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Geoscientific Model Development Discussions

Interactive comment on "Rapid development of fast and flexible environmental models: The Mobius framework v1.0" *by* Magnus Dahler Norling et al.

Anonymous Referee #2

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General comments

This paper presents a framework to support the development of environmental models, referred to as the Mobius framework (v1.0). The aim is to allow scientists with potentially limited programming skills to develop component models within the framework, which can then be linked together. This is an important and timely contribution as new approaches to modelling are urgently required particularly as we head towards the need for integration of models. The framework is developed for hydrology and water quality analyses but should be applicable to other settings. The framework is also available as an open source tool with a link provided in the paper to the relevant github

repository. This is a well-written and accessible paper. My own major concern is how it is framed. It is written very much as a description of the approach rather than as a research paper. To be a fully-fledged research paper it would have: research questions and/ or a guiding hypothesis, consideration of the state of the art and gap identified, methodology and evaluation/reflections/discussion. These elements are largely missing. The paper would be much stronger being re-framed as more of a research contribution. I pick up on these points in my more specific comments below.

Specific comments

The introduction does a good job of motivating the research and I very much welcome the arguments presented in the paper. However, as mentioned above it is not framed as a research paper. It could be though with a bit of refactoring, for example, the paper claims things like flexibility and ease of use wrt novice programmers. . . these could be hypotheses that are evaluated through the research. The same argument applies to improvements over 'fixed models'. This is something that could also be evaluated. The second section provides an overview of Mobius. I found it quite hard to get to the crux of the design, and it is quite short and lacks any real depth. I am a computer scientist by training and I wanted to see things like an overarching software architecture and also an explanation of key design decisions with rationale. This is missing from me. It would be very hard fro example for other researchers to consider the text here and get anywhere near reproducing 'the approach'.

Section 3 is then a 'demonstration of Mobius' and this title says a lot about the way the paper is framed. To me, it should not be a demonstration of a given approach but rather should be an evaluation of how well the approach achieves its goals, with the evaluation being rigorous and scientific. Instead, it steps through the GUI (but curiously not in a visual way) and also the use of Python wrappers (the key to interoperability in their approach), but not in a way that allows the reader to see beyond the "what" to the "why" this is done (and other alternatives that could have been considered). This section also contains a case study – but again its stated purpose is to demonstrate not to evaluate. It is also quite a small example and it is not clear how this would scale up to something more substantial. The section concludes with some benchmark figures, which are interesting, but it is not clear why performance is measured and nothing else is evaluated, when performance is not mentioned as a goal. Section 4 contains a discussion but to me this is way to narrow and specific and lacks a true element of reflection, e.g. what has worked, what has not worked, what are the strengths of the approach and weaknesses, and so on.

There is also so much more could be done in such a framework and these dimensions are not considered, e.g. running the model multiple times, perturbing parameters to carry out sensitivity analyses, running ensembles of models, looking at model coupling in a more sophisticated way, and so on. Finally, there is a lack of consideration of related work and yet there are a significant number of other frameworks in existence with similar goals.

In summary, I do think this is an interesting and potentially significant project but the paper needs significant revision to reach the stage where it can be published. In particular, it needs to be reframed as a research contribution in my view rather than a description of a particular approach.

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