



## **Role of Stratospheric Sudden Warmings on the response to Central Pacific El Niño**

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The Northern Hemisphere polar stratospheric response to Central Pacific El Niño (CP El Niño) remains unclear. Contradictory results have been found on its resemblance with the canonical East Pacific El Niño (EP El Niño), depending on the index used to characterize these events or the number of cases. Some studies found a stronger and colder polar vortex while others displayed a weaker and warmer polar stratosphere.

Our results, based on reanalysis data, show that Stratospheric Sudden Warmings (SSWs) occurrence dominates the CP El Niño response in the Northern Hemisphere. A robust CP El Niño signal is observed when the events are classified according to the presence or absence of SSWs. CP El Niño winters without SSWs show significant cold anomalies in the Northern Hemisphere polar stratosphere in early winter. In contrast, CP El Niño winters with SSWs are associated with significant warm anomalies, which are in fact related to SSWs. Therefore, the polar stratospheric response to CP El Niño events is significant and opposite during winters with and without SSWs.

In addition, and contrary to previous studies, CP and EP El Niño polar stratospheric responses are clearly distinguishable in early winter in the absence of SSWs. The analysis of the Pacific-North American (PNA) pattern and the tropospheric wave anomalies entering the stratosphere support the observed stratospheric signals. In the absence of SSWs, EP El Niño winters are characterized by a strengthened PNA pattern and enhanced propagation of planetary wave number 1 into the stratosphere, while during CP El Niño winters a weakened PNA pattern is resembled, related to inhibited upward wave propagation. This is consistent with a weaker polar vortex in EP El Niño winters and a stronger vortex in CP El Niño winters.

Results are robust regardless of the CP El Niño definition or the size of the composite used. Similar conclusions are reached in CMIP5 historical simulations. Hence, our study reveals that the SSW occurrence needs to be taken into account when studying the CP El Niño stratospheric response and explain why different responses to CP El Niño were previously reported.