Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-261-RC2, 2021

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "LUCI-EntEx v1.0: A GIS-based algorithm to determine stream entry and exit points at boundaries of any given shape" *by* Bethanna Jackson et al.

Anonymous Referee #2

Received and published: 5 May 2021

The paper describes the LUCI-EntEx v1.0 algorithm for the preprocessing of DEMs, automatic identification of intersections between the river network and the boundary of the study area and classification into entry and exit points. The algorithm also allows to determine if the overland flow on the boundary cells enters or leaves the catchment. The algorithm is in the form of a toolbox for ArcGIS and has been developed both as a standalone tool as well as embedded into LUCI v0.9. The paper presents the application of the toolbox to two farms and two catchments in New Zealand, and compares the standalone version vs the version embedded in LUCI v0.9.

The tool for identification of entry/exit points is novel and can be useful to simplify

Printer-friendly version

Discussion paper

geospatial analyses. The paper is overall well written, describes the algorithm in detail and presents the applications in a logical order. However, I think that the structure of the paper should be improved and that several aspects should be clarified, to clearly state which parts of the code are new and which have been taken from previous models. Also, some analyses should be improved, especially that of the net impact of the farm on the water quality, and the scientific context of the proposed applications clarified. It is not stated which research questions the authors want to address with the comparison between LUCI v0.9 and LUCI-EntEx v1.0, and between the 15m and 5m DEM application on the Mangatarere catchment, and which conclusions are drawn from them. I think that the paper would also strongly benefit from a discussion section separated from the results, where these scientific questions are addressed.

Main comments:

- It is not clearly stated if the "pre-processing DEM" algorithm (Fig. 1) has been developed in the context of this work, or has been taken from the LUCI v0.9 model.

- LUCI EntEx v1.0 is freely available and open source, but it requires ArcGIS which is not free. I think this diminishes the meaning of LUCI EntEx v1.0 being open source. What is the reason for developing the LUCI-EntEx v1.0 for ArcGIS and not QGis, for example? To which extent can the algorithm be adapted to QGis?

- Fig. 11 to 14 show that the upstream contributing areas need to be modelled in order to have accurate results from the algorithm, i.e. the algorithm is sensitive to the dimension of the buffer around the study area. Isn't this result expected? What is the scientific question you want to address by comparing the application including the upstream area (panels b) vs the 2-pixel buffer (panels a)? I already expect that omitting the upstream area will provide a much less precise solution. Is there any case in which omitting the upstream area could still be a meaningful choice?

- For the farm applications (Fig. 11 to 14) could you provide a map of the entry/exit

points manually identified from the on-ground stream network, to validate the algorithm and the thesis that the panels (b) of the figures are more correct? It is easy to expect that the algorithm is helpful in identifying entry/exit points from large catchments, but does it really provide an advantage to manual mapping in the case of farms? Especially given the sensitivity to the modelled upstream area, and likely other parameters too.

- Table 1 and 2: in lines 13-16 p. 20 the authors say that they want to estimate the net impact of the farms on the nitrogen loads, but in Table 1 and 2 only the loads at the exit points are shown, which is not sufficient to quantify such impact. To quantify the impact, the loads at the entry points should also be reported, and I also suggest to add a line at the end of the table to show the net impact of the farm (difference between total exit loads and total entry loads). Only with these data the underestimation of the net impact when not considering the upstream contributing areas can be quantified.

- It is not explained what the authors want to show with the comparison of the model application with the 15m and 5m DEM for the Mangatarere catchment in Section 3 (Fig. 15), as well as what are the conclusions drawn from it.

- Theoretically speaking one should not expect to find entry/exit points along the boundary in the case of self-contained catchments, however there can be mismatch between catchment masks and physical boundary, as the authors mention at page 22. Could you provide some examples of concrete situations/conditions in which such points should be expected? And therefore, when the application of LUCI-EntEx v1.0 at the catchment scale is recommended.

- I think that some context about the LUCI framework and its relationship with LUCI-EntEx v1.0 is missing. Currently, it is partially explained at page 14, but still several aspects are missing: what are specifically the differences between LUCI v0.9 and LUCI-EntEx v1.0 in the derivation of the stream network? What is the reasons for such different choices in LUCI-EntEx v1.0? At the moment, the motivation for the comparison between the two models is not explained. Could you discuss how these affect

the stream networks shown in Fig. 11 to 14? What should the user keep in mind when choosing to use LUCI v0.9 or LUCI-EntEx v1.0?

- What is the advantage of having LUCI-EntEx v1.0 as a standalone tool compared to the same algorithm embedded in LUCI v0.9?

Specific comments

Introduction:

- I think the clarity of the paper would benefit from a more structured anticipation of the content of the sections at the end of the introduction: how is the new algorithm used to estimate the net impact of farms, mention that you will look at nitrogen concentration with LUCI and explain why you chose this pollutant, introduce that you will compare the application including the upstream area VS small buffer, and the 15m and 5m DEM, and why such applications are of interest.

- Also introduce briefly what LUCI is and explain that in this paper a part of that code will be used and further developed to create a standalone tool, and the new component has also been embedded in LUCI. And that you will provide a comparison between the two

- Add a literature review to support your thesis that this algorithm complements the available GIS tools, if and which other similar tools are present, and what is the advantage provided by this new algorithm.

Section 2:

- Line 15 page 3: here it should be specified that the input stream network is an independent ground-measured one. I did not understand the meaning of having it as an additional input file, given that it can be derived from the DEM, until page 4.

- Fig 1: in the caption it is said that the procedure has been taken from Maidment

(2002). Please cite this source also in the description of the preprocessing of the DEM in the main text. Now it is present in line 17 p. 4, but not as the source of the preprocessing procedure.

- Figure 2: why is there (a) in front of “Burn streams into the DEM”? If it is to say that this figure is a sub-process of Figure 1, I would add the same (a) after “Burn streams into the DEM” in the yellow box in Figure 1. If this is done, please also do the same for Fig. 3 and 4 for the “Find if intersection points are entry or exits points”

- All flow charts: adapt the dimension of the rectangles/diamonds to the length of the sentence to improve readability and to allow writing more complete sentences. Also the figure resolution should be increased.

- Fig 4: right arrow starting from diamond “Is starting point inside study area mask” is misaligned

- Fig 8: write FAC as fac (italics) coherent with the rest of the text and use the caption to provide a summary of the described process

- Fig. 9: use the caption to provide a summary of the described process

Section 3:

- Lines 24-28 p. 14: this summary should be come earlier in the text (at the end of introduction or the beginning of the methods)

- Line 27 p. 14: Nitrogen is mentioned here for the first time. It would be better to introduce it earlier and motivate why it is chosen for the modelling

- Lines 29, 30 p. 15: is that the procedure described in section 2 “preprocessing of the dem”? If so, refer to the section for clarity

- Line 30-31 p. 15: I do not understand what you did here. Is that a comparison of LUCI-EntEx v1.0 with an established ArcGIS tool? If so, how does the ArcGIS tool compare with LUCI?

Section 4:

- Line 10 p. 16: “Applying the methodology above”, refer to the section where the methodology is described

- Line 5 p. 17: “reflects the fact that the accumulation . . .”, add “that”

- Fig 11, 12: remove the black lines around the figures and overlap the maps of the farm to the hillshade of the DEM as in Fig. 13 and 14

- Line 1 p. 18: “there can be instances where another tributary enters converges with the river just outside the farm boundary”. Did you mean “exits, “?

- Fig. 13: can you repeat in the caption the description of point 1 and point 10 in panel (b), and specify that point 5 in panel (a) is located after the convergence of the streams? Alternatively try to enlarge the figures to show it, for example by saving space removing one of the legends.

- Fig. 14 has the same legend as Fig. 13. You could instead use it to highlight some differences between Fig. 14 and Fig. 13.

- Line 2 p. 21: it is the first time that it is mentioned that the buffer is 2-pixels. Please specify it also in Section 3 in the description of the numerical applications

Code and data availability:

- Line 27. The link to the tutorial doesn’t work

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-261, 2020.