Answer to RC2 (Anonymous referee), nhess-2021-13

General comments:

I read this paper with great interest. This paper test the validity of three strokes-to-ground-strike-points grouping algorithms by comparing the outputs of the grouping algorithms with the ground-truth data derived from high-speed video observations in several regions. As I said in my comments for part 1 (the companion paper), this validation study can help current LLSs to derive strike points data from their existing data and such product is going to be a very important parameter for lightning protection/lightning risk assessment. See additional specific technical comments below.

Specific Comments:

1. Since SMA is not available for all LLSs, I recommend authors add A4 (even simpler than A3), which uses distance threshold only to determine if a stroke is PEC or NGC and show the results of the simplest method as well, just for comparison.

=> The algorithm A4 as proposed by the reviewer has been indeed investigated by the authors. The reason for not including it in the manuscript is because its output does not vary much from the output of A1. This is not so surprising, since A1 decides between assigning a stroke as NGC or PEC based on a simple distance threshold. Only the SMA comes into play in A1 for calculating the GSP position as the weighted mean of the stroke positions in the GSP.

=> We would therefore opt to include a comment concerning "A4" and its output, rather than including it as an extra algorithm.

2. In this paper, the authors listed the performance of three algorithms using different distance thresholds. In order to ensure a high success rate, the selection of such threshold in all algorithms is strongly dependent on the location accuracy of the network. I think that might need more discussions. Hopefully, authors can come up with a general guidance/rule regarding how to select the optimal distance threshold with respect to the location accuracy (or even more parameters) of the network.

=> Looking at the change in success rate in Figure 2 for the different algorithms, one could conclude that adopting a distance threshold proportional to 3 to 5 times that of the mean LA results in the best success rate.

3. Can authors share any insights on why larger peak current are more likely to be correctly classified (PEC vs. NGC)? Possibly related to location accuracy's dependence on peak current? Do large peak current CGs always have better location accuracy?

=> The mean SMA for 1st strokes & subsequent NGC in a flash is 0.26 km, whereas it is 0.45 km for PECs for all data sets combined.

=> Combining the LLS information from the different data sets in this study it is found that the larger the absolute peak current of the stroke, the smaller the SMA is on average. Larger peak current strokes are reported by an increased number of sensors on average. The more sensors participate in a solution; the better the location accuracy will be of that particular stroke.

4. Table 1, it would be nice to also give years when the ground-truth datasets were recorded.

=> This will be included in a next version of the manuscript.

5. Line 116, I think here you are referring to "electric field change sensor/meter", or fast/slow antenna. Field mill is usually referred to as the electrostatic flux meter that monitoring electric field intensity at ground over a long period but with time resolution usually in one second.

=> Correct, this will be corrected in a next version of the manuscript.

6. My understanding is that in your ground-truth dataset, you only kept flashes with at least two return strokes detected by the LLS. Correct?

=> The ground-truth data sets include multiple stroke flashes as well as single-stroke flashes. However, since first strokes are (per definition) always correctly assigned by the different ground strike point algorithms, we have included in Table 2 the results when first strokes are excluded, i.e., results within brackets, and in Figure 3 we show results without first strokes as open symbols.

7. Line 172, "repeated until the mean GSP positions do not vary anymore" I thought it is repeated till the last return stroke was assigned.

=> The algorithm really ends when the GSP locations are stable, meaning no variation with the previous iteration, as has been described as such in the manuscript.

8. In this study, there is no flash grouping (group strokes into flashes) on the LLS end involved in this study because a flash was first defined by the high-speed video data and LLS data were searched for the flash. Is my understanding correct?

=> This is correct. The flash grouping is based on the video images. LLS data is then used to assign the location and other parameters belonging to the observed strokes. This will be stressed in a new version of the manuscript.

9. Line 190, please provide a reference for the scaling method

=> A reference is included at the beginning Section 4.2. "Algorithm 2 (A2)" to Campos et al. (2015, 2016). But it is indeed a good idea to reference once more to Campos et al. (2015) in which the ellipse scaling factor is clarified in more detail.

Line 110, Here I am providing two additional references on CG validation studies of NLDN using videos published in JGR, with titles: 1) Upward lightning observations from towers in Rapid City, South Dakota and comparison with National Lightning Detection Network data, 2004-2010. 2) A study of national lightning detection network responses to natural lightning based on ground truth data acquired at LOG with emphasis on cloud discharge activity.

=> **Those particular references will be included in a new version of the manuscript.**

Minor editorial suggestions:

2. Line 59: "By definition, the location of a flash is determined by that of the first stroke in the flash." This is probably true for some of the LLSs (like NLDN or EUCLID). Some use centroid.

=> **Correct, a comment to this issue will be included in an updated version of the manuscript.**

3. Line 87, What are "CC discharges"?

=> **Typo. Intracloud (IC) discharges are meant.**

4. Line 61, It is not clear to me what does subscript SG stands for.

=> **The same terminology and acronym has been used for the ground strike point density as defined in IEC 62858 Ed. 2. Indeed, one may wonder whether this abbreviation covers the name correctly.**

5. Figure 1, please label stroke no in (b), as you did for (a).

=> **This will be adjusted in an updated version of the manuscript.**