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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The importance of better mapping of stream networks using high resolution digital elevation models – upscaling from watershed scale to regional and national scales" *by* Anneli M. Ågren and William Lidberg

Anonymous Referee #2

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The authors used a novel national dataset of stream points and compared the location and total number of stream points with those on a property map and modeled stream maps based on a lidar based digital elevation model using different stream initiation thresholds (thresholds in accumulated area). This work is important because most stream maps under-represent the total stream length; the use of maps that do not depict the stream network correctly leads to large errors when upscaling riparian length or CO2 evasion from streams. However, very few results are shown in the manuscript (just one example map) and there is almost no discussion of regional differences in the op-

timal stream initiation threshold. As such the manuscript doesn't reach its full potential and doesn't highlight the novelty of the study well. Also, the discussion remains largely limited to comparisons with a more detailed study in the Krycklan catchment, while other (international) studies could be mentioned here as well. Furthermore, there is no discussion on how the DEM pre-processing steps affect the results. The manuscript contains relatively many typos and some awkward phrases and would have benefitted from a careful round of editing before submission. For example, with 'headwaters' sometimes the catchment and other times the streams are meant. Similarly, it is not always clear for 'streams' if the simulated streams based on the DEM, the streams from the property map or the stream points from the NILS dataset are meant. This is confusing and could easily be solved with clearer writing. Some of these are highlighted in the attached pdf.

Specific comments:

Abstract:

P1L16: Mention the Nils dataset in the abstract. Now it is not clear from the abstract to what dataset you compared your modeled stream networks.

P1L21: You don't really illustrate the effect of the stream network on upscaling aquatic research or climate research but rather your results show that these upscaling results depend on which stream network are used. A bit more careful wording is needed here. Also, what is meant with 'upscaling climate research'?

Introduction:

References to studies that compared stream networks on maps and actual stream networks seem to be largely missing. Because this is exactly the topic of this paper, this is strange and makes it more difficult to judge the novelty of this research. For example: âĂć Brooks RT, Colburn EA. 2011. Extent and Channel Morphology of Unmapped Headwater Stream Segments of the Quabbin Watershed, Massachusetts1.

JAWRA Journal of the American Water Resources Association, 47: 158-168. DOI: 10.1111/j.1752-1688.2010.00499.x. âĂć Russell PP, Gale SM, Muñoz B, Dorney JR, Rubino MJ. 2015. A Spatially Explicit Model for Mapping Headwater Streams. JAWRA Journal of the American Water Resources Association, 51: 226-239. DOI: 10.1111/jawr.12250. âĂć Fritz, K. M., Hagenbuch, E., D'Amico, E., Reif, M., Wigington, P. J., Leibowitz, S. G., Comeleo, R. L., Ebersole, J. L., and Nadeau, T.-L.: Comparing the Extent and Permanence of Headwater Streams From Two Field Surveys to Values From Hydrographic Databases and Maps, JAWRA Journal of the American Water Resources Association, 49, 867-882, 10.1111/jawr.12040, 2013.

Methods:

P4L8-10: More information needs to be given for the methods used to create the NILS database. This is the data to which your modeled stream networks are compared. It appears to be a very novel dataset that makes this work novel but almost no information is given on it (and what is written on it is not clear until one looks at figure 2).

P4L14: Quantify this movement and snapping of the streams. For what fraction of the sites was this the case? To me the 20 m distance seems a lot considering the 200 m line segments, particularly for flat areas where streams are not incised. Please comment on the effect of this step here (and in the discussion!).

P4L29/P514: Is the property map really the most logical map to look for streams? Add more information on how this map was created.

P4L29: Didn't you use any smoothing or the filling of the DEM before creating the stream networks based on the D8 method? Also, I have the feeling that there is a bit of a circular work flow here. First you use the stream map to adjust the DEM (burn in the streams), then you use the adjusted DEM to simulate where the streams are, and finally you compare the simulated stream network with the original map that you used for burning the streams into the DEM. Doesn't this burning of the stream network affect the simulated stream network and especially the number of FPs and FNs? This is not

mentioned nor discussed anywhere.

P5L6: Please describe why you used the D8 method and not the DMinf method. Generally the D8 method leads to many "parallel streams" in headwater catchments and this would significantly affect the number of streams. Please justify the choice of the D8 method and discuss this in more detail.

P6L2: Some background information on the statistical methods used would be useful. Not everyone is familiar with OPLS-DA.

Results:

Almost no results are shown in the results section. Figure 2 is nice but it would be interesting to show this for more locations (e.g., a site in the north and one in the south, a flat site and steep site, etc.). Also maps with the NILS sites and the fraction of correctly mapped stream points, FP and FN for these points would be very useful. Now the results are very thin. I think that the work is interesting and that it uses is a unique database but none of the regional variability in the modeled stream networks nor the goodness of fit of the simulated networks is shown. This information needs to be shown to understand the residual analysis. Almost more results are described in the discussion section than in the results section.

Discussion:

The discussion is very limited and focused on comparisons with a previous study of the authors in the Krycklan catchment. Other studies could and should be referenced in the comparison of the modeled and simulated stream networks as well (see comment for the introduction). Also, I would have expected some discussion of the trade off between the number of FPs and FNs but it seems that the authors advocate optimizing the FP. Is this really the best from a management point of view? or would too many FNs mean that the maps won't be used at all. Some discussion of this trade off would be useful.

It would also be useful if there was more discussion on the regional patterns in the goodness of fit of the simulated networks. I realize that the focus is on finding the national scale optimal stream network initiation threshold value but there must be large regional differences that are interesting to explore. Not knowing what these regional differences are makes it hard to appreciate the value of having a national average stream initiation threshold value.

Finally there is almost no discussion of the effects of the uncertainties caused by the methods or the DEM pre-processing steps, e.g. the burning of the stream network or the snapping of the streams. P9L16-29: The down-valley changes in topography are important as well. See: Prancevic, J. P., and Kirchner, J. W.: Topographic Controls on the Extension and Retraction of Flowing Streams, Geophysical Research Letters, 46, 2084-2092, 10.1029/2018gl081799, 2019.

P10L21-29: I find this a bit of a long stretch. Wouldn't you use for something local (and expensive) like building a road local knowledge and field observations or more detailed maps than a national scale stream map derived from a national average stream area initiation threshold? I can see the advantage of a national scale map for up-scaling biogeochemical fluxes or the size of riparian corridors or many other things but not for local road construction.

P11L4: But this doesn't take all the FNs into account and thus uses the wrong stream length/points as well. Shouldn't you at least mention that this would cause an over-estimation of the total length? Admittedly this effect is small compared to the huge uncertainty due to using the stream map with far too few streams but it should at least be acknowledged.

Conclusion:

The conclusion doesn't highlight the novelty of the research well.

Please also note the supplement to this comment:

https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-34/hess-2019-34-RC2-supplement.pdf

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