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Simulated lake-effect precipitation over the Tibetan Plateau:a case study at Nam Co Lake

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Lakes affect local climate conditions significantly, and the effects vary spatially and temporally. Past studies have found that enhanced precipitation occurs on the downwind shores of many lakes, which is known as lake effect precipitation (Eichenlaub, 1970).There are thousands of lakes on the Tibetan Plateau (TP); however, few studies examine the impacts of these lakes on local climate. To investigate lake effect precipitation over the plateau environment, we take Nam Co Lake as a case study, due to its large size and the availability of in-situ observations. Using the Weather Research and Forecasting (WRF) model, the impacts of Nam Co Lake on downwind precipitation events are studied quantitatively. The results show that the WRF_lake simulation accurately captures the precipitation events that occurred in October 2006. Two simulations are then carried out in WRF with and without the lake. The results show that WRF cannot simulate the large center of precipitation observed east of Nam Co Lake if the lake is absent. The simulation results show that the lake caused an increase in precipitation of up to 60% over the lake's area and downwind of the lake in October of 2006. From a climatological perspective, the warm lake surface induces low-level horizontal convergence and updrafts over the lake and provides energy and water vapor that promotes the development of development in October. The lake effect mainly occurs under the westerly wind. The wind direction determines the location of the lake effect precipitation, which falls to the east of the lake.