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## Unified parameterization of the planetary boundary layer and shallow convection with a higher-order turbulence closure in the Community Atmosphere Model: single-column experiments

P. A. Bogenschutz et al.

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**Abstract.** This paper describes the coupling of the Community Atmosphere Model (CAM) version 5 with a unified multi-variate probability density function (PDF) parameterization, Cloud Layers Unified by Binormals (CLUBB). CLUBB replaces the planetary boundary layer (PBL), shallow convection, and cloud macrophysics schemes in CAM5 with a higher-order turbulence closure based on an assumed PDF. Comparisons of single-column versions of CAM5 and CAM-CLUBB are provided in this paper for several boundary layer regimes. As compared to large eddy simulations (LESs), CAM-CLUBB and CAM5 simulate marine stratocumulus regimes with similar accuracy. For shallow convective regimes, CAM-CLUBB improves the representation of cloud cover and liquid water path (LWP). In addition, for shallow convection CAM-CLUBB offers better fidelity for subgrid-scale vertical velocity, which is an important input for aerosol activation. Finally, CAM-CLUBB results are more robust to changes in vertical and temporal resolution when compared to CAM5.

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