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Impact of the Indo-Pacific Warm Pool on the Tropical Circulations and Changes in Saturation Threshold SST

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The Indo-Pacific warm pool (IPWP) is enclosed by a 28 °C isotherm and plays a vital role in controlling tropical circulations. However, the effects of changes in regional warm pool sea surface temperatures (SSTs) on the circulations remain unexplored. To do this, we divided the IPWP into the Indian and Pacific sectors and distinguished their responses to natural variability and global warming. And then, we examined the impacts of the interannual variability (IAV) in warm pool SST on the tropical Hadley, Walker, and monsoon circulations. The Hadley circulation was affected by warm pool SST warming, i.e., warmer SSTs over the warm pool strengthened the upward branch of Hadley circulation, whereas the downward branch was weakened and strengthened in the Northern and Southern Hemispheres. Walker circulation was strengthened (weakened) in the warming (natural) mode. Consequently, the Walker circulation is weakened since the natural variability of warm pool SST plays a more dominant role than the warming trend of SSTs over the warm pool. It is notable that warm pool warming has little impact on monsoon circulation. Our findings highlight the different roles of the IAV of warm pool regions in each tropical circulation as part of the warming trend and natural variability. Furthermore, an increase in precipitation is limited up to a specific SST, although SST becomes warmer. We defined this specific SST as Saturation Threshold SST (STT). Under a warming climate, future changes in STT over the IPWP and its mechanism will be shortly shown in this presentation.