## Supplementary Figures

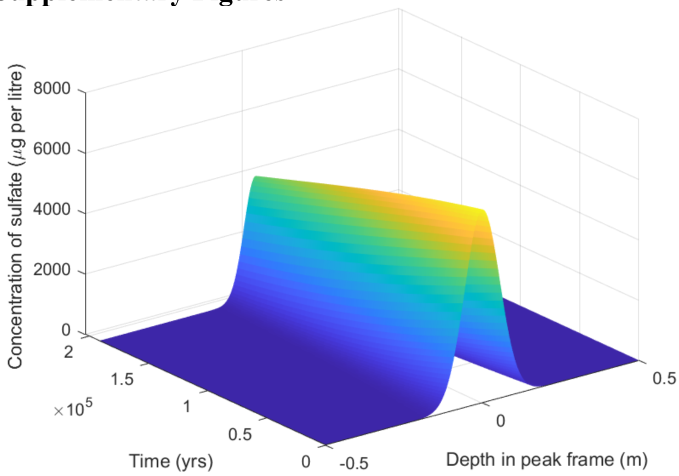


***Figure S1: Example of a modelled sulfate peak evolving through time as it undergoes thinning and diffusion. The peak height is decreasing through time due to diffusion but the peak is narrowing in the depth domain as the rate of thinning is outpacing the rate of diffusion.***

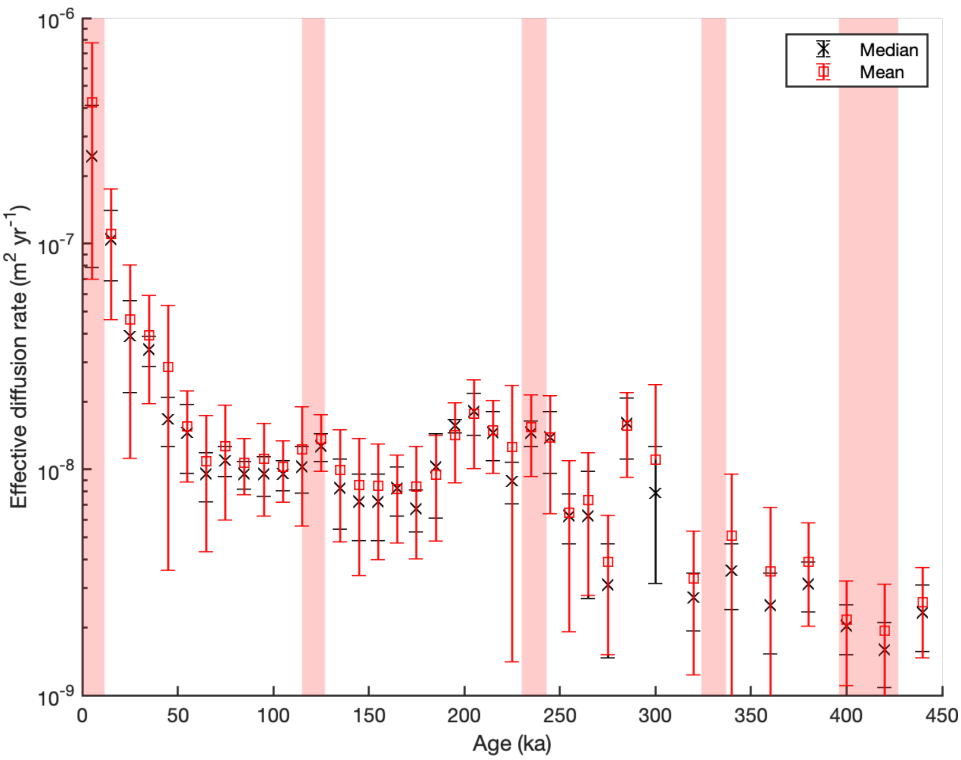


***Figure S2: Comparison of effective diffusion rate of sulfate for each time bin calculated as a median or mean. As Figure 3 in main text with the addition of means for each time bin (red open squares) and standard deviations (red vertical lines).***

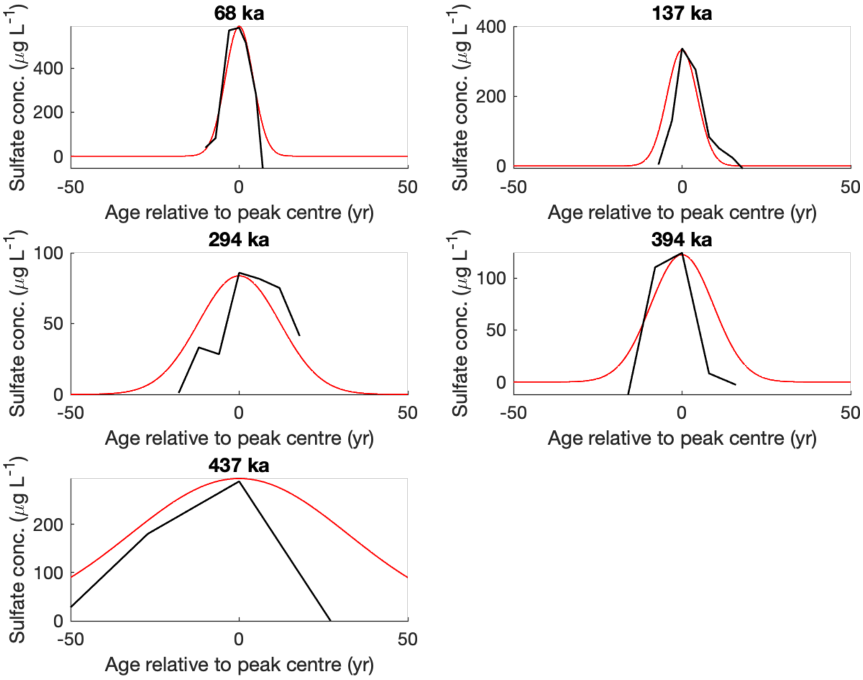


***Figure S3: Comparison of sulfate peaks in ice core with peaks produced by forward model. This figure is identical to Figure 4 except that the model result for each peak is produced using the effective diffusion rate specific to that event rather than the median value for the time bin.***

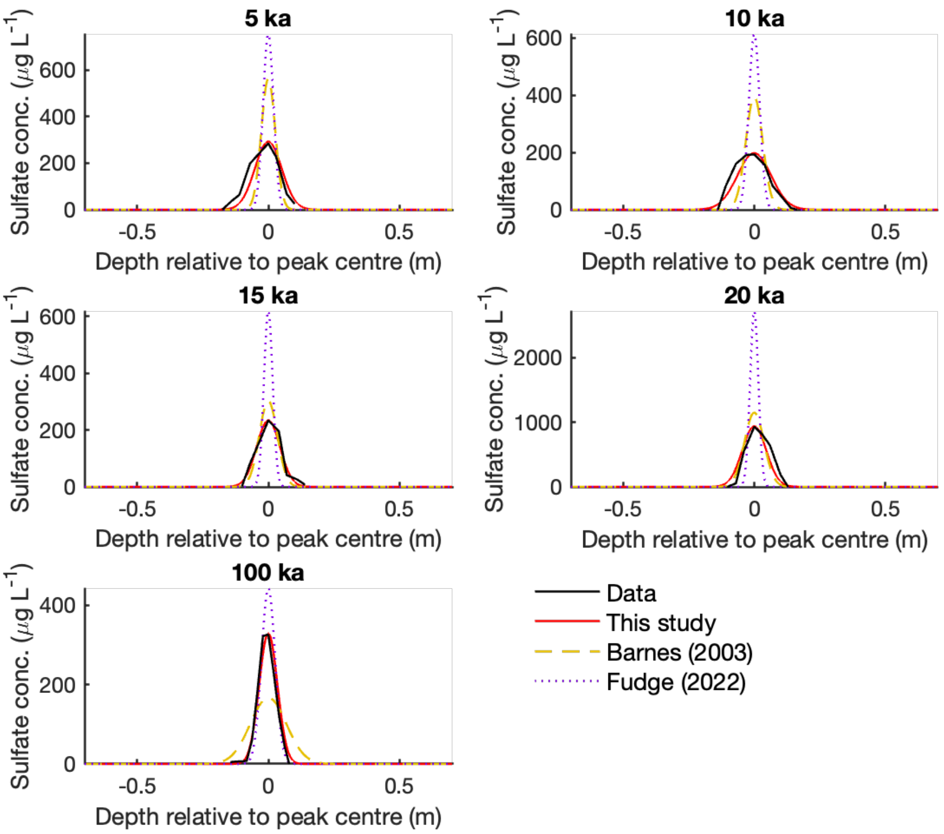


***Figure S4: Comparison of sulfate peaks in ice core (black) with peaks produced by our forward model using effective diffusion rates from this study and the literature. $D_{eff}$ values from this study (red lines) are specific to each event, rather than the median value for the time bin (but result but would similar – compare Fig. 4 and Fig. S3). Barnes et al. (2003) $D_{eff}$ (3.9 x $10^{-8}$ $m^2yr^{-1}$) is for Holocene ice only (gold dashes). Fudge et al. (2022) $D_{eff}$ (5 x $10^{-9}$ $m^2yr^{-1}$) is for 0-450 ka (purple dots).***

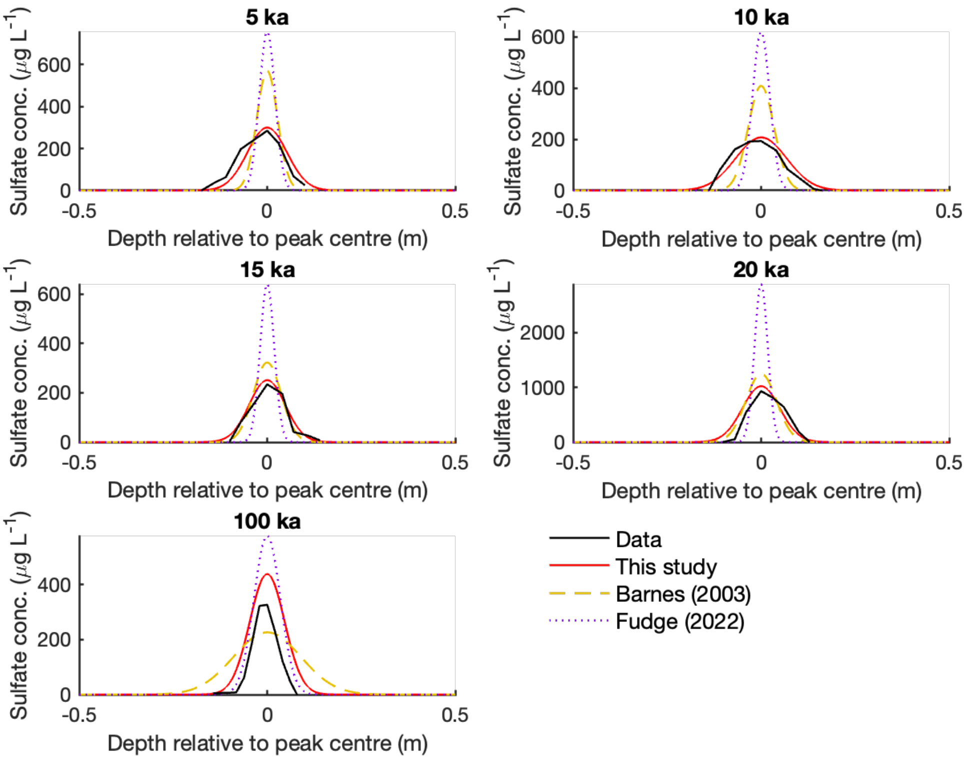


***Figure S5: As Fig. S4 but with no thinning applied. Each modelled peak is slightly wider in the depth domain relative to Fig. S4, reflecting the lack of thinning. Each peak's concentration is slightly higher relative to Fig. S4 because with no thinning is applied and so the sulfate concentration gradient is less steep, resulting in less diffusion. These offsets increase with depth/age as thinning of the ice sheet becomes more important.***