Li-Ciao Hong

Super El Niño

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Supervisor's Foreword

In her thesis, Hong recognized the distinctness of "super El Niños" although only three episodes of "super El Niño" (1972/1973, 1982/1983, 1997/1998) have been observed during the instrumental era. Hong identified features which are universal among super El Niños but rarely seen in a conventional El Niño. Hong showed these features are statistically significant.

Two preconditions were identified by Hong as the deciding factors to breed the super El Niño. Eighteen months before the super El Niño peak, the Walker cell starts to intensify thus stashing positive heat content anomalies in the extra-equatorial western Pacific. Such intensified Walker cell appears to be in defiance of ENSO condition, whereas the ENSO source region only presents a neutral/weak La Niña phase. In the subsequent winter, a Meridional Mode developed in the Northern Hemisphere which emerges at a position much equatorward than the usual pre-Niño southern lobe. As winter advances, the Hawaii low sprawls via the mutual enhancement of the wind–evaporation–SST (WES) feedback and the Sverdrup balance, leading to a broad area of low-level westerly wind anomalies. The wind anomalies further induce eastward current anomalies along the northern flank of the equator. The SST anomalies within a key box N-CEP (0–7.5°N, 155°E–170°W) change phase from cold to warm and set up the stage that once the N-CEP deep convection is flared up in spring, vigorous interaction between ENSO and the mid-latitude circulation in the Southern Hemisphere takes place, as Hong described.

Upon the eastern Australian coast, the seasonal modulation of local westerly jet provides a viable Rossby wave source. It further facilitates the self-intensification of a transverse circulation between the N-CEP convection and a high-pressure anomaly near the South Australia. This loop particularly adapts at driving the cross-equatorial flow near New Guinea that accounts for the unusual growth of a super El Niño. Called as the "Southern Hemisphere Booster" (SHB, Hong et al.

2014 GRL), this mechanism enlarges the Bjerknes instability framework with important implication that the super El Niño owes its strength to the aggressive intervention from mid/high latitude in both Hemispheres.

Dr. Hong has keen eyes and light speed efficiency. The casting of super El Niño should shed new light on future global warming related topic.

Taipei, Taiwan   Prof. LinHo
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