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Effects of the surface heat fluxes on the cloud systems over the Tibetan Plateau

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The influence of the surface heat fluxes on the generation and development of the cloud and precipitation and its relative importance with the large-scale circulation patterns is investigated via the Cloud-Resolving Model (CRM) simulations and the diagnostic approach over the Tibetan Plateau (TP) in boreal summer. The diagnostic results show that the precipitation shows a positive relationship with the apparent heat over the Eastern TP (ETP), which is similar to the Eastern China. However, this relationship is negative over the Western TP (WTP), which is mainly caused by the different characteristics of the surface heat fluxes. Simulation results show that the heavy rainfall is mainly controlled by the dynamical and thermal properties of the atmosphere while the surface heat fluxes impose weak influence on the heavy rainfall process (e.g., the Middle and Low reaches of Yangtze River). However, the surface thermal driving force is a necessary factor for the heavy rainfall in the ETP and WTP. The warm and ice cloud processes are substantially restricted when the surface heat fluxes are weakened. As a consequence, the heavy rainfall cannot be aroused under this situation. Over the ETP, the deep cloud can be triggered by the intensive surface thermal driving due to its relative abundant moisture, leading to precipitation process. Over the WTP, the heavy rainfall evens are closely related to both the strong surface heat fluxes and the moisture which is transported from the southern tropical ocean. In addition, the surface heating effects take the main responsibility for the high frequent convections in the afternoon and the cloud top of convections shows a positive relationship with the intensity of the surface heat fluxes. Except the convections in the afternoon, the convections show a second-high incidence in the evening, which is mostly related to the large-scale circulation.