**Supplementary Materials: Dynamic Time Warping to Quantify Age Distortion in Firn Cores Impacted by Melt Processes**

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**Supplementary Figure 1.** Prior to alignment with the dynamic time warping algorithm, firn density values were estimated by correcting for ice layers at sites G1–G9 (left panel, where the black data are the reported bulk density values, and the green data are the estimated firn density values). The firn density values were then interpolated to centimeter spacing (center panel) and all density values measured from layers estimated to be 90% ice or more were removed (right panel). Data shown here are from site G1 but an identical protocol was conducted for each site (G1–G9).



**Supplementary Figure 2**. The algorithm can also indicate intervals of unmatched values in the target record as a result of squeezing. Each candidate (G1–G8) max *t* alignment with the target record (G9) indicates numerous intervals where the target record time-axis was squeezed to achieve the best fit, all of which are plotted above by color. Taken as a whole, much of the record may have undergone some degree of alteration, leading to unmatched values between G9 and any one of the candidate records, and some intervals are indicated as potentially altered by many candidate records. Considering the proximity of these cores, these unmatched values indicate that there is considerable short-scale variability or alteration within these records.

**Supplementary Data**

The included Excel spreadsheet (*Hagen\_Harper\_SupplementaryData.xlsx*) includes all alignments reported in this contribution, with the following spreadsheet tabs: the max *t* composite (**t comp tab**), comparison between max *r* and max *t* alignments (**r vs t tab**), normalized alignments with the age model (**normalized age model tab**), non-normalized alignments with the age model (**age model tab**), reported ice layers (**ice tab**), and alignments between the max *t* composite and the age model (**tcomp-age tab**).