

## Influence of the IOD on the relationship between El Nino Modoki and the East Asian-western North Pacific summer climate

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The relationship between El Nino Modoki and the East Asian-western North Pacific summer monsoon (EA-WNPSM) has been revealed to be under the influence of Indian Ocean Dipole (IOD). When a pure El Nino Modoki occurs without a positive IOD, a strong EA-WNPSM is observed with a significant anomalous low-level cyclone over the western North Pacific (WNP), excessive rainfall there and deficient Meiyu-Baiu rainfall. In contrast, when an El Nino Modoki happens simultaneously with a positive IOD, the anomalous EA-WNPSM tends to be much weaker. This difference is attributed to a positive IOD effect. The results demonstrate that a positive IOD usually leads to a strong South Asian summer monsoon heating, which further causes easterly anomalies in the western Pacific. These anomalous easterlies tend to strengthen the WNP anticyclonic vorticity leading to a weak EA-WNPSM. Therefore, a positive IOD weakens the relationship between the El Nino Modoki and the EA-WNPSM. In addition, numerical experiments verified that the strong low-level WNP cyclonic anomaly is built through the off-equatorial heating associated with the local cyclonic circulation. The anomalous WNP anticyclonic vorticity induced by a positive IOD weakens this off-equatorial heating, thus leading to a weak EA-WNPSM.