The impact of Chikira-scheme to tropical convection and large-scale circulations of NICAM

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The impact of the Chikira convective parameterization scheme in a cloud-system resolving model NICAM configured with a cloud-permitting 14-km mesh is assessed.The Chikira scheme adopts an entrainment rate sensitive to the humidity of the environment, and usually increase congestus clouds in the tropics that are under-resolved at 14-km mesh. In this study, 3-month NICAM simulations are carried out with and without the Chikira scheme. Simulations with several different Chikira scheme parameters are tested. The horizontal scale of convection becomes larger and precipitable water increase in the tropics in the simulations with the scheme turned on. The effect is magnified in the simulations that apply smaller values for the parameter that define the fraction of loss of buoyancy-generated energy in the parameterized convection. The vertical velocities are smaller in the simulations with broader convection and updrafts, maintaining the tropical mean vertical velocities comparable among all simulations. The cross-equatorial cell of the Hadley circulation is expanded due to a northward shift of the intertropical convergence zone when the Chikira scheme is turned on, possibly reflecting that the increased moisture and vertically deeper atmospheric heating in the tropics tend to prefer Rossby-wave type disturbances, which increase off-equatorial upward motion. The upward motion near the Maritime continent is also enhanced when the Chikira scheme is turned on, resulting in a stronger Walker circulation.

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