



Effects of the Tibetan Plateau on East Asian Summer Monsoon via Weakened Transient Eddies

Qiaoling Ren¹, Song Yang¹, Xinwen Jiang², Yang Zhang³, and Zhenning Li⁴

¹Sun Yat-sen University, School of Atmospheric Sciences, China (renql@mail2.sysu.edu.cn)

²Institute of Plateau Meteorology, China Meteorological Administration, Chengdu, China

³School of Atmospheric Sciences, Nanjing University, Nanjing, China

⁴Institute of Environment, Energy and Sustainability, Chinese University of Hong Kong, Hong Kong, China

Previous studies have revealed that the Tibetan Plateau (TP) can weaken the high-frequency and low-frequency transient eddies (TE) transported along the westerly jet. Here the effects of TP on East Asian summer monsoon via weakened TE are investigated based on the simulations by the NCAR Community Earth System Model, in which a nudging method is used to amplify the TP's inhibition of TE without changing the steady dynamic and thermodynamic effects of TP. Results reveal that the weakened TE by TP weaken the East Asian westerly jet (EAWJ) and shift the jet southward via transient vorticity flux. The southward EAWJ accompanied with reduced poleward transport of moisture by TE results in less rainfall in northern East Asia but more rainfall in southern East Asia, particularly in early summer when the EAWJ is stably located over the TP and the meridional gradient of water vapor is large. Furthermore, the anomalous precipitation can move the EAWJ further southward through the anomalous diabatic heating in early summer, forming a positive feedback. Therefore, the TP's inhibition of TE can shift the East Asian rain belt southward, different from the TP's steady forcing which favors a poleward shift of the rain belt. It is also demonstrated that the atmospheric internal variability can lead to the south-flood-north-drought pattern of summer rainfall change over East Asia, indicating the important role of TE in East Asian summer monsoon.