

Effect of El Niño on the response ratio of Hadley circulation to different SST meridional structures

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The role of El Niño in influencing the response ratio of the Hadley circulation (HC) to different tropical sea surface temperature (SST) meridional structures is investigated over the period 1979–2016. The explained variance of the equatorially asymmetric principal mode of HC variability is enhanced during El Niño events that are characterized by equatorially symmetric El Niño SST anomalies. The reason for the enhanced explained variance is examined. It is shown that the response ratio of the HC to different SST meridional structures is greatly enhanced in El Niño events; this is because the SST over the Indo-Pacific warm pool (IPWP) shows inhomogeneous warming in El Niño events, with greater values in the southern IPWP. The asymmetric warming over the IPWP is opposite to the climatological meridional structure of the SST over the IPWP, which intensifies the equatorially symmetric variation of SST, and contributes to the enhanced response ratio of the HC to SST. This point is further verified by the suppression of this enhanced response ratio in El Niño events of the HC to SST when the effects of SST over the IPWP are removed, implying the different warming amplitude within the IPWP during the El Niño events contributes to the enhanced response ratio. The response in La Niña events is also explored, indicating a difference between El Niño and La Niña events. These results may help explain the corresponding variations of the HC during the El Niño events, and highlight the different influences of the El Niño and La Niña events on the response of the HC to SST.

Keywords: Hadley circulation, sea surface temperature, Indo-Pacific warm pool, El Niño

