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The Role of Arctic Oscillation Phases in Modulating El Niño

Dynamics: A Comparative Analysis

Abstract

The westerly wind anomalies play the important role in triggering the occurrence and development of El Niño-Southern Oscillation (ENSO). Previous studies have illustrated that the March and April averaged (spring) Arctic Oscillation (AO) can affect the formation of El Niño by inducing westerly wind anomalies over the tropical western Pacific. Besides, Chen et al. (2014) also illustrates El Niño events tend to follow high spring AO forcing, whereas low spring AO forcing tends to precede La Niña events. However, they also find that the occurrence ratio for La Niña following the low spring AO is only about 28%. This means El Niño could also follow low spring AO. Moreover, related research has rarely analyzed the mechanism from the perspective of ocean dynamics, such as RO. Therefore, this study aims to compare the impact of different spring AO phases (hereafter referred to as AO) on El Niño and examine the possible oceanic mechanism involved.

Both AO phases may delay El Niño onset due to slower accumulation of positive anomalies in the subsurface, compared to neutral AO, although negative AO phase would cause a longer delay than positive AO phase. Besides, the stronger and longer El Niño event would occur during positive AO phase compared to negative AO. During the positive AO, owing to the large accumulation of ocean heat content and mass in the subsurface, the La Niña-like pattern would be less likely to occur in the winter of the second year, despite the pronounced strong divergence of V_g . However, there is the occurrence of La Niña-like pattern in the following winter during the negative AO although the discharge process is weaker. This is due to stronger easterly wind anomalies that appear in the following winter.

Keywords

Recharge Oscillator (RO)