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Discussions

Interactive comment on "iGen: a program for the automated generation of models and parameterisations" *by* D. F. Tang and S. Dobbie

Anonymous Referee #1

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Review of "iGen: a program for the automated generation of models and parameterisations: by Tang and Dobbie.

Recommendation: accept after minor revisions

This paper presents a novel approach to generate simplified models by analyzing more complicated models of physical processes. I have to admit that I am a physicist, not a mathematician, so some aspect of the approach are not crystal clear to me. However, the idea presented in the paper is intriguing and the results need to be published. This is the first paper out of two by the same authors that I agreed to review, so I do not know the details of the material presented in the second paper (it concerns the issue of entrainment in stratocumulus-topped boundary layer which is closer to my interests and expertise). I wonder if the two papers should be combined, but I assume that the

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material in the second paper is sufficient for a stand-alone publication.

I only have a few relatively minor comments concerning details of the presentation. I feel an applied mathematician should look more closely at the mathematical foundation of the approach as I am not able, for instance, to evaluate the novelty of the approach.

Specific comments.

1. I do not like the introduction. First, I do not agree that when it comes to developing parameterizations, the main problem is in the "model assumptions". I think the problem is that parameterizations represent our understanding of the system and ability to reduce the system behavior to simple rules. For that, one needs to understand the system in the first place. This may come from the observations (i.e., isolating the forcings and finding the response), or from model simulations, where the forcings can be better controlled and the responses perhaps easier to isolate. The fact the models have their limitations (through the model assumptions or, more generally, model imperfections, due to limited spatial resolution, for instance) is a secondary issue in my mind. The key point is the thought processes that leads to the understanding of model behavior and to the designing simple rules that form the key component of a parameterization. If I think about the parameterization of deep convection, for instance, an area where I have some expertise, I can clearly see how this thought process works and why it is so difficult to develop a robust parameterization because of the complexity of the system.

Note that the parameterization can be just a simple rule or even another model (simple or complicated), but the key element is that such a model does encapsulate our understanding. And this is where the iGen comes in: it can analyze a complex model and create a set of simple rule that can be quickly use as a parameterization. But it also has a drawback because by using iGen one can come up with rules without physical understanding, and the understanding is in my mind the key element of progress.

I personally would prefer to see the introduction built around such discussions.

GMDD

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2. The reference to superparameterization (SP) is actually a good example of what I refer to above. Since the convective atmosphere is a complex system involving multiscale dynamics, why not to use another model (that we know does a decent job in representing deep convection) to replace convective parameterization? This is the idea for SP. (BTW: SP was suggested by Grabowski and Smolarkiewicz in 1999; the reference to Khairoutdinov et al. does not seem right here; perhaps a better reference would be 2003 BAMS paper by Randall et al.) IGen can analyze such a model and create a simpler set of rules that can replace the subgrid-scale model. I am sure the authors would like to embark on such a project, although analyzing 3D moist fluid flow model seems quite challenging. Perhaps a comment on that would be desirable.

3. P. 846, l. 6: I think this is the average KE of an atom that is proportional to temperature, not the other way around.

4. It is not clear to me what the parameter r is on p. 851, line 7. Can this be explained a little better?

5. P. 862, the discussion of the entrainment in stratocumulus simulations. I do not understand what "variance per second" and "variance of entrainment per second" are. Please clarify. Overall, this section can be removed from the manuscript and replaced by a reference to the second paper as the details of the results are very sketchy. Perhaps more importantly, I am not sure if comparison between 2D simulations and observations is that easy. I am sure I will have some comments on this for the second paper.

Interactive comment on Geosci. Model Dev. Discuss., 4, 843, 2011.