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A stochastic shallow cumulus ensemble model as a scale-aware parameterization of convective fluctuations[1] MIRJANA SAKRADZIJA, Max Planck Institute for Meteorology, AXEL SEIFERT, Deutscher Wetterdienst, THIJS HEUS, Cleveland State University, ANURAG DIPANKAR, Max Planck Institute for Meteorology — Numerical models are approaching the high-resolution limit where some aspects of deep convection and mesoscale convective systems can be explicitly modeled, while shallow cumuli are still a subgrid process that requires a parameterization. The classical assumption of a sufficiently large cloud sample within a model grid column breaks down in this regime, so it is crucial to develop scale-aware parameterizations. Therefore, we propose an approach to represent the variability of subgrid shallow cumuli about the ensemble average convective response. The shallow clouds are studied using Large Eddy Simulation (LES), where the original cloud field modeled on the grid of 25 m resolution is coarse-grained to mimic resolutions from 1 to 50 km. A canonical statistical ensemble is developed based on theoretical and LES findings and fluctuations of shallow convection are modeled by random subsampling of microstates from the convective ensemble distribution. The resulting distribution of subgrid convective states is scale-aware, and it represents stochastic fluctuations that increase with grid resolution and become substantial on the kilometre-scale grids. We find that the local cloud memory plays an important role in defining the convective ensemble statistics in a steady cumulus regime.

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