

Interactive comment on “Delineating wetland catchments and modeling hydrologic connectivity using LiDAR data and aerial imagery” by Qiusheng Wu and Charles R. Lane

Anonymous Referee #1

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Manuscript: Delineating wetland catchments and modeling hydrologic connectivity using LiDAR data and aerial imagery

General Comments

This manuscript addresses an important area of research, improving our ability to model and map hydrological interactions between wetlands and streams. It is well written and creative in its integration of methods, however the paper becomes a little confusing and muddled in interpreting whether theoretical or actual connectivity was modeled. In addition the inundation map does not appear to be validated. General and specific comments are below.

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1) The Introduction provides a strong background of the PPR, but could be strengthened by clarifying the novelty of the approach. Right now this is limited to stating that few studies of prairie wetlands have treated wetlands and catchments as integrated units and lidar is rarely used at broad scale but no citations are offered. Has this approach been used in other wetland landscapes, just not in the PPR? Or is this approach actually quite novel? What about related studies that have mapped wetland depressions and/or delineated wetland catchments? How does this approach fit in with those studies? Adding just a few sentences to discuss this would help contextualize the work presented.

2) Right now the last paragraph of the introduction is essentially a summary of what the paper did, but it would be stronger if the authors added what the goals, objectives, or research questions were. . .for example, our goal was to demonstrate a method to map potential hydrologic connections between wetlands and the river networks. . .

3) In calculating flow paths it is sometimes acknowledged that these are potential and sometimes stated that temporary and intermittent flowpaths have been identified. It should be made clear that these are potential hydrologic connections that are identified via the flowpaths, as it is not shown currently in the paper how or if active flowpaths are or could be distinguished from inactive flowpaths. However, the authors also mapped inundation and depressions, couldn't these be used to determine which depressions were connected? It isn't entirely clear if this is what is presented partially in Figure 10 or not.

4) It does not appear that the inundation map has been validated. Because of a lack of date match between the NAIP imagery and the LiDAR collection date, the NAIP imagery, appropriately, is primarily used to show that surface water changes over time. I realize it is challenging to validate maps classified from high resolution imagery but given the nearby Cottonwood site which monitors water levels at multiple ponds, are there field-measured water levels collected at a close date that could be used to help validate the inundation map?

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5) I think the conclusion that dry NWI wetlands are likely no longer wetlands is a bit of a stretch. The PHDI does not consider snowmelt and is just based on rainfall and temperature, as the LiDAR collection was in October it is entirely possible that a large number of these wetlands are temporarily wet for few weeks in the spring following snowmelt. I don't think you can assume that these NWI wetlands no longer function as wetlands given just 1 fall date of inundation, even if in a wet year.

Minor Comments Line 27 – grammatical error, change “highly” to “most” and modify sentence to avoid using “as” twice.

Line 32 – awkward sentence, change to “the potholes range in size from”

Line 34 – the term ephemeral is more commonly used for streams, the term “temporary” is more commonly used for wetlands.

Line 37 – remove the word “as”

Line 39 – conterminous is misspelled

Line 94 – change to “collected in late October”

Line 97 – add space between in and 15.0 cm.

2.2. LiDAR Data – I realize you mention this in the Discussion, but it would be helpful to also add quick comment here regarding how wet October 2011 was and how this may have influenced the resulting DEM.

Line 126 – change “these” to “the”

Comment - In the Methodology section change from present tense to past tense.

Line 215 – add the word “of” between number and upslope.

Section 3.2 – I'm assuming to use the contour approach you need to convert the DEM to vectors. . .is any information lost in this process? . . .why not just use a raster-based approach to find depressions?

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Section 3.4 – In calculating ponding time, are you assuming no infiltration? If so, add this as an assumption to the text.

Section 3.4 – Does the water storage capacity, and in turn the ponding time equations assume the depression is dry to start with? How is the pre-existing water in the depressions dealt with? This is particularly an issue for permanent wetlands.

Comment – what was the range of rainfall intensities that were added to derive the ponding time estimates?

Line 287-310 This paragraph is methods and should be moved to the Methods section accordingly.

Line 303-304 – What about inundation in streams that may not have been mapped as depressions, would these inundation objects be lost given this filtering step?

Section 4.2 How common was it for wetland depressions to be nested within a larger catchments? Is there a way this nested hierarchy could be quantified or showed?

Line 362-363 – Although the findings are based on a much larger sample size, they are also all derived from a single watershed, so the results may also be site specific.

Section 4.3 – The flow paths are potential flow paths, however, right? Water may not have flowed along a fraction of them to date. This should be made clear in the text.

Line 384 – remove “the” before late October

Line 385 – add “a” after such.

Line 388-389 - revise sentence to “A substantial number of inundated NWI wetlands were found to coalesce with adjacent wetlands. ...”

Line 402 – Do you mean you “could” use it if a dry-period LiDAR was available?

Line 384-406 – This is a good discussion of an important issue but it is not entirely clear how this issue affected your findings in this case. I would guess that you likely

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under-estimated the number of depressions that coalesced?

Line 404-405 – As far as I can tell, however, in this case you did not use the time-series or wet inundation to evaluate or summarize fill-and-spill patterns. Is this correct?

Line 425 – Can't use the word "accurately" if no validation was done.

Line 433 – Add "potential" before hydrological connectivity.

Line 435 – I am struggling with this statement which is used several times throughout the manuscript. Although temporary or seasonal flow paths were likely identified, flow-paths were also likely identified that never actually carry water. How can we distinguish between these or can we?

Line 439 –Add what the specific limiting factors have been with traditional remote sensing methods.

Table 1 – remove extra spaces between Freshwater and Emergent.

Figure 5, 8 and 10 – I would add a basic color to the histograms, maybe light gray? To improve the aesthetics.

Figure 6 – Modify x-axis to just show year

Figure 7 – the yellow and blue lines are hard to see, maybe making them a little thicker might make them more visible.

Figure 10 – This figure gets at several questions I had. Was connectivity calculated so that all wetlands connected to each other and eventually to a stream? And this is then the length distribution of those flowpath lines? If so it should be indicated that these are potential connectivity. What does connected wetlands mean here? Are these just the coalesced wetlands?

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