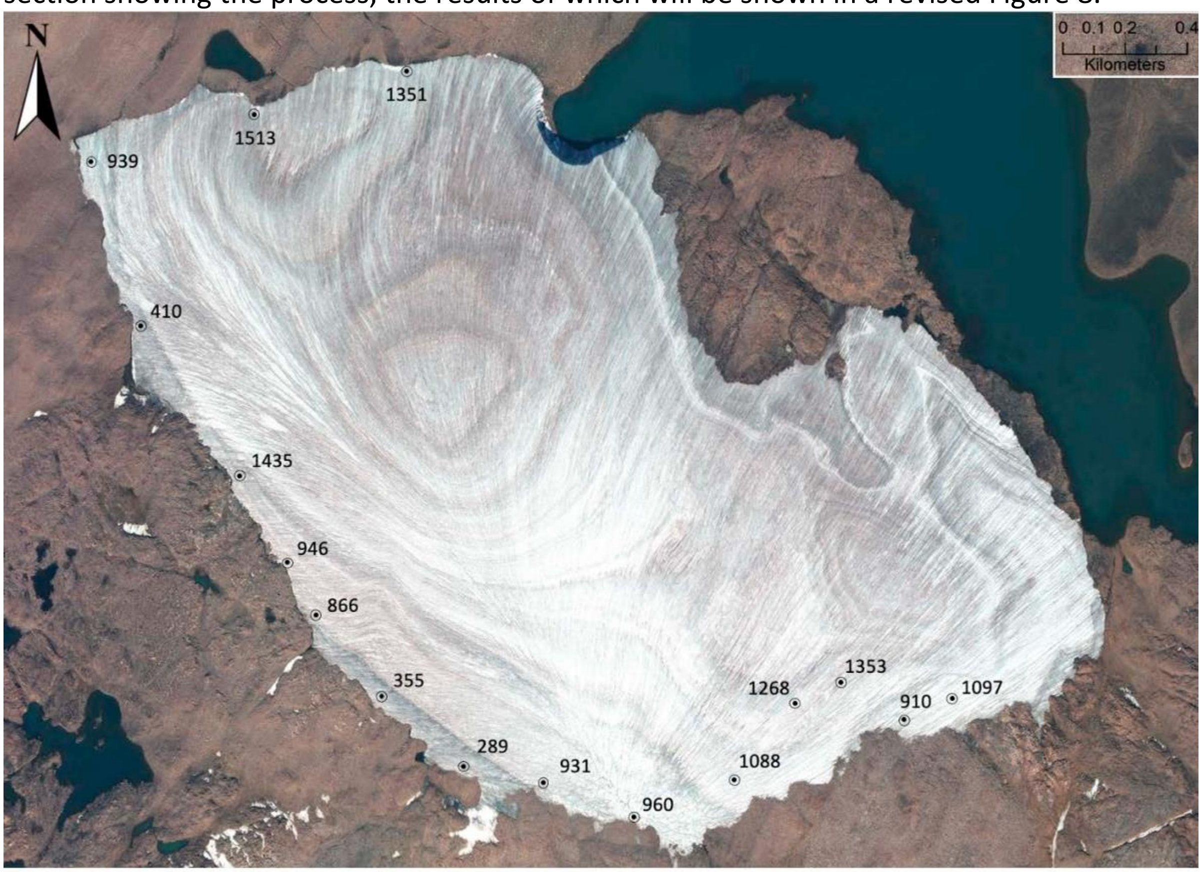
Response to Anonymous Referee #1. The authors thank the anonymous referee for their comments. G H Miller responds for the full authorship list.

An important initial issue raised by the reviewer is the way we tested for potential calibration bias in the ^{14}C ages, an issue which was also discovered in conversations between co-authors. John Southon reminds us that events take place in real calendar time not radiocarbon time, so to test for 14C bias we now use a set of calendar dates, rather than radiocarbon dates, spanning the 1500-year interval covered by our dataset (1-1500 CE). Then we take into account the fact that the measured 14C dates are not perfectly accurate by modifying each of those theoretical ^{14}C ages with a random draw from a Gaussian distribution with sigma equal to 20 years, the average of our dating precision for the moss ages.

That modified set of ^{14}C ages is then calibrated using the IntCal20 curve to convert those calendar ages into a set of theoretical ^{14}C dates - these are what the ^{14}C ages "should be", and the probability distributions summed to quantify any calibration bias, which is much less pronounced than shown in our original figure. The revised ms will include a supplemental section showing the process, the results of which will be shown in a revised Figure 8.



New additional Figure for Miller et al. "Moss kill-dates---"
Digital Globe image of one ice cap in the Orion Ice Complex (~4 km long axis) captured 20 Aug. 2015, shows moss kill dates collected in 2018 with their median calibrated age (CE year). The three early CE kill dates (289, 355, 410 CE) are situated beneath ice with distinctive surface characteristics that differ from the rest of the ice cap, consistent with an early CE ice expansion killing the moss, followed by partial retreat, and then subsumed by a late First Millennium episode of ice-cap growth, as well as Little Ice Age ice-cap growth, and now being revealed as ice is melting at all elevations. These small ice caps on nearly flat landscapes are frozen to their beds and exhibit little internal ice flow.

In lines 347-349 we note that ice-edge *in situ* moss ages collected in 2005 (site A) dated to ~1250 CE are older than *in situ* ice-edge moss collected along the same flow line in 2018 (site B) after ~200 m of ice recession dating to ~1450 CE. We interpret this apparent "anomaly" to reflect an ice advance ~1250 CE killing moss at site A, that was followed by at least 200 m of subsequent ice recession before a second advance killed the moss at site B, then advanced ~200 m to re-cover the moss at site A without disturbing the moss killed 200 years earlier. Given the common, near-perfect preservation of moss during ice advances throughout the region, it is not surprising that a readvance would equally entomb well preserve a "dead" moss as an "alive" moss. While "in general" dead moss are rapidly removed by running water, dead moss can remain in optimal sites away from running water. We remind readers that in this region the ice is not advancing by flow, rather by accretion of snow as snowline descends, which is then transformed into ice.

An alternative explanation for moss kill-dates of very different ages is illustrated by the newly added Figure (shown above) showing how an early CE ice expansion of the Orion Ice Cap receded partially, and was then subsumed by a subsequent snowline lowering and regrowth of a younger ice cap late in the First Millennium. As the entire ice cap is now receding rapidly, moss kill-dates from the ice margin in some instances differ by more than 600 years, with "dead moss" of equal "preservation-appearance" collected near each other at the ice margin yielded similarly different ages (289 CE and 931 CE), but strong contrasts in the ice surface demonstrates that the early First Millennium dated moss is emerging from beneath a different ice cap than the late First Millennium moss kill dates.

The bottom line is that all radiocarbon dates on ice-entombed moss provide a kill-date that defines when ice expanded across the site, killing the moss. The tight clustering of 186 "kill dates" into three narrowly defined time windows through the entire Common Era supports that contention.

Other Comments:

446: typo - I think "in" should be "is" here (**corrected**)

457: Be explicit about what the data are saying that the model is getting wrong here. **Text has been revised**

Figures 5, 6 and 8. I think it'd be very instructive to add a panel showing the difference between 2018 and 2005 data, highlighting what moss kill ages were exposed during recent retreat. **Fig 5 (ORN) and Fig 6 (SRP) do show all of the 2005 separately from 2018/19 collections showing a higher proportion of "older" dates have been exposed by recent recession, but that the combined results (bottom panel in each) looks very similar to either panels A or B.**

844: I couldn't readily find the Dewar lake data at that website. Could you provide a more specific link? **Historical Dewar Lakes climate data can be downloaded from this link:**
https://climate.weather.gc.ca/climate_data/hourly_data_e.html?hlyRange=1956-06-16%7C2023-06-15&dlyRange=1958-02-01%7C2023-06-14&mlyRange=1958-01-01%7C2007-09-01&StationID=1746&Prov=NU&urlExtension=_e.html&searchType=stnName&optLimit=yearRange&StartYear=1840&EndYear=2023&selRowPerPage=25&Line=0&searchMethod=contains&Month=6&Day=15&txtStationName=Dewar+Lakes&timeframe=1&Year=2023

Please add where the Hvitavatn dataset can be found.

Hvitarvatn varve dataset can be found in the online version of Larsen et al QSR 2011, https://doi.org/10.1016/j.quascirev.2011.05.026:
under "Appendix. Supplementary data - and GFZ Data Services.

References have been updated and will be included in the revised ms.