Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-34-RC1, 2019

Earth Surface Dynamics Discussions

Interactive comment on "Computing water flow through complex landscapes, Part 2: Finding hierarchies in depressions and morphological segmentations" *by* Richard Barnes et al.

Anonymous Referee #1

Received and published: 1 July 2019

This paper presents an innovative data structure for representing hierarchical depression on complex landscapes and the corresponding algorithm for constructing such data structures. The data structure and algorithm are well presented and explained. It definitely provides insights to hydrological terrain analyses researchers who want to understand and analyze complicated depression groups in a systematically way. However, I think this draft only present the method part of this study without adequate supports from real-world hydrological applications. Although in the Application section, the authors list several potential terrain analyzing processes that this new data structure can be beneficial to, there is no concrete evidence to demonstrate the improvement brought by this new data structure. The only result presented with quantified informa-

tion is Table 1, which only shows the time requirement of implementing this algorithm on data sets in different sizes. To make this paper complete as an individual journal article itself, the authors need to compare the efficiency of running different applications (such as pit filling) w/o introducing this new depression hierarchy structure. Even with another paper submitted, it only focuses on 6.5 Flow Modelling, but evidence for application in section 6.1∼6.4 is still missing. Due to this concern, a major revision decision is recommended to the editors. A set of technical issues and comments for the paper are provided here: 1. If it is possible, try to reconcile the 1-d topographic profiles used in Figure 1&2 and Figure 3&4 as a single dataset/profile. Illustrating the points in the context by jumping back and forth between two examples is confusing. For example, the majority of Section 3.4 Hierarchy Construction is explained with the case presented within Figure 3 and 4. Then in line 12-13 of Page 10, the authors suddenly refer to Figure 1 to illustrate some point. The thing is that the outlet key assignment is only given in Figure 3 and 4. Then the point the authors make ("As an example, in Figure 1, 5 drains into 8, but the cells that actually constitute the outlet will be labeled 2 and 6") is not that obvious to readers. 2. Figure 3(f) "an outlet of elevation 3" A specific elevation number ("3") suddenly appears without any indication in the context. If these numbers need to be maintained, please add a y-axis with labels to the subplot. Also, try to use different number formats (like with circles) to differentiate those representing the PQ popup order from those representing the spilling elevations of the outlets. 3. Page 7 Line 29-30 "Figure 3h-i depicts the front of a traversal, in this case, expanding the area that is defined as OCEAN. We discuss both possibilities below." The placement of this sentence seems odd. It is not closely connected to previous statements in this paragraph, which explains cells assigned with given depression labels. 4. Page 8 Line 23-24 "If any entry for an outlet is already present, only the outlet of lower elevation is retained; this is important, as it allows for the realistic case of multiple spillways that exist between two depressions." This statement seems contradictory. The former part states that the value of the lowest joining cell will overwrite the value in the hash map as the outlet value. Since the value of this hash map is a single value instead of an ar-

ray. How can it keep track of the multiple-spillway case the authors discuss in the later part? 5. Page 8 Line 24-25 "but the one-dimensional elevation profile in Figure 3 cannot depict the case of multiple outlets of different elevation." Then can you add a figure of a two-dimensional domain to clarify the multiple outlets case? 6. Page 8 Line 28 "assigned each of them a flow direction" As a byproduct, the flow directions are rarely discussed during the depression assignment process, which is understandable. The only place I saw that flow directions were mentioned is in Line 10 (P8): "Flowdir(n) is set to point to c". If I understand it correctly, in this way, the flow directions are assigned locally, which means each cell will drain to the lowest local pit following the assigned directions. This point needs to be emphasized here because they are different from the typical flow directions we have seen draining water to the ocean. 7. Page 9 Figure4(d) "Were M part of another depression (call it 6) that had previously found an outlet to the ocean, then 5's parent would be the depression identified by the label of M, which would be a leaf of the tree rooted by 6. This would ensure that 5 would drain into the bottom of 6 before overflowing out of it." An actual figure could be helpful to illustrate this hypothetical scenario. If the authors think it's not necessary, remove this statement should be fine. 8. Adding a reference to a draft in preparation is not acceptable. Please remove the reference to "Barnes, R., Callaghan, K., and Wickert, A.: Computing water flow through complex landscapes, part 3: Fill-Merge-Spill: Flow routing in depression hierarchies, In preparation, 2019."

Interactive comment on Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2019-34, 2019.