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Preliminary results from a multiscale modeling framework with a higher-order turbulence closure implemented in its cloud-resolving model component

Kuan-Man Xu (1) and Anning Cheng (2)

(1) NASA Langley Research Center, Hampton, VA 23681, USA, (2) Science System and Application, Inc., Hampton, VA, USA

In this study, preliminary results from a two-year climate simulation from three models are compared. They are the Community Atmospheric Model (CAM3.5) with the conventional cloud parameterizations, a multiscale modeling framework (MMF) that uses the System for Atmospheric Modeling (SAM) cloud-resolving model (CRM) as cloud parameterizations and a new MMF that implements a third-order turbulence closure in its CRM component that replaces the first-order turbulence closure in the standard SAM. The third-order turbulence closure is expected to better represent the low cloud processes in the coarse-resolution CRM (with a grid spacing of 4 km). Annual and seasonal mean state, diurnal cycle, and MJO-like variability simulated from these three models are analyzed. The global distribution of low cloud amount and the representation of the middle-level clouds in mid-latitude storm track regions show a substantial improvement compared with those from the original MMF with the standard SAM CRM. The cloud amounts are in excellent agreements with the CloudSat observations while these cloud amounts are severely underestimated in the CAM3.5 and the original MMF. Some improvements can also be seen from the diurnal cycle and MJO-like (Madden-Julian Oscillation) variability.