This manuscript is quite practically focused on initial assessment of drilling locations for oldest ice, proposing and demonstrating that borehole optical logs of dust would be an effective method to estimate the age of ice back to 1.5 Ma. Overall, I find this to be a valuable scientific contribution worthy of publication. However, a few portions of the manuscript need to be clarified and a few more calculations/experiments would also be very useful.

We appreciate this evaluation and the very useful suggestions offered.

Needed clarifications:

1. Line 117-118: The meaning here is ambiguous about what the authors did to "correlate" the records and put them "on a common timescale." I think the intended meaning is that the records were sampled at common time steps in order to calculate the correlation coefficient between the signals. However, the phrasing could alternatively be interpreted as *stratigraphic* correlation that aligned the records to one common target timescale. Please clarify. If the records are all staying on their respective published timescales described in section 2, then a brief discussion of the extent to which these timescales are expected to agree or differ is warranted.
    A. Your reading is correct: the records were sampled at common time steps on their respective timescales. The sentence in lines 117-118 was meant to introduce the paragraph, not imply that the records were aligned to one common target time scale. We will reword this section to avoid confusion.
2. Like Eric Wolff, I found Figure 5 to be extremely confusing. The caption, axes labels, and legend don't seem to agree with one another. I think the blue line color was used for two different types of data. If so, the problem could be fixed by changing the line color for laser dust in panel c to another color that isn't already used for something else.
    A. We apologize for the error in the legend color that caused this confusion and will correct it in the revised manuscript. Per
3. The description of how the artificial dust record was created is not clear, particularly "scaling the smoothed record by random factors between 0.4 - 0.7 linearly interpolated between 500 kyr intervals" (line 186). An additional concern I have about this methodology is that the laser dust record for EDC shows a much weaker dust amplitude from 500-800 ka than 0-500 ka. Are depth-dependent processes contributing to the weakening of the dust signal in the ice? If so, it would be more realistic if your artificial borehole dust record progressively decreased in amplitude farther back in time rather than scaling randomly through time.
    A. We appreciate this suggestion. We will reduce the dust amplitude of the artificial record farther back in time and clarify the description.
4. It is very difficult to visually discern misalignment in the DTW results, which strengthens the manuscript's conclusion that DTW is not a suitable method for initial comparison between the borehole optical dust logs and the marine record. This point would be strengthened if the authors could find an additional way to illustrate the misalignment. For example, at the top of panel c, the artificial dust record could be plotted on its original, correct age model and arrows could be drawn to DTW results to show how dust peaks were misaligned.

A. The misalignment has been difficult to visualize so we appreciate this suggestion and will try it out.

Additional calculations/experiments:

1. The weaker correlation for derivatives of the log of the data than the log itself is worthy of a bit more discussion/exploration. I wonder whether this might be an artifact of small differences in the age models for each record. The derivative has higher frequency variability and is therefore more likely to be affected by small age model differences/misalignments. This might actually make the derivative more useful for alignment than the log itself. The correlation of the derivative may also be advantageous if it is less sensitive to long-term trends in the mean or amplitude of the signal through time. This could potentially be evaluated by improving the alignment between the records or by analyzing synthetic records.
    A. The sensitivity of the derivative to higher frequency variability might make it more useful for fine-scale alignment, but perhaps not for alignment on the scale of glacial cycles, which is our focus for this rapid dating method intended for use in the field. We will mention this in the discussion.
2. Was the alignment experiment for an artificial dust signal repeated multiple times with different random noise or only once? Multiple iterations would be useful for characterizing the probability of incorrect conclusions. Additionally, what if the correlation between UF1537 and dust ice were slightly lower before 800 ka (e.g., R=0.7 instead of 0.76)?
    A. Great suggestions. We will implement sensitivity tests for the artificial dust signal with slightly weaker correlation in the older part of the record.
3. Eric Wolff makes a good point about the need to detect ice disturbances that could produce repeated or jumbled sections of the dust time series. I recommend creating an artificial signal that contains jumbled or duplicated sections (from the modified marine dust record) to determine whether your proposed method would detect a misfit between the simulated disturbed ice and the original marine dust record.
    A. This is also a good suggestion and we will try it.