

Potential regulation on the climatic effect of Tibetan Plateau heating by tropical air–sea coupling

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Based on the conventional weather research and forecasting (WRF) model and the air–sea coupled mode WRF-O MLM, we investigate the potential regulation on the climatic effect of Tibetan Plateau (TP) heating by the air–sea coupling over the tropical Indian Ocean and western Pacific. Results indicate that the TP heating significantly enhances the southwesterly monsoon circulation over the northern Indian Ocean and the South Asia subcontinent. The intensified southwesterly wind cools the sea surface mainly through the wind–evaporation–SST (sea surface temperature) feedback. Cold SST anomaly then weakens monsoon convective activity, especially that over the Bay of Bengal, and less water vapor is thus transported into the TP along its southern slope from the tropical oceans. As a result, summer precipitation decreases over the TP, which further weakens the TP local heat source. Finally, the changed TP heating continues to influence the summer monsoon precipitation and atmospheric circulation. To a certain extent, the air–sea coupling over the adjacent oceans may weaken the effect of TP heating on the mean climate in summer. It is also implied that considerations of air–sea interaction are necessary in future simulation studies of the TP heating effect.

Keywords: Air–sea coupling, Tibetan Plateau, Thermal forcing, Regional model