Title: Automating the analysis of hailstone layers

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General comments:

This article details a novel methodology for quantitatively and objectively analyzing hailstone growth layers to make inferences about their growth histories and trajectories and which can serve as a way to generate databases which hailstone growth model output can be compared and validated against. The paper is succinct and well-written and will be a valuable contribution to the field, helping to very-much address the large existing gap in hailstone observations and hailstone model validation. I have no concerns with the manuscript beyond the minor comments below and am glad to see such advancements being made.

Jacob, thank you for taking the time to review this paper and providing us with lots of useful feedback and ideas. Please see below our replies to individual comments in blue coloured text.

Specific comments:

L59**:** I am doubtful it would have affected the measurements appreciably, but can the authors include how long the time gap was between when the hailstones were collected and when they were ultimately sliced and photographed? I'm wondering mostly about the potential for (likely minor) sublimational losses while in the freezer, or how that may have affected at least the very outer layer of each hailstone.

Laboratory analysis wasn't performed immediately after collection, rather is was closer to three months afterwards. Hailstones were individually sealed inside plastic bags to limit sublimation, but some losses would have still occurred. The information has been added to the manuscript in lines 59-61.

L101: Regarding "80" and "25", is this on the 0-255 scale or normalized to a 0-100 scale?

This sentence has been expanded to clearly state that these values are on the 0-255 scale. Please see lines 102-105.

L102: Was the efficacy of the algorithm strongly affected by these find_peaks parameter choices (and, e.g., the 30%-of-peak threshold for consolidating layers) or is it relatively immune to the specific values chosen? The same question goes for the parameters applied to the consolidated smoothed radial on lines 115-117.

The find_peaks parameters are closely tied to physical properties of imagery, and thus are sensitive to changes in the values. For example, to detect dry growth layers, the local maxima threshold was manually selected such that the (stretched) lightness value is the transition between wet and dry growth, the prominence represents the minimum observed difference in lightness between wet and dry growth and the separation was selected as the minimum separation of dry growth layers that could be robustly resolved in the imagery. The methodology section has been expanded in lines 102-109 to document the physical dependence of the parameters and whether they need to be re-tuned for new datasets.

The second application of the find_peaks function is less sensitive to the choice of parameters, but would still require re-optimisation if the image resolution or bin width used in the analysis technique changed. This additional information has been added to the lines 124-125.

L135: Is my understanding correct that the “total wet growth fraction” is the % of cross-sectional area that is due to wet growth, and the “final wet growth layer fraction” the % of the cross-sectional area that is present in the outer-most wet growth layer? (Even if the outer layer is due to dry growth? Or in that case should it be 0%?) This was for some reason a bit confusing to me at first but was made clearer by the caption of Figure 6. Perhaps a brief explainer in-text of what is meant by each term may be helpful to readers.

Thank you for this suggestion. An explanation of these two metrics has been added to the text in lines 145-147.

L139: Is it known how well the oblate spheroid model fits (vs. an ellipsoidal model) for the 26 hailstones that were measured in 3D?

The mean difference between the equivalent dimension calculated from the spheroid and ellipsoidal models was -7.3 mm (standard deviation of 4.5 mm), indicating the lower-order oblate spheroid model has a bias towards larger equivalent dimension for this dataset (as you’d expect from the poorer fit). While this figure is somewhat large (~20% of the mean Deq), the consistent sign of the bias suggests the results can still be interpreted with some confidence. I’ve documented the mean bias in line 151 for the reader.

L149: I certainly understand and appreciate the uncertainty in so many of the parameters governing hailstone melting. Nevertheless, is it possible to add a brief sentence about how much melting might be expected under typical conditions for hailstones of different sizes? I’m thinking just an order-of-magnitude-style estimate. E.g., simulations in Ryzhkov et al. (2013a) show that for a 35-mm hailstone over 4-km only about 5 mm of ice core diameter is lost. This might help orient readers to how severe these impacts from melting might be expected to be regarding the true nature of the outermost layer of these stones.

Thank you for this suggestion. I can see the value in this, especially given the smaller hailstones in the collection. We’ve added this new information into lines 163-165.

Technical corrections:

L75: Missing closing parenthesis

L87: Move parenthesis to around year

L119: “if” should be “of”

L130: “a” should be “the”

Thank you for picking up these corrections. They have all been amended in the text.