

Possible impact of tropical El Niño Modoki on SST of China's offshore and its adjacent waters



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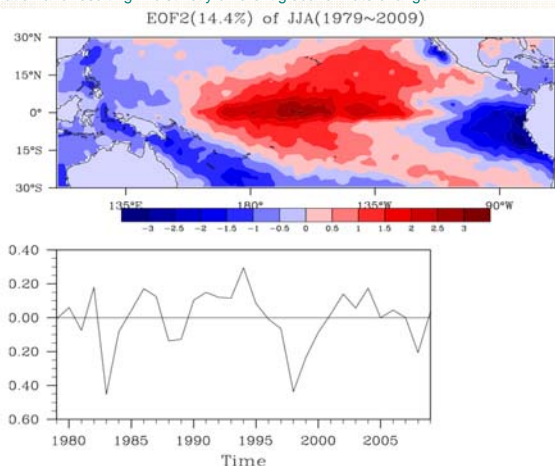
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Abstract

El Niño Modoki, a new type of tropical Pacific phenomenon, which is similar but different from the canonical El Niño, has been observed since the late 1970s, followed by its unique influence on global climate. In this paper, relationships between SST during the four seasons in the offshore area of China and its adjacent waters and El Niño Modoki have been comparatively analyzed based on the HadISST dataset and NCEP/NCAR wind data, respectively. The results indicate that (1) a significant negative correlation is found between El Niño Modoki in summer and SST in the offshore area of China and its adjacent waters in autumn, with the significant regions located east of the Kuroshio and (2) during the El Niño Modoki period, anomalous northerlies prevail over the northern part of the Philippines to the offshore area of China. It is therefore suggested that the northerlies are unfavorable for the transport of warm water from the western tropical Pacific to the mid-latitude area. Consequently, El Niño Modoki in summer may contribute to cold SSTs in the offshore area of China and its adjacent waters in autumn by the Kuroshio, with a lag response of the ocean to the atmospheric wind field.

Essential Characteristic of El Niño Modoki

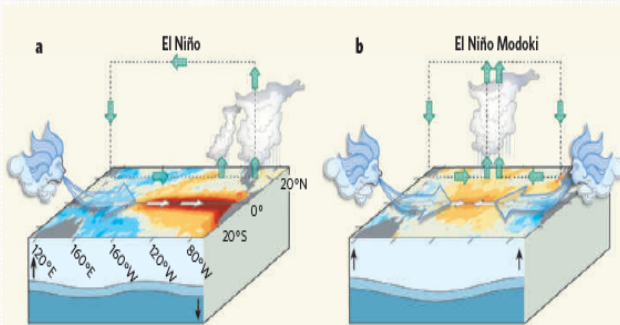
The warmest SSTs occur in the central equatorial Pacific, flanked by colder waters to the east and west, from the boreal summer through to the winter, modifying the atmospheric circulation and resulting in distinctly different global climate change.



The Second EOF Mode of Tropic Pacific JJA SSTA (1979-2009)

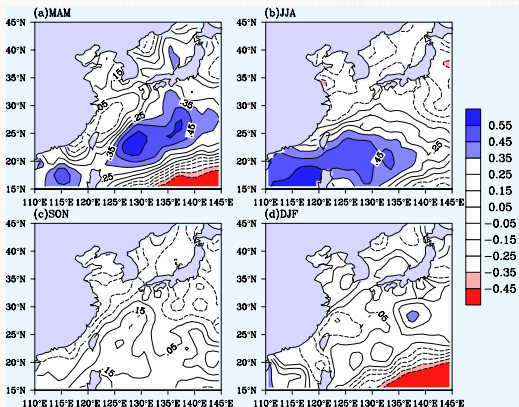
Anomalous Atmospheric Circulation Conditions in tropical Pacific

Compared to the canonical El Niño, the double Walker circulations maybe the most distinct characteristic during an El Niño Modoki event, with the anomalous atmospheric convection over the central equatorial Pacific.



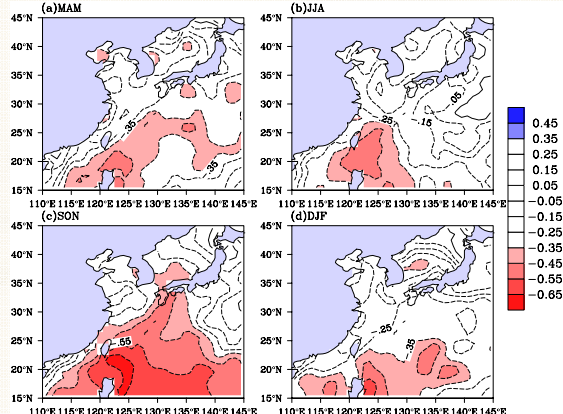
Anomalous conditions in the tropical Pacific during El Niño (a) and El Niño Modoki (b) (Ashok and Yamagata, 2009)

Relationship between El Niño in boreal winter and SSTs during the following four seasons of China's offshore, respectively.



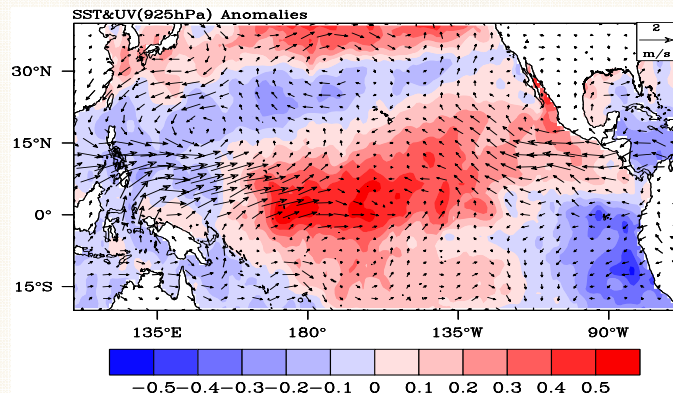
Relationship distribution between El Niño in boreal winter and SST of China's offshore during the following Spring (a), Summer (b), Autumn (c) and Winter (d), respectively.

Relationship between El Niño Modoki in boreal summer and SSTs of China's offshore during the four seasons in the same year.



Relationship distribution between El Niño Modoki and SSTs of China's offshore in the foregoing Spring (a), contemporaneous Summer (b), the following Autumn (c) and Winter (d), respectively.

Possible Causes for Influence of El Niño Modoki on SST of China's offshore



Composited mean summer (JJA) winds at 925hPa (arrows) and SSTA (color shading) in the Tropic Pacific

When El Niño Modoki event occurs, upwelling of cold waters appears in the western tropical Pacific as the warm waters flow to the central equatorial Pacific, resulting in the weakened polar heat transport of the Kuroshio. Meanwhile, anomalous northerlies prevailing over the offshore area of China, are also unfavorable for the transport of warm water from the western tropical Pacific to the mid-latitude area. Consequently, El Niño Modoki in summer may contribute to cold SSTs in the offshore area of China and its adjacent waters in autumn by the Kuroshio, with a lag response of the ocean to the atmospheric wind field.

Conclusion

A significant negative correlation is found between El Niño Modoki in summer and SST in the offshore area of China and its adjacent waters in autumn, with the significant regions located east of the Kuroshio. Anomalous northerlies prevail over the northern part of the Philippines to the offshore area of China during the El Niño Modoki period. It is therefore suggested that the northerlies are unfavorable for the transport of warm water from the western tropical Pacific to the mid-latitude area. Consequently, El Niño Modoki in summer may contribute to cold SSTs in the offshore area of China and its adjacent waters in autumn by the Kuroshio, with a lag response of the ocean to the atmospheric wind field.

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