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The Role of Extratropical Air Systems in the ENSO Cycle

Yafei Wang
Chinese academy of meteorological sciences, China (yfwang@cma.gov.cn)

It is known that the current conceptual El Niño and Sothern Oscillation (ENSO) models have some deficiencies that resulted in failure for ENSO forecasting. Furthermore, the current ENSO theories mainly focus on discussing the evolution of the ENSO related elements within tropical regions since the fluctuations of them (e.g., sea surface temperature) are obviously larger than in other regions during the period. However, a fact that cannot be ignored is that the oceanic/atmospheric heat exchange between higher and lower latitudes exists forever. Thus, the impact from non-tropical regions on ENSO should be taken into account as well. This article conducted statistical analyses on the formation of ENSO from several angles by using conventional data. The results revealed that both El Niño and La Niña are closely associated with the preliminary activity of some extratropical air systems (EAS) if bringing an assumption of the influence of annual cycle on ENSO cycle into our calculations. We found that the strengthening or weakening of the EAS could act as a more original force for driving the ENSO cycle than the elements in tropics. The phase lock of the ENSO cycle might be explained by this clue. In addition, the indices produced by the EAS were successful in ENSO forecast in a very early ENSO developing stage. After discussing the obtained results in many ways, we proposed a plausible mechanism for the ENSO formation based on the results and conducted a targeted discussion on this new mechanism that could explain the problems the current conceptual ENSO models left.