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Heavy summer precipitation events in the Sichuan basin and their connection to meso-scale convective systems and Tibetan Plateau vortices

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Heavy summer precipitation events in the Sichuan basin, located at the eastern edge of the Tibetan Plateau (TP), can lead to disastrous flooding and landslides amplified by the complex terrain. Those events pose a threat to people's lives and livelihood as well as infrastructure in this densely populated part of China.

Mesoscale convective systems (MCSs) were identified as the source of some heavy rainfall events in the downstream regions of the TP including the Sichuan basin. Some case studies argue that Tibetan Plateau vortices (TPV) play a crucial role in the development of MCSs and extreme rainfall events in the Sichuan basin.

MCSs are recognized as cloud clusters that produce heavy rainfall over large areas, while TPVs refer to frequently occurring meso-scale vortices that are initiated over the TP and mainly travel eastwards steered by the large-scale circulation. Around 20% of TPVs can move off the TP and affect the mainland of China, especially the regions close to the TP like the Sichuan basin and the upper reaches of the Yangtze and Yellow Rivers.

In this study, we identify the most extreme summer precipitation events in the Sichuan basin for the period 2000-2018 using daily accumulated rainfall observations from meteorological stations operated by the China Meteorological Administration (CMA). We analyse how many of those events are attributable to MCSs and if so whether there is a TPV in the vicinity affecting the MCS initiation and development. We make use of databases of MCSs and TPVs in the region of interest for which MCSs and TPVs have been identified using objective tracking algorithms.

Linking extreme precipitation events in this region to the occurrence and moving-off of TPVs may help to improve forecasts of extreme precipitation and subsequent flooding.