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Seasonal Diversity of Indo-Pacific Warm Pool Volume Expansion: The Role of Climatological Subsurface Temperature Patterns

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The Indo-Pacific warm pool (IPWP) expansion under global warming has huge impacts on global climate. While recent studies have revealed the seasonal diversity of IPWP surface expansion and its impacts under greenhouse warming, understanding the changes in seasonality of the IPWP volume is of greater importance, especially given the crucial role of subsurface ocean temperature in climate systems. This poster presents the seasonal diversity of Indo-Pacific warm pool volume expansion.

In this study, we find a significant difference of IPWP volume expansion rate across seasons from 1950–2020, although the oceanic warming is rather seasonally uniform. The expansions of IPWP volume during boreal autumn and winter are faster compared to boreal spring and summer. This consequently weakens the seasonality of IPWP volume, particularly in the upper-layer, with a significant decreasing trend of $-0.54 \times 10^7 \text{ km}^3/\text{decade}$. Further analyses suggest that this seasonal diversity in IPWP volume expansion is primarily caused by the seasonality of capacity for IPWP volume change, which is determined by the seasonal climatological subsurface temperature pattern over the Indo-Pacific Ocean. Furthermore, these variations may exert varied impacts on the troposphere and East Africa precipitation in rainy seasons. Namely that the larger expansion of IPWP in short rains is more closely related to the enhanced ascending motion and increased precipitation over East Africa, comparing with the long rains. This study emphasizes the crucial impacts of climatic subsurface Indo-Pacific Ocean temperature properties on the change of IPWP volume seasonality, which may have crucial effects on the precipitation in East Africa rainy seasons, and may hold important clues about how greenhouse warming affect oceanic seasonal cycle.