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Turbulence effects on warm cloud properties

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The effect of turbulence that enhances the collision rate between cloud drops on precipitating warm cloud properties are numerically investigated using the large-eddy simulation version of a community mesoscale model coupled with a detailed bin microphysics scheme. As in previous studies, the enhanced collision induces an increase in drop size. The turbulence effect accelerates the onset of surface precipitation and increases the amount of surface precipitation because of the increased drop size. Moreover, condensation and evaporation lessen as drop size increases although an increase in surface precipitation might contribute to an increase in evaporation in the subcloud layer. Cloud sizes enlarge due to the decreased evaporation while the intensity of updraft weakens due to the decreased condensation. Consequently, the variability of vertical motion decreases, and this decrease results in a decrease in the turbulent kinetic energy by decreasing the local wind shear although the buoyancy tendency of the turbulent kinetic energy becomes less negative. Therefore, the effect of turbulence shows a negative feedback. Moreover, the increased cloud size and the decreased updraft induce the increased cloud fraction and the decreased cloud albedo.