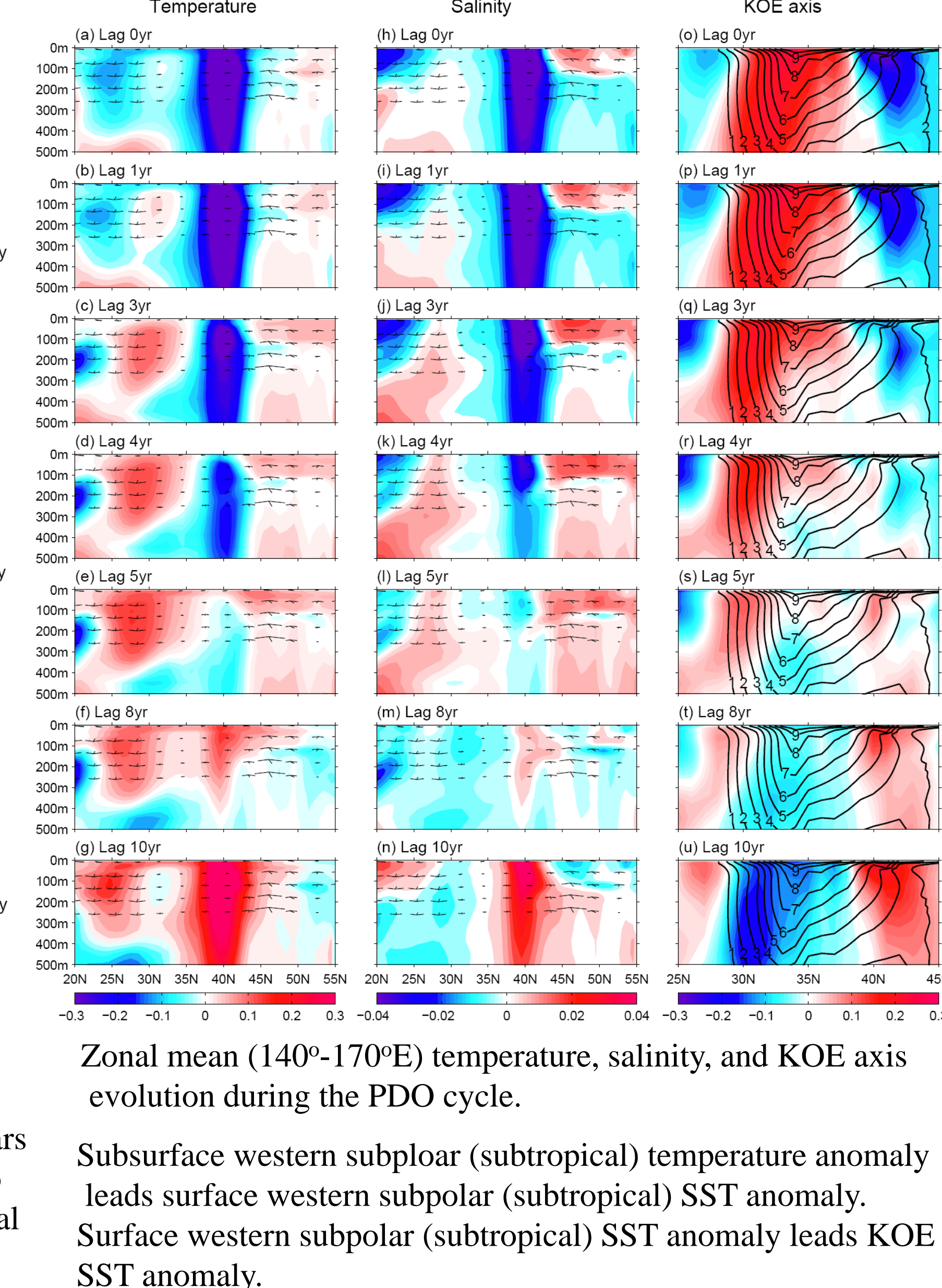
The maximum SST anomalies associated with the PDO are found in the central North Pacific and weaker secondary maximum is located along the Kuroshio Oyashio Extension (KOE).

The PDO index has two most energetic periods, one from 15-to-25 years, and the other from 50-to-70 years (e.g. Minobe 1997).

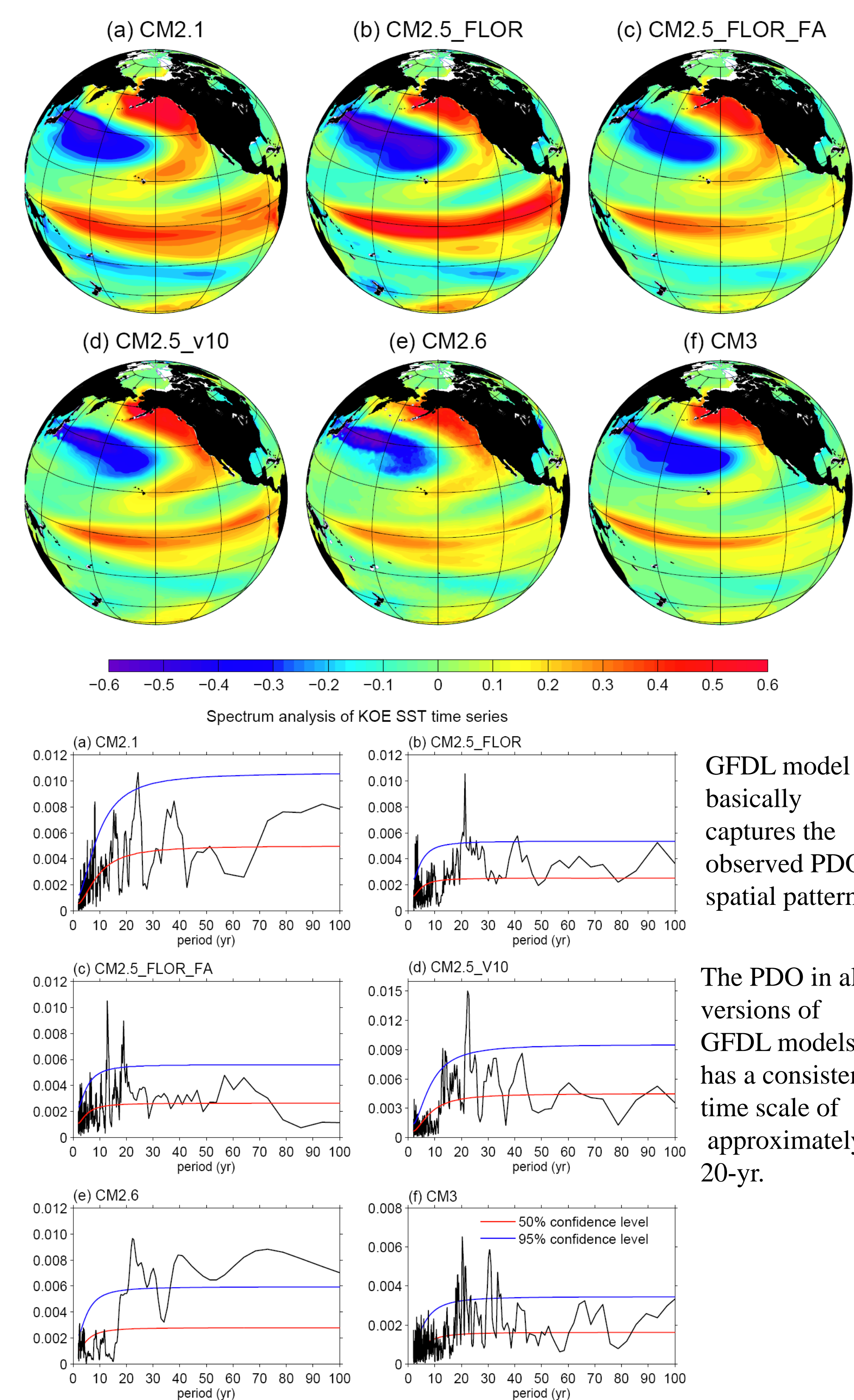
3. Life cycle of PDO (CM2.5_FLOR as an example)



Heat budget analysis of PDO horseshoe SST pattern. SST, net heat flux (positive downward), surface wind and wind stress curl evolution during the PDO cycle. Warm SST in the subpolar (subtropical) region appears to be advected southward (northward) by the Oyashio (Kuroshio), leading to a phase flip of PDO. The central Pacific SST anomaly leads KOE SST anomaly.



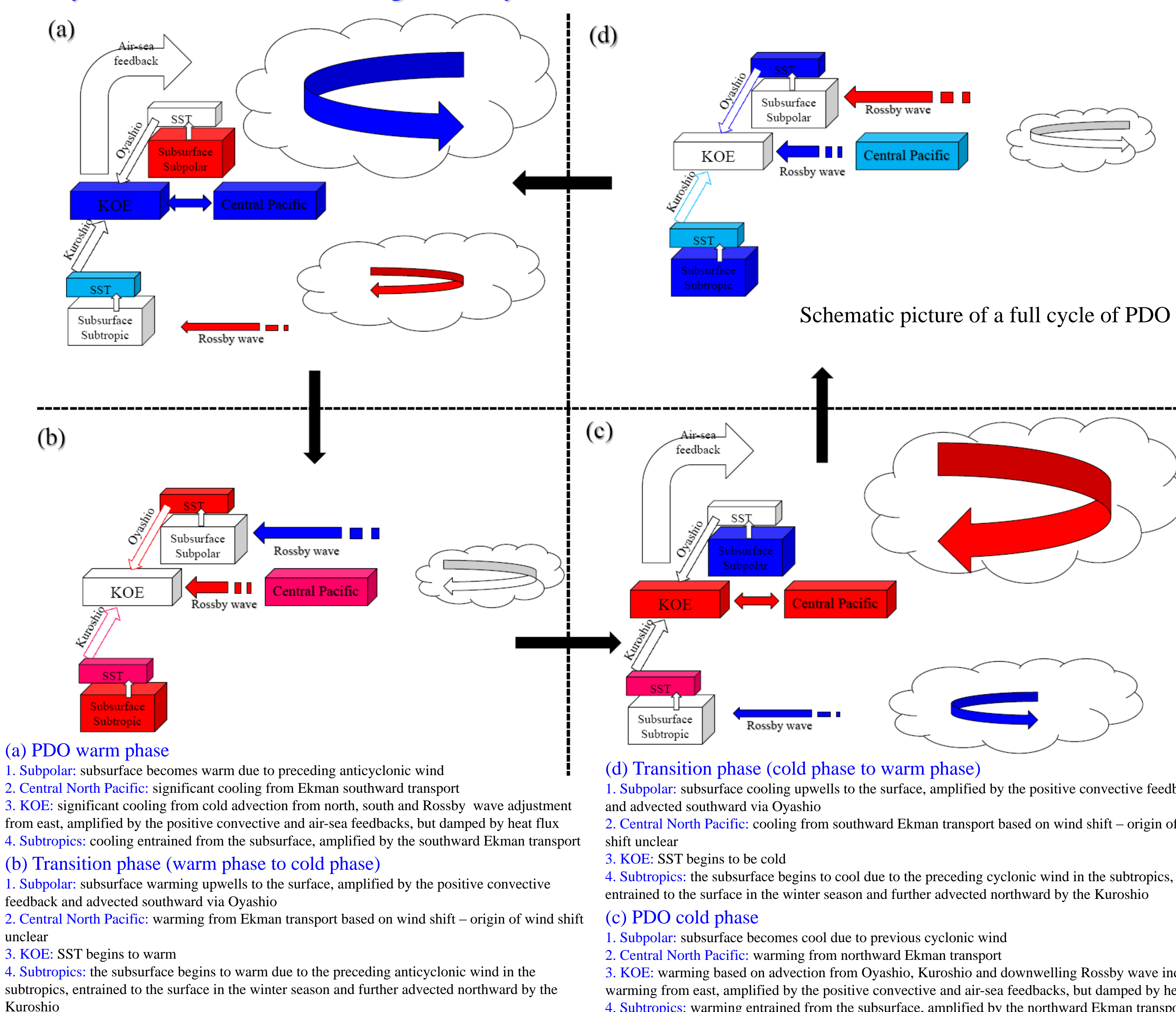
2. The PDO in GFDL models



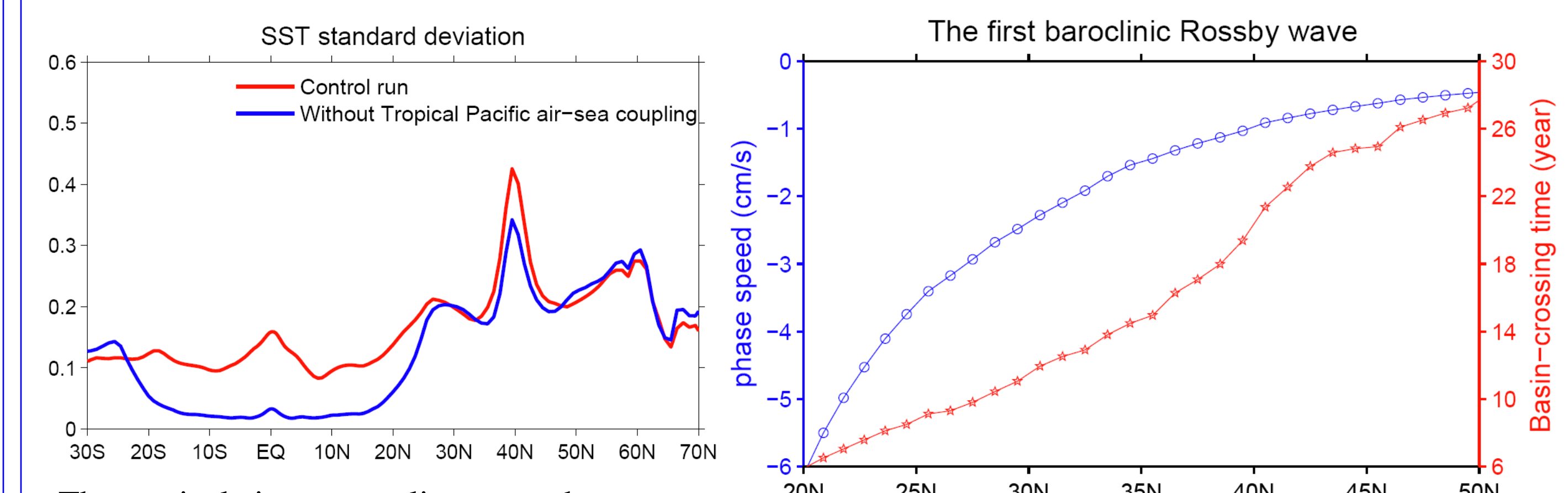
GFDL model basically captures the observed PDO spatial pattern.

The PDO in all versions of GFDL models has a consistent time scale of approximately 20-yr.

4. Physical mechanisms controlling the life cycle of PDO

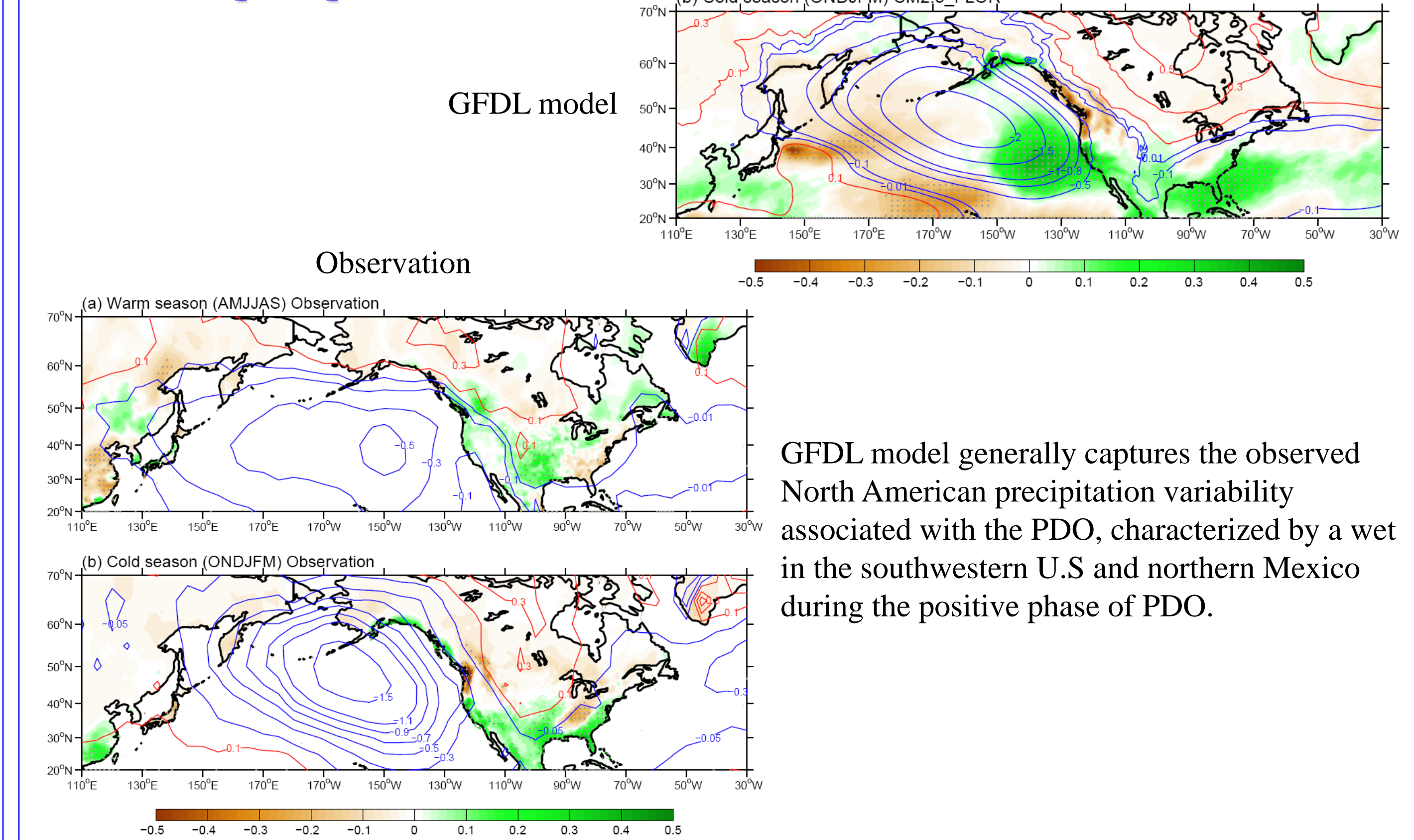


5. The role of tropical Pacific air-sea coupling and the PDO decadal time scale selection



The tropical air-sea coupling can enhance the PDO amplitude, but it is not the primary contributor.

6. The PDO impact on North American precipitation



GFDL model generally captures the observed North American precipitation variability associated with the PDO, characterized by a wet in the southwestern U.S and northern Mexico during the positive phase of PDO.