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Geoscientific Model Development Discussions

Interactive comment on "A unified parameterization of clouds and turbulence using CLUBB and subcolumns in the Community Atmosphere Model" *by* K. Thayer-Calder et al.

Anonymous Referee #2

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This paper introduces a sub-column variant of the Cloud Layers Unified By Binormals (CLUBB) parameterization and provides a number of key modifications to the previously published formulation to better unify the treatment of cloud types. The manuscript is quite interesting and an important contribution to the literature. However, the explanation is terse and leaves the reader wanting of many key details relevant to this work. The authors may wish to consider expanding on references to the background literature on PDF-based parameterizations and sub-column methods, and clarify the description of the methodology. Nonetheless, I am happy to recommend the manuscript for publication subject to minor revisions as long as the comments and questions below are addressed.

Page 5047, line 2-10: Please provide some brief justification of the given choice of prognostic moments and the marginal distributions. How are mean and variance of these distributions chosen?

Page 5048, line 1: Please provide a brief contrast of MG1 and MG2, and provide an explanation as to why MG2 was not used. Would there be any advantage in adapting CLUBB-SILHS to work with MG2, or any other microphysics scheme for that matter?

Page 5048, line 23: Do the tendencies computed from sub-stepped CLUBB feed into the dynamics on the sub-cycled time scale or on the physics time scale?

Page 5051, section 3: How representative is this cost of operational model performance? Has much effort gone into optimizing CLUBB-SILHS? Do you anticipate any performance gains could be made to the present code?

Page 5058, line 15: In SP-CAM, there is also a sensitivity to the number of sub-columns that is analogous to the response observed in CLUBB. In SP-CAM communication can occur laterally between sub-columns, and consequently when few sub-columns are present there is insufficient area for compensating subsidence, which suppresses convection and drives unphysical results. In the CLUBB-SILHS case I could imagine a similar effect would occur. Namely, is it the case that with insufficient sub-columns the vertical profile will be closely locked to the grid-cell mean and so will be unable to develop convection?

Page 5060, line 8: How would you anticipate the parameterization will behave as grid resolution is reduced to 0.25 degrees, 0.1 degrees, or finer? Is there a natural mechanism that could be used for deactivating the parameterization as the resolved scales are reduced?

Interactive comment on Geosci. Model Dev. Discuss., 8, 5041, 2015.