RCEMIP: 放射対流平衡モデル比較実験プロジェクト

RCEMIP: Radiative Convective Equilibrium Model Inter-comparison Project

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Radiative Convective Equilibrium Model Inter-comparison Project (RCEMIP) is proposed.
Radiative-convective equilibrium (RCE) is referred to as atmospheric quasi statistical balance between convection and radiation processes (Manabe and Strickler 1964). Historically, RCE has been argued mainly with one-dimensional models, but in recent years more computationally intensive numerical calculations of RCE have been conducted with three-dimensional numerical models with explicitly resolved convection and domain lengths of 100-1000 km. A simple horizontally uniform boundary condition is prescribed with a constant sea surface temperature (SST) or a slab ocean model with uniform solar insolation. Since clouds are a most ambiguous part of climate models, the simple framework of RCE is suitable for understanding how clouds are simulated in numerical models. RCE is also useful to clarify the sensitivities of clouds to the details of cloud schemes implemented in numerical models (e.g., Satoh and Matsuda 2008). A number of RCE numerical studies have been conducted until recently with their own various configurations. One category is RCE on the sphere either with or without a cumulus parameterization scheme (e.g., Popke et al., 2013; Arnold and Randall, 2015; Reed et al., 2015; Bony et al., 2016; Satoh et al., 2016; Ohno and Satoh, 2016). The other category is RCE with regional models in an arbitrary domain size , primarily with explicitly resolved convection (e.g., Wing and Cronin 2016; Silvers et al. 2016). In order to systematically understand differences or similarities of various model results, a more coordinated framework for RCE numerical studies is demanded as “RCEMIP”. Possible choices for experimental settings of RCE are listed as follows:
Geometry: sphere / plane (square or channel)
Domain size: Earth radius R / length=40,000 km ×factor (e.g., 0.1–1.0)
Horizontal resolution: Δx = 1–10 km for explicit convection, or coarser resolution (1–2 degree) with a cumulus parameterization
Boundary condition: fixed SST (e.g., 296, 300, 304K) or a slab ocean
CO_2: a current value or increased (e.g., 4×CO_2)
Physics dependency: cloud microphysics, turbulence, radiation,; switch on/off of cumulus parameterization
Interactive radiation or non-interactive, with/without clouds
With or without diurnal cycle
Without rotation, or with rotation
Among a lot of varieties listed above, we will discuss the experimental design of RCEMIP, scientific targets, and how to proceed. One strength of RCEMIP is the numerous scientific questions that could be explored, such as better understanding of uncertainties of climate sensitivities and changes in clouds and

circulations, or convective aggregation, associated with global warming.

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