

NICAMを用いた雲放射フィードバックの解析—温暖化応答の雲微物理依存性—

High Cloud Responses to Global Warming Simulated by Two Different Cloud Microphysics Schemes Implemented in the Nonhydrostatic Icosahedral Atmospheric Model (NICAM)

*Chen Ying-Wen¹、清木 達也¹、小玉 知央¹、佐藤 正樹^{1,2}、野田 暁¹、山田 洋平^{1,2}

*Ying-Wen Chen¹, TATSUYA SEIKI¹, Chihiro Kodama¹, Masaki Satoh^{1,2}, Akira Noda¹, Yohei Yamada^{1,2}

1.独立行政法人 海洋研究開発機構、2.東京大学 大気海洋研究所

1.Japan Agency for Marine-Earth Science and Technology, 2.Atmosphere and Ocean Research Institute, The University of Tokyo

This study examines cloud responses to global warming using a global nonhydrostatic model with two different cloud microphysics schemes. The cloud microphysics schemes tested here are the single- and double-moment schemes with six water categories: these schemes are referred to as NSW6 and NDW6, respectively. Simulations of one year for NSW6 and one boreal summer for NDW6 are performed using the nonhydrostatic icosahedral atmospheric model with a mesh size of approximately 14 km. NSW6 and NDW6 exhibit similar changes in the visible cloud fraction under conditions of global warming. The longwave (LW) cloud radiative feedbacks in NSW6 and NDW6 are larger than the average LW cloud radiative feedbacks in the Coupled Model Intercomparison Project Phase 5 (CMIP5)/Cloud Feedback Model Intercomparison Project 2 (CFMIP2). The LW cloud radiative feedbacks are mainly attributed to cirrus clouds, which prevail more in the tropics under global warming conditions. For NDW6, the LW cloud radiative feedbacks from cirrus clouds also extend to mid-latitudes. The changes in cirrus clouds and their effects on LW cloud radiative forcing (LWCRF) are assessed based on changes in the effective radii of ice hydrometeors (R_{ei}) and the cloud fraction. We determined that an increase in R_{ei} has a non-negligible impact on LWCRF compared with an increase in cloud fraction.

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