

Title:

Parameterization of deep convection in E3SM with higher-order closure

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Abstract:

Use of a unified parameterization of turbulence and all cloud types in E3SM would have several advantages. One of them is simplicity. For instance, a unified parameterization of clouds would avoid the need to use two microphysics parameterizations, one for stratiform clouds and a second for convective clouds. In addition, scalars would need to be transported only once, rather than separately by eddy diffusivity and also by a deep convective scheme.

However, a unified parameterization requires the parameterization of deep clouds, which is a challenge. Here, we parameterize all clouds in E3SM, including deep clouds, with a higher-order closure model, namely, CLUBB, plus a microphysics sampler, SILHS.

We will show results from global unified E3SM simulations, including global climatologies and profiles from deep convecting regions. Turbulence budgets from the tropical Pacific warm pool look plausible. At the same time, the unified parameterization simulates shallow cumuli that have realistic profiles of cloud fraction and that do not drizzle excessively.