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Decomposition of Future Moisture Flux Change Projected by Global and Regional Climate Models over the Tibetan Plateau

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Abstract

This study focuses on future moisture flux change projections over the Tibetan Plateau (TP). The downscaling results for the historical period (1980-2005) was evaluated for water cycle aspects precipitation (P), evaporation (E) and P-E against the Global Land Data Assimilation Systems (GLDAS). Whether the mechanisms applying in the historical period continue to the future (2010-2100) is also investigated by WRF and CCSM projections under two scenarios (RCP4.5 and RCP8.5). The mechanism of P-E changes is analyzed by decomposing into dynamic, thermodynamic and transient eddy components. Compared to the coarse-resolution forcing, the downscaling better reproduces the historical spatial patterns and seasonal means of annual average P, E and P-E over the TP. WRF projects a diverse spatial variation of P-E changes with an increase in northern TP and decrease in southern TP in contrast to the averaged increase in CCSM. The dynamic component dominates P-E changes for the historical period in both CCSM and WRF. In the future, however, the thermodynamic component in CCSM contributes dominantly to P-E changes under RCP4.5 and RCP8.5 from the near-term (2010-2039) to the long-term future (2070-2099). Unlike CCSM, WRF inherits the mechanism seen in the historical period: the dynamic component dominates P-E changes. Further, P-E changes in the dynamical downscaling in the future are less sensitive to warming than its coarse-resolution forcing.