Quantitative identification of moisture sources over the Tibetan Plateau and the relationship between thermal forcing and moisture transport

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Despite the importance of the Tibetan Plateau (TP) to the surrounding water cycle, the moisture sources of the TP remain uncertain. In this study, the moisture sources of the TP are quantitatively identified based on a 33-year simulation with a horizontal resolution of 1.9°×2.5° using the Community Atmosphere Model version 5.1 (CAM5.1), in which atmospheric water tracer technology is incorporated. Results demonstrate that the major moisture sources differ over the southern TP (STP) and northern TP (NTP). During the winter, Africa, the TP, and India are the dominant source regions, contributing nearly half of the water vapour over the STP. During the summer, the tropical Indian Ocean (TIO) supplies 28.5±3.6 % of the water vapour over the STP and becomes the dominant source region. The dominant moisture source regions of the water vapour over the NTP are Africa (19.0±2.8 %) during the winter and the TP (25.8±2.4 %) during the summer. The overall relative contribution of each source region to the precipitation is similar to the contribution to the water vapour over the TP. Like most models, CAM5.1 generally overestimates the precipitation over the TP, yielding uncertainty in the absolute contributions to the precipitation. Composite analyses exhibit significant variations in the TIO-supplied moisture transport and precipitation over the STP during the summer alongside anomalous TP heating. This relationship between moisture transport from the TIO and the TP heating primarily involves the dynamic change in the TIO-supplied moisture flux, which further controls the variation in the TIO-contributed precipitation over the STP.

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