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## iGen 0.1: a program for the automated generation of models and parameterisations

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Received: 10 Mar 2011 – Discussion started: 08 Apr 2011 – Revised: 31 Aug 2011 – Accepted: 31 Aug 2011 – Published: 16 Sep 2011

**Abstract.** Complex physical systems can often be simulated using very high resolution models but this is not always practical because of computational restrictions. In this case the model must be simplified or parameterised in order to make it computationally tractable. A parameterised model is created using an ad-hoc selection of techniques which range from the formal to the purely intuitive, and as a result it is very difficult to objectively quantify the fidelity of the model to the physical system. It is rare that a parameterised model can be formally shown to simulate a physical system to within some bounded error. Here we introduce a new approach to parameterising models which allows error to be formally bounded. The approach makes use of a newly developed computer program, which we call iGen, that analyses the source code of a high-resolution model and formally derives a much faster, parameterised model that closely approximates the original, reporting bounds on the error introduced by any approximations. These error bounds can be used to formally justify conclusions about a physical system based on observations of the model's behaviour. Using increasingly complex physical systems as examples we illustrate that iGen has the ability to produce parameterisations that run typically orders of magnitude faster than the underlying, high-resolution models from which they are derived.

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**How to cite:** Tang, D. F. and Dobbie, S.: iGen 0.1: a program for the automated generation of models and parameterisations, *Geosci. Model Dev.*, 4, 785–795, <https://doi.org/10.5194/gmd-4-785-2011>, 2011.