

The impact of hybrid usage of the Chikira-Sugiyama scheme on tropical convection and large-scale circulations in NICAM

Tomoki Miyakawa (miyakawa@aori.u-tokyo.ac.jp)

The University of Tokyo, Atmosphere and Ocean Research Institute

The impact of activating the Chikira-Sugiyama (CS) scheme in the global Nonhydrostatic Icosahedral Atmospheric Model (NICAM) coupled with a 1D mixed-layer ocean model is assessed using a cloud-system resolving, 14-km mesh. The CS scheme, which employs an entrainment rate sensitive to the humidity of the environment, is known to produce congestus clouds in the tropics when used in conventional global climate models, which are under-resolved in the default 14-km mesh NICAM. In this study, boreal-summer NICAM simulations were carried out with and without the CS scheme, and several different scheme parameters were also evaluated. Results showed that the horizontal scale of convection and precipitable water increased in the tropics when using the CS scheme. Model adjustments were apparent at two different timescales; a rapid adjustment within the first week, and a slower adjustment at one to two months. Both effects were magnified in simulations that applied smaller values for the parameter that defined the fraction of loss of buoyancy-generated energy in the parameterized convection. The upward branch of the Hadley circulation shifted northward and the Walker circulation was enhanced when the CS scheme was activated. These large scale adjustments suggested that increased moisture and deeper atmospheric heating in the tropics tended to favor larger organized convective activities, which require a rich moisture supply; in this case available to the north of the equatorial West Pacific Ocean.