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A New Convective Time Scale for Kain-Fritsch Eta Scheme and Preliminary Validation in a Convective Cloud Precipitation

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General uncertainty in simulation of clouds and convective precipitation occurs in almost all models. Many studies and considerable efforts to improve simulation accuracy for them through making convective parameterization scheme (CPS) adapt to the gray zone ($\sim$1 to 5 km horizontal grid spacing). In this study, a new convective adjustment time scale for the Kain-Fritsch eta (KFeta) scheme in the Weather Research and Forecasting (WRF) model applied in high resolution simulation, but different from the version with a scale-aware function, was proposed and validated by a typical and frequent convective precipitation over the Tibetan Plateau (TP). The results show that modifying convective adjustment time scale τ can evidently improve the simulation performance. Compared to the original scheme, the τ can well reproduce the simulated precipitation pattern, horizontal scale and intensity. This result also illustrates that choosing a suitable convective adjustment time scale τ still can apply the CPS in high resolution simulation. Further diagnoses show the new scheme performs reasonably well in representing the strong entrainment processes and the increasing accumulated precipitation. Moreover, while the relative humidity (RH) bias in initial and boundary condition is corrected, the results receive more significant improvement on the propagation of the convective precipitation system over the TP region.