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**Geoscientific
Model Development
Discussions**

Interactive comment on "iGen: the automated generation of a parameterisation of entrainment in marine stratocumulus" *by* D. F. Tang and S. Dobbie

Anonymous Referee #1

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Review of "iGen: the automated generation of a parameterization of entrainment in marine stratocumulus" by Tang and Dobbie.

Recommendation: accept after major revisions

I was looking forward to reading this manuscript after reviewing the previous discussion paper on iGen (GMDD 2011, p. 843-868, TD1 hereafter). TD1 presented what seemed to be a relatively straightforward way to analyze complicated model of a physical phenomenon and produce a significantly simplified model through the application of iGen. TD1 used simulations described in the current paper as the most complicated application of iGen, but TD1 did not discussed any details of it. So the current paper was supposed to satisfy my curiosity. Unfortunately, the paper end up being a significant disappointment. There are a few reasons for that and I briefly discuss them below.

First, I hoped I would learn in detail how the approach detailed in TD1 can be applied to a system as complicated as 2D fluid flow model applied to a very specific situation of stratocumulus entrainment. But the paper devoted a really small section to this problem and it is unclear to me how this is actually done. My suggestion is to significantly expand section 5 and to provide details on how iGen is used to simplify the entrainment rate prediction. And this should be done in the spirit of TD1, that is, explaining iGen application as it was done using simple examples there.

Second, description of the model and specific aspects of the particular case takes a lot of space and detracts the reader from the original goal of the paper, which is the application of iGen. I wonder if the description of the model should be removed from the paper and presented in another publication, perhaps with a suite of tests documenting its performance (using, for instance, past test cases of the GCSS Boundary Layer Clouds Working Group). More specifically, and perhaps related to 1 above, I do not understand the discussion in section 3. Why the depth of the boundary layer needs to be kept constant? Why does one need to modify grid point values of total water, liquid-water potential temperature and buoyancy. The averages evolve on much longer time scales, so why one needs to adjust? Why this is part of wrapping the model by iGen? The discussion on pages 977-980 and what role it plays in application of iGen is not clear to me. I suggest the authors revise this part of the presentation significantly.

Specific issues.

1. The authors refer to the fluid flow model they use as a cloud resolving model. I do not think this is consistent with the traditional nomenclature. Models with gridlength of a few tens of meters are typically referred to as large-eddy simulation models. A subset of 2D LES models (which really are not LES models as they cannot simulate 3D turbulence) are often called eddy-resolving models. I think the paper by Moeng et al. 1996 (referred to in text) applies such terminology.

2. How the entrainment rates derived in the study compare to GCSS results published

over the last decade or so? I think a reference to these estimates would be desirable to show the context of this work.

3. P. 974. I do not think the "specific water content" is the correct term. Do you mean total water mixing ratio?

4. P. 978-979. What are the reasons for specific choices of timescales involved in the formulas presented in the discussion?

5. I think sensitivity to initial conditions (bottom of p. 981 and top of p. 982) should not be surprising. Does this call for an ensemble of simulations? How long a single simulation needs to be run to obtain meaningful statistics?

6. Figs. 5 and 6 show increase of the mean cloud top. Is that correct? If so, why the vertical axis refers to it as the total entrainment? And why the cloud top rises in the first place? I thought the methodology was aiming at maintain the cloud top in place.

Interactive comment on Geosci. Model Dev. Discuss., 4, 971, 2011.