**Geoscientific
Model Development
Discussions**

Interactive comment on "Unified parameterization of the planetary boundary layer and shallow convection with a higher-order turbulence closure in the community atmosphere model: single column experiments" *by* P. A. Bogenschutz et al.

Anonymous Referee #2

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This manuscript describes the implementation of the CLUBB parameterization into the single-column version of CAM5. The implementation is tested with a number of relevant cases and sensitivity with respect to vertical grid spacing and time step is explored. Overall, these early results are very encouraging.

The manuscript would benefit from a few clarifications or modifications:

- On some of the vertical profile figures, it would be useful to add profiles of $\overline{\theta_l}$ and $\overline{q_t}$ as these variables can reveal the integrated impact of the parameterization

fluxes.

- Describe in more details the coupling between CLUBB and MG. Are CLUBB predicted pdfs being used in the microphysics? Are there any changes to the microphysics?

- P 1744, line 23: "Medieros" -> "Medeiros"

- P 1746, line 1: Larson and Golaz (2005, doi:10.1175/MWR2902.1) is also be relevant here.

- P 1747, line 2: For AM3, cite Donner at al (2011, doi:10.1175/2011JCLI3955.1).

- P 1747, line 11: "2011" -> "2010" according to the references.

- P 1748, line 11: does CLUBB predict $\overline{u'w'}$ and $\overline{v'w'}$?

- P 1748, line 13: $q_j'^o$ -> $q_t'^o$

- P 1748, second paragraph: how is the turbulence transport of scalars handled in CAM-CLUBB?

- P 1748, last paragraph. Please define SGS vertical velocity. Clarify how is it computed for LES, CAM-BASE and CAM-CLUBB. Also clarify elsewhere in the text where references are made to the SGS vertical velocity. For CAM-CLUBB, an alternative approach would be to integrate over the pdf of w predicted by CLUBB.

- P 1749, first paragraph. Tighter coupling between CLUBB and the microphysics may also help in representing aerosol effects on cloud dynamics (Guo et al, 2011, doi:10.1029/2011GL048611).

- P 1752 and Figure 2: CAM-BASE results for BOMEX cloud fraction appear to be substantially degraded compared to Bretherton et al. 2004 and Park and Bretherton (2009). Please elaborate in the text.

- P 1756, line 5: "i.e" -> "i.e."