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Why is there an abrupt northward jump of the warmest SST axis in the monsoon region

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The sub-seasonal variability of SST during pre-monsoon season in Asian and Northwest Pacific monsoon regions is characterized by the unique abrupt northward jump of the warmest SST axis (WSSTA) from the equator to the north of 10°N. The abrupt northward jump of WSSTA is contributed to the monsoon onset. The possible mechanisms for the abrupt northward jump of the WSSTA are examined, utilizing GODAS, OAFlux and NCEP reanalysis data.

During pre-monsoon season, the WSSTA is almost around the equator, and there are subtropical highs (SH) in the Asian and Northwest Pacific monsoon regions. There are weak wind speeds, positive vorticity and less cloud cover around the ridgeline of SH, associated with shallow ocean mixed layer depth, more downward short wave radiation flux and weak evaporation at sea surface and weak cold water upwelling in base of mixed layer. Therefore, the location of SH ridgeline is a favorable place for the warmest SST. Prior to the monsoon onset, the maxima of solar radiation at the top of atmosphere move northward to the Northern Hemisphere, and the winter monsoon become weaker. These conditions lead to rapid increase of downward shortwave radiation flux, and decrease of evaporation and mixed layer depth, resulted in the occurrence of the warmest SST around the SH ridgeline, accompanied with abrupt northward jump of the WSSTA. The timing of the abrupt northward jump of WSSTA is corresponded with orientation and latitude of the SH ridgeline and intensity of the winter monsoon, which are determined by the land ocean distribution in different scales.