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# How Does Mei-yu Respond to Climate Change?

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Mei-yu is an important weather phenomenon in the middle-lower Yangtze River valley (YRV) region. For instance, in 2020, extreme precipitation events frequently occurred in the YRV region during the Mei-yu period, which caused flood and resulted in over 200 deaths/missing persons and over 170 billion CNY of direct economic losses. Whereas in 2022, persistent high temperature and drought events occurred in the YRV region, which greatly affected the agriculture, hydropower, and human health in the YRV region. These extreme events during the Mei-yu period have brought severe challenges to the government for combating climate change.

This study investigates the changes in the characteristics of Mei-yu under global warming and the potential reasons based on observation and reanalysis data during 1961–2022. It is found that the number of days without rainfall (NDWOR), intensity of rainfall event, and frequency and intensity of extreme precipitation events (EPE) in the YRV region have increased significantly during the Mei-yu period (June 15–July 10) over past decades. These trends indicate that the weather during the Mei-yu period is becoming more unstable and extreme under global warming. Particularly, the increasing trends in intensity of rainfall events and EPE (NDWOR) account for a relatively large (small) portion of the variability of corresponding variables, suggesting that the increased rainfall intensity is a key feature in the response of Mei-yu to climate change.

The increasing trend of NDWOR during Mei-yu is attributed to decreased relative humidity. According to the Clausius-Clapeyron equation, the saturation specific humidity (qs) would dramatically increase as the global warming continues, at an increasing rate of approximately 7% per□ rise in temperature. As qs increases more dramatically than q under global warming, the RH is decreased, which may lead to more days without rainfall during the Mei-yu period.

The increased intensity of rainfall event, and frequency and intensity of EPE may be correspond to the thermodynamic and dynamic effects in the YRV region during the Mei-yu period. Through analyzing the regional rainfall events in the relatively cold period of 1961–1980 and in the relatively warm period of 2001–2022, it is found that the transient southerly water vapor transport, water vapor convergence and enhanced convection in the troposphere associated with the regional rainfall events in the YRV region during the relatively warm period are notably larger than that during relatively cold period during the Mei-yu period.

Furthermore, the response of Mei-yu to 2□ of global warming with respect to pre-industrial climate is analyzed using CMIP6 models. The results suggest that the NDWOR, intensity of rainfall events,

and frequency of EPE will increase in the YRV region during the Mei-yu period under the 2□ warming scenario, which imply a more challenging climate risk management in the future.