Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2016-85-AC2, 2016

Geoscientific Model Development Discussions

Interactive comment on "A computationally efficient depression-filling algorithm for digital elevation models applied to proglacial lake drainage" *by* Constantijn J. Berends and Roderik S. W. van de Wal

Constantijn J. Berends and Roderik S. W. van de Wal

c.j.berends@uu.nl

Received and published: 30 September 2016

We like to thank the reviewer for his comments on the manuscript and would hereby like to address the concerns raised.

In Italics the comments, below our rebuttal

While the work carried out looks to be robust and of value to a fairly specific application, I wonder whether the work has a broad enough reach to be published in a relatively high impact journal such as GMD. The first line of the paper suggests that the problem of determining lake depths is often encountered in many fields, but doesn't go on to

give any examples beyond proglacial lakes. And do these other applications need to solve this problem over many iterations? Otherwise the computational time of minutes is not a massive issue, and the techniques presented have a fairly niche application, and could be presented in a paper specific to the application.

We agree that we could have expressed the relevance of the work a bit better than we did. We provided a couple of papers with applications in hydrology for which our work has relevance (Tarboton et al., 1991, Zhu et al., 2006, Goelzer et al., 2012 and references therein), where drainage direction maps need to be determined while accurately accounting for lakes within the maps. In addition, there are studies looking at changes in global hydrology either over past climate changes or future projections (e.g. Renssen and Knoop, 2000) where the boundary conditions of the problem may change over time. While we believe that hydrological studies benefit from our improved algorithm, we agree that the main application will probably still be the treatment of proglacial lakes within ice models.

Having said that, we would like to stress that the dynamics of ice sheets is an emerging field of interest driven by the need to address the uncertainty in sea level projections and the appearance of more and more empirical data and paleoclimatological data. Meltwater pulses for instance are still poorly understood. What we hope to offer with this manuscript is a generic tool for all ice sheet models, which researchers can use to test the importance of lakes in their specific area of interest. Whether this is the Laurentide, Eurasia, the past or present and future evolution of Greenland and Antarctica is up to the individual researchers. Given the importance for hydrology and dynamical ice sheet studies we believe this model deserves a separate paper rather than an appendix to a specific application. This thought is strengthened by the fact that we need a full paper to explain the merits of the approach.

We have improved the introduction to clarify this better and added the reference to the work by Renssen and Knoop.

The introduction does not give enough background to the task, such that I had to read it a number of times to understand exactly what the task at hand was.

We have improved the introduction in order to clarify the problem addressed in the paper.

Further there is not much detail on the default algorithm, the reader is left to go and read the paper by Zhu et al. (2006), such that it is a bit hard to follow independently.

We have improved section 2 with a figure and text to illustrate how the default algorithm works as a starting point for our own configuration.

There are also a lot of vague statements such as "A second issue is an efficient way to determine the water level" on page 3, line 22. Because you don't introduce your terms, such as "base level" and "water level" it is not always easy to follow the methods. Be more specific in these statements to help the reader understand what it is going on.

The term "base level" in the manuscript is indeed erroneous, this should read "local topography". The term "water level" means the elevation of the water surface with respect to sea level. We clarify this in the revised version of the manuscript.

Another example, on page 4, line 18 and Fig. 1, you talk about a true/false mask but don't define what this is. In Fig. 2 you talk about a land/ocean mask, but all I can see is DEM elevations? Is the deep blue actually a mask and not elevations? In this case, this needs to be in the legend.

The "true/false-mask" is the same one that is introduced on page 3, line 21. We will re emphasize this in the text. Fig. 2 does indeed show the DEM elevation with the land/ocean mask as a deep blue overlay. We will clarify this in the figure caption.

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-85, 2016.