

Modification of Extratropical Natural Variability Associated with El Nino/Southern Oscillation

**Wilbur Y. Chen
Climate Prediction Center
NCEP/NWS/NOAA
Washington D.C. 20233**

Abstract

The NCEP/NCAR reanalysis data are examined for the characteristics of high- and low-frequency variability (HFV, LFV) that are embedded in the seasonal time mean flows (TMFs) associated with El Nino and La Nina winters. A large difference in the impact of the tropical anomalies on the internal dynamic variability of the extratropical atmosphere is found. A variety of diagnostics is performed to help reveal the dynamical processes leading to the large difference. In addition to the reanalysis data, three sets of 10-year long perpetual January runs integrated with the NCEP's global spectral model are also investigated. Similar behaviors are observed for the real atmospheric and the model data.

Large blocking flows and deep trough flows develop twice as much over the North Pacific during La Nina than El Nino winters. Consequently, the low frequency variability (LFV), with time-scales between 7-61 days examined here, and which is mainly internal dynamics associated, displays distinct characteristics: much larger magnitude for the La Nina than the El Nino winters over the eastern north Pacific, where the LFV is largest over the globe.

Diagnostics of the localized Eliassen-Palm fluxes and their divergence reveals that the high-frequency transient eddies (1-7 days), being diverted more northeastwards into a more diffluent background flows during La Nina winters, are much more effective in forming and maintaining the blocking flows, while those southward and much eastward diverted high-frequency transients, into less diffluent ambient flows during El Nino winters, are less effective. This difference results in much more blocking flows over the central North Pacific during La Nina than El Nino winters.

In addition to the above dynamical process operating on the high-frequency end of all fluctuations, the local barotropic energy conversion between the LFV components and the time-mean flows is also operating and playing a crucial role. The kinetic energy conversion represented by the scalar product between the E-vector of the low frequency components and the deformation D-vector of the time-mean flow reveals that, on average, the low frequency components extract energy from the time-mean flow during La Nina winters while deposit their energy to the time-mean flow during El Nino winters. This local barotropic energy conversion on the low-frequency end, together with forcing of the high-frequency transients on blocking flows on the high-frequency end, combine in explaining why there is a large difference in the magnitude of the low frequency variability between La Nina and El Nino winters. With much larger (smaller) magnitude of climate noise, and an indication of weaker (stronger) ENSO signal, we expect lower (higher) tropical boundary condition dependent potential predictability for the La Nina (El Nino) winters.