Supplementary information for:

Evolution of Maud Rise Polynya during the last 250 years – a multiproxy ice core reconstruction from coastal Dronning Maud Land, Antarctica

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1. Effect of water isotope diffusion

Polar ice core water isotope data are naturally smoothed by molecular diffusion processes in the top 60–80 m of the ice sheet (Johnsen et al., 2000). Diffusion in the firn attenuates high-frequency water-isotope information in ice cores. Diffusion length quantifies the statistical vertical displacement of water molecules from their original position and is based on accumulation rate, temperature, surface pressure, and strain rate at the drilling site (Johnsen, 1977; Johnsen et al., 2000). Our 122-m-long IND36/B9 core has experienced limited surface melt, with annual melt proportion varying between 0 and 4.4%, with a median melt proportion of 0.25% (Dey et al., 2023). We used diffusion-correction code developed by S. Johnsen, University of Copenhagen (Johnsen et al., 2000; Vinther et al., 2003) and made publicly available in Jones et al. (2023) which uses maximum entropy methods to invert an observed power-density spectrum. The determination of diffusive attenuation and correction arises from the observed frequency spectra themselves and therefore is entirely independent of firn diffusion and densification models. After diffusion correcting the isotopic data, the winter minima and summer maxima (used to define mid-winter and mid-summer) in the diffusion corrected data can be shifted slightly in depth as compared to the raw isotopic record. In our corrected record, this shift is less than 5 cm, which is within the sampling interval of 5 cm and therefore making it insignificant in altering the accuracy of the chronology. The diffusion corrected water isotope record is then further used for developing an age-depth model for the ice core.

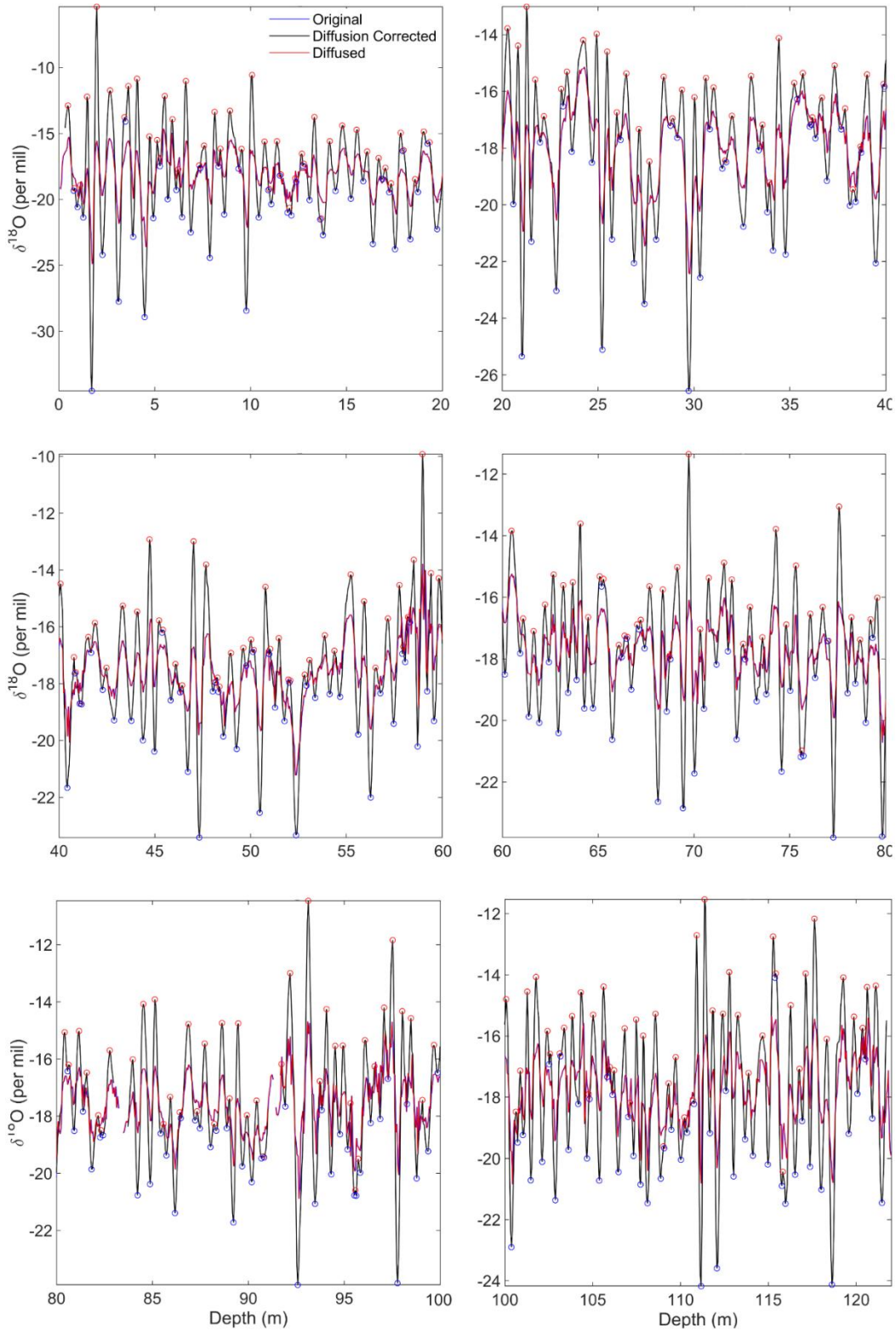

Figure S1 | Diffusion correction of water isotopes. Diffusion correction of $d^{18}O$ records (raw: blue curve; corrected: black curve) for the Djupranen ice core. Algorithmically identified annual maxima (red circle) and minima (blue circle) from the diffusion corrected record.

References

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