

Changing links between South Asian summer monsoon circulation and tropospheric land-sea thermal contrasts under a warming scenario

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Forced with increased greenhouse gases, the South Asian summer monsoon (SASM) circulation weakens in climate models, which appears inconsistent with the projected increases in near-surface land-sea thermal contrasts during the 21st century. Our analysis shows that the SASM intensity positively correlates with the land-sea thermal contrast in both the lower- and upper-troposphere before year 2000; thereafter a reduced upper-tropospheric thermal contrast leads to a weakened SASM circulation, despite an increasing lower-tropospheric thermal contrast. The decrease in the upper-tropospheric thermal contrast mainly results from enhanced upper-tropospheric warming over the tropical Indian Ocean due to increased latent heating. The results suggest a crucial role of enhanced tropical convection in the weakening of SASM circulation and a weak influence of lower-tropospheric thermal contrast on the SASM under global warming. They also imply a less important role of near-surface processes over the Tibetan Plateau in the long-term SASM change during the 21st century.