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The Effects of the Unified Parameterization in the CWBGFS: the Diurnal Cycle of Precipitation over Land in the Maritime Continent

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The unified parameterization (UP) is a framework that physically adjusts the precipitation partition between the parameterized convection and the grid-scale processes based on the convective updraft fraction. This study investigates the effects of the UP on the diurnal cycle of precipitation over land in the Maritime Continent using an atmospheric general circulation model at the spatial resolution of 15 km. Three experiments are carried out; the conventional deep convection scheme (RAS), the RAS incorporated with the UP (URAS), and the no deep convection scheme (NDC). Using the short-term hindcast approach, the results show that the UP leads to drastic changes in the way moisture and energy being redistributed, resulting in the more realistic precipitation diurnal cycle and precipitation spectrum over land. As the convective instability increases during the daytime, the RAS quickly redistributes the moisture and energy solely by parameterized convection, while the URAS involves the grid-scale processes. The difference in partitioning the processes that represent deep moist convection causes the difference in moisture and cloud condensates distributions in the afternoon, thereby the difference in energy fluxes at the surface. During the evening and midnight, the grid-scale processes in the URAS can continue to produce precipitation even when the convective instability decreases. Overall, turning off the deep convection scheme leads to the delayed diurnal peak time.

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