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Interactive comment on "Soil surface roughness: comparing old and new measuring methods and application in a soil erosion model" *by* L. M. Thomsen et al.

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As new methods to capture shapes of surfaces become available, a comparison of these methods is valuable and necessary. Thus, the objective of the paper is highly significant. In my opinion, parts of the paper are written very well (introduction, parts of methodology) but the remaining parts are not precise enough. There are some ambiguities or even contradictory passages, which will be addressed in the following paragraphs.

1 Mixture of soil roughness categories

In the introduction, four different categories of soil roughness are defined (p. 983, lines 5-13). This subdivision into different scales is nice and necessary, as different scales of roughness influence different aspects of (surface) runoff processes. The authors decided to focus on random roughness, the second category, which is plausible considering the application of the metric in LISEM. In the rest of the text, it seems like the authors did not manage to keep up this focus for all measuring methods and, even worse, the focus is different for the different methods:

- For the chain, the direction of cultivation has been respected (p.986-987, lines 27-3). Thus, this method really focuses on category 2 (random roughness, related so toil aggregates). Category 1 (micro-relief) does not influence the result, due to the joints' / link's length. Category 3 (oriented roughness) is filtered by respecting the direction of cultivation and category 4 (higher order roughness) is not visible for the chain at all.
- For the pin-profilers, the same statements are valid.
- For the remaining methods, only category 4 is filtered (according to section 2.3 Data processing, p. 989, lines 16-21), as the slope is removed by fitting a plane through the point cloud. But the oriented roughness, as shown in figure 2, seems to remain in the data.

Thus, the different data sets resulting from different methods take different scales of roughness into account.

From my point of view, the chain and pin-link should be used in both directions, as this component of roughness is also contained in the sensor method-derived RR. Or the direction of cultivation should also be considered for the point clouds, e. g. by estimating RRs for suitable subsets of the whole point cloud.

2 Oriented roughness and ponding

According to the description of LISEM's usage of RR, surface runoff occurs when surface micro-depressions overflow. Thus, the oriented roughness should be considered for non-isotropic surfaces, like shown in figure 2, depending on the slope's orientation, as the oriented roughness will result in ponding or not.

3 Outliers

In the text, different definitions of RR are mentioned (p. 983, l. 14-22): one removes the upper and lower 10% extreme values, the other one does not. The latter one is used according to these lines. However, later on the removal of outliers by application of the three-sigma rule is described (p. 989, l. 21 f). Has this removal been applied unsupervised / automatically or was the removed point set at least inspected manually? Depending on the amount of vegetation residuals and considering the given standard deviations, parts of the residuals will be treated as outliers or not. Is this stable?

4 Vegetation residuals

In section 3.1, the influence of vegetation residuals is discussed (p.993, l. 16 ff). From the description, it can be concluded that these residuals are included in the point clouds in some methods, in others not. The stereophoto seems to produce holes in the data set at these places (lines 22-25), while the Xtion Pro does not. Unfortunately, there is no comparison between these two methods and the laser for plots with residuals, the laser should be able to capture them.

5 Minor comments

- P. 982, l. 8: There should be a colon before "'the Xtion Pro"', not a semicolon.
- P. 982, l. 20f: "'Results from the LISEM model indicate that especially the roller chain underestimated the RR values and the model thereby calculated less surface runoff than measured."' I think this has been mixed up. Lower RR values should result in more surface runoff. Compare p. 996, l. 8ff.
- P. 983, l. 24: RR changes over time. Considering this aspect: Does it make sense, to use a runoff event from summer (section 2.5.2) while measuring RR in spring (section 2.2)?
- P. 984, l. 13ff: A short summary of the results would be nice.
- P. 986, l. 26ff: I do not understand how this description results in the numbers given in Table 1. Shouldn't there be exactly twice as much transects for the roller chain than for the pinboard?
- P. 987, l. 13: new method, new paragraph after [m].
- P. 993, l. 25: Why should this explanation also apply to the Xtion? Structured light is reflected by plants. They should be contained in the model. But plants are a problem for feature comparison in structure from motion / stereophotos. Have the point clouds been inspected or is the text only an assumption based on the distribution of RRs?
- P. 994, l. 7: "'Representative"': Considering the spread of values shown in figure 4, this specific plot shown in figure 5 seems to be at the very low end. Why is it representative?

- P. 997, l. 14: There are several free software products to derive point clouds from image sets, e. g. VisualSFM. Works even without markers.
- P. 998, l. 3ff: This sentence should be printed in red and blinking. I like it very much! :-)
- P. 1003, Table 1: Why is the number of points for forest and Xtion smaller than for stereo-photos? For harrowed and ploughed it is the other way round. Especially, as the Xtion is able to capture plants better than the stereophoto, like mentioned before in the result's section.

6 General thoughts

- The model assumptions of LISEM, which are relevant for this paper, seem to be empirical. Thus, they are derived somehow using measurements. Which method has been used to measure RR in this context? Is it possible that properties of the method to estimate RR are already contained in the equation?
- LISEM's relevant model assumptions are described in detail. I would prefer a more detailed description of the applied methods.

Interactive comment on SOIL Discuss., 1, 981, 2014.