

General Responses:

We thank the three reviewers for their comments, and those who provided community comments too. We will respond to all comments individually but there are some general points mentioned in multiple comments that we would like to address, here labelled as General Responses 1 to 3 (GR-1 - GR-3).

GR-1: There is some confusion as to the purpose of this work; this work is an addition to the Varved Sediments Database (VARDA) as opposed to a data compilation exercise using the database. This was not made clear within the text and in the revised manuscript we now explicitly state that this data is a new addition to VARDA (Lines 15, 18, 60, 74).

GR-2: The Kernel Density Estimate plots are not meant to be a comprehensive overview of all known findings of the tephra layers, instead they are intended for use as a statistical and schematic diagram to highlight the future potential to better synchronise varve chronologies using tephra layers. We hope that further clarification in the caption of Figure 4 addresses this issue.

GR-3: The inclusion of tephra data into VARDA is not intended to be used as a new database for tephrochronologists; we aim that the inclusion of tephra data enables varve chronologists to better synchronise varve chronologies to an absolute timescale using tephra as an isochronous marker horizon.

Reply to Reviewer #4 ([://doi.org/10.5194/essd-2023-154-CC2](https://doi.org/10.5194/essd-2023-154-CC2))

Our thanks extend to Stefan Wastegård for constructive feedback. All comments were copied below, numbered them in order of appearance (CC2-1 to CC2-4). We hope to have addressed all concerns and improved the manuscript according to the suggestions.

CC2 - 1: I am not familiar with the VARDA database, but I question your decision to include Aspevatnet (not varved) and L. Storsjön (not Storsjom) as potential varve sites for the LGIT. Storsjön was under the Fennoscandian Ice Sheet during most of the LGIT and it would be better to mention south Sweden as a potential area for tephra in glacial varves, as in MacLeod et al (2014) and Devine (2020, PhD thesis).

Authors response: *We appreciate the feedback and agree that these sites would be unsuitable for tephra investigations for this time period. We have adjusted Figure 4 accordingly.*

CC2 - 2: Tephra distribution maps should be updated (see also comment by Carl Regnell). I don't fully understand how Kernel maps are constructed, but e.g. Laacher See Tephra has not been found in Latvia, and Vedde Ash and Askja-S not in Finland (not so far, anyway). I think that the maps are misleading and should include all known sites, not only sites in the RESET database.

Authors response: *We would refer here to GR-2 (page 1), which explains our intention for the KDE maps as a purely statistical approach to estimating tephra dispersal. We reiterate that the intention of the maps was to compare with the RESET database and the data as it stands on VARDA, but agree that we should have clearly stated in text the up to date known sites that were included in the KDE to begin with. We hope the revised text clarifies this point (Figure 4 caption).*

CC2 - 3: Some older references are missing, e.g. Merkt et al. (1993; Boreas) who found Saksunarvatn in four sites in north Germany, of which at least one sequence was varved. This paper could also be cited as an example of improved techniques for cryptotephra extraction along with Blockley et al. (2005) and Walsh et al. (2021). The manuscript has a focus on European deposits, which is understandable, but I think that you should cite the "classic" varve/tephra paper by Stihler et al. (1992; Geology) in the introduction.

Authors' response: *The Merkt et al., (1993) paper is a good example of a historic paper which underreports the geochemical data from tephra. In this instance the published dataset uses averages and there is no access to the complete dataset. Consequently, we have excluded sites like this from this new iteration of VARDA. We do however, take on board the acknowledgment of older papers that also improved tephra techniques in the past, and have included these in the introduction (Line 35, 37).*

CC2 -4 : Small comment: Zillen should be Zillén consistently

Authors' response: *We have corrected the spelling of the author name accordingly (lines 120, 123)*