Supplementary Material

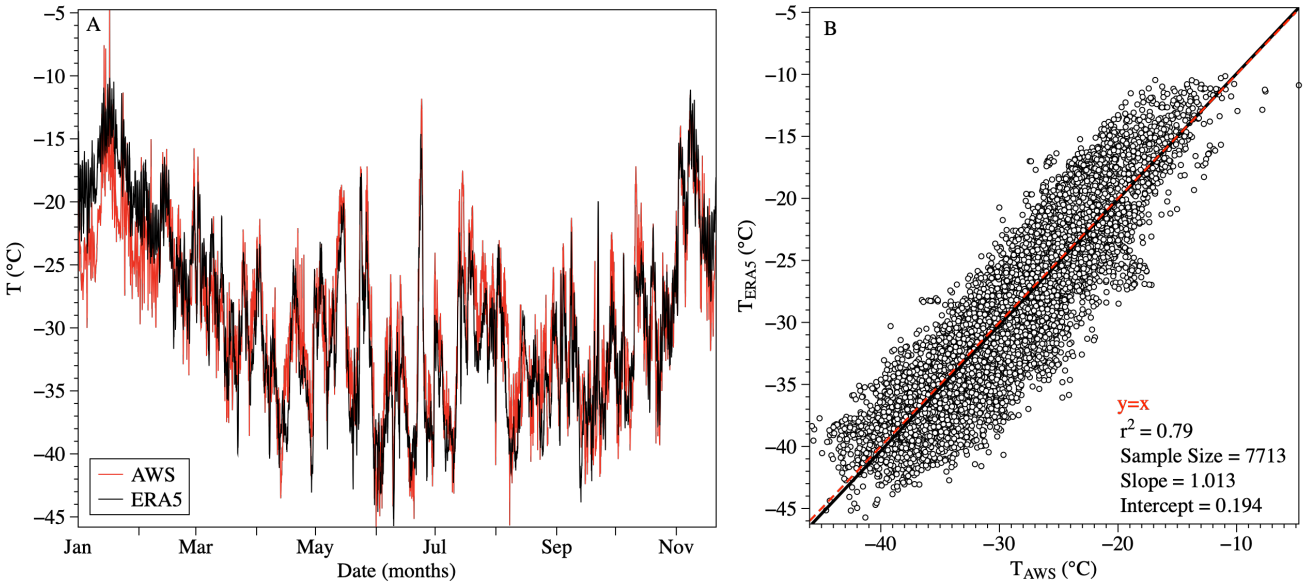

Figure S1: (A) Time series of hourly-averaged temperature data from ERA5 reanalysis (black line) and AWS observational data (red line) during the post-drilling period in 2016, covering the operational period of the AWS. The ERA5 dataset provides reanalyzed atmospheric data, while AWS measurements represent in-situ observations. (B) Correlation between the hourly-averaged temperature data from ERA5 and AWS.

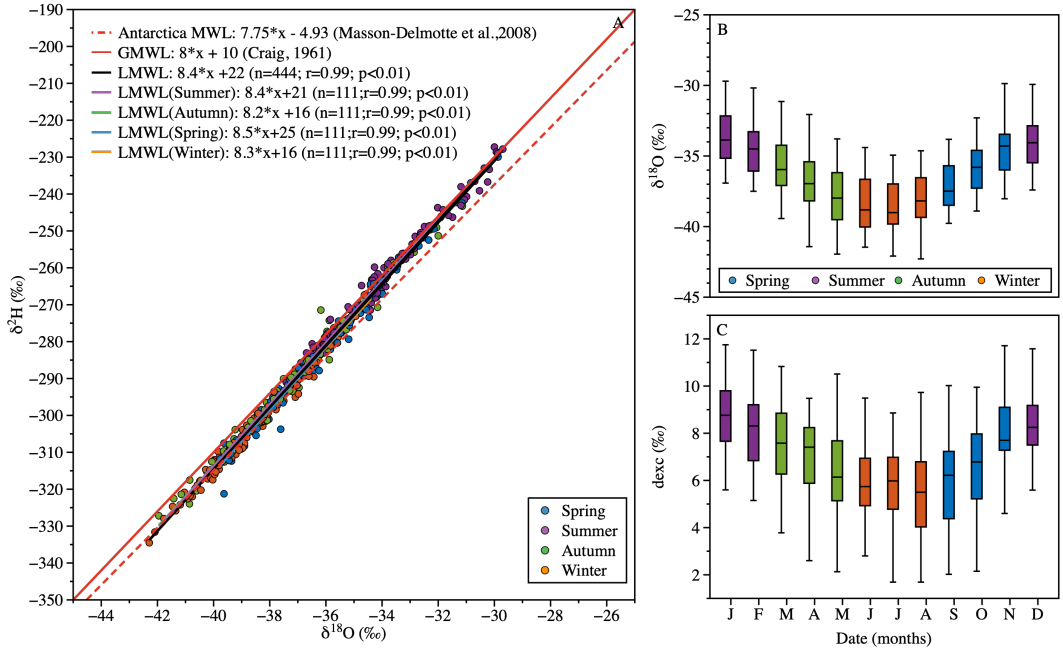

Figure S2: Seasonal variation in the isotopic composition ($\delta^{18}O$ and $\delta^{2}H$) of ice core at Hercules Névé. (A) Comparison of $\delta^{18}O$ and $\delta^{2}H$ values across four seasons and regression lines for each season's local meteoric water line (LMWL). Regression lines for the Antarctic meteoric water line (AMWL) and the global meteoric water line (GMWL) are presented for reference. (B) Box plot showing $\delta^{18}O$ values by month, categorized by season (spring, summer, autumn, and winter) at Hercules Névé. (C) Box plot showing deuterium excess (dexc) values at Hercules Névé by month and season.

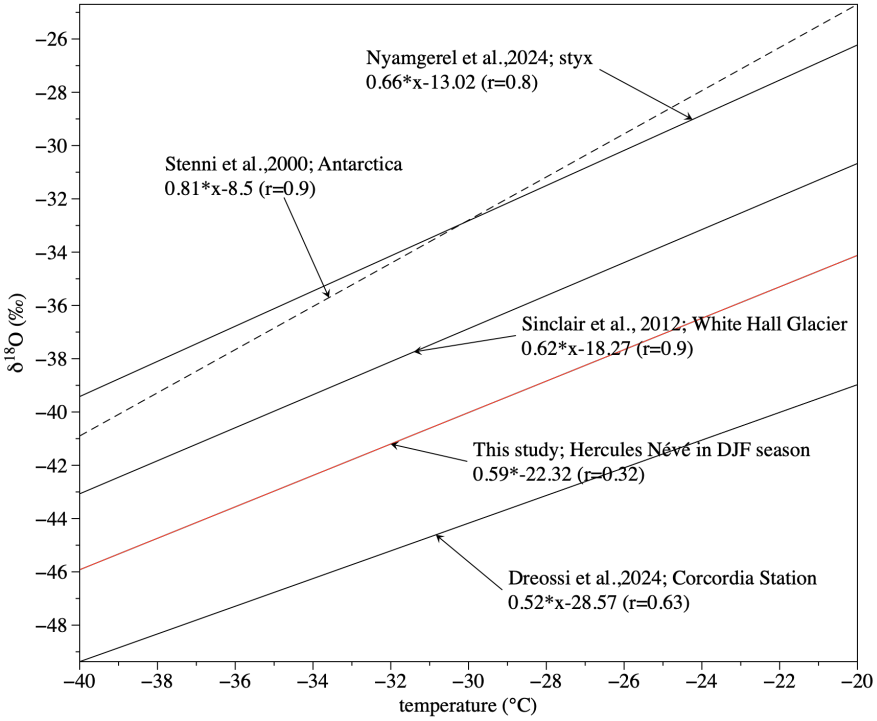

Figure S3: Relationship between $\delta^{18}O$ and temperature for various Antarctic studies. The linear regression depicts the correlation between $\delta^{18}O$ and temperature (°C) for different sites, including this study at Hercules Névé during the DJF season. The slopes and correlation coefficients (r) are shown for each dataset, with comparisons to previous studies from Stenni et al. (2008), Nyamgerel et al. (2024), Sinclair et al. (2012), and Dreossi et al. (2024). The red line represents the regression calculated in the present study.

Table S1: Table S1. Information on ice core water isotopes, core chronology, elevation, and references near the study area

	$\delta^{18}O$ (‰) mean (standard deviation)	$\delta^{2}H$ (‰) mean (standard deviation)	dexc (‰) mean (standard deviation)	Period (year)	Elevation (m a.s.l.)	reference
Styx-M	–33.49 (3.05)	–264.04 (3.72)	3.91 (3.72)	1979-2014	1,623	Nyamgerel et al., 2024
Hercules Névé_IT	–35.37 (1.55)	-	-	1770-1992	2,960	Stenni et al., 2008
Whitehall Glacier	-	–202.965 (14.179)	9.5*, 4.6**	2006-1882, 2004-1993*, 1993-1980**	400	Sinclair et al., 2012; Sinclair et al., 2014
Talos Dome	–37.1	–286	-	1217-1996	2,316	Stenni et al., 2002
Hercules Névé_KR	–36.25 (2.69)	–283.0 (22.6)	6.9 (2.1)	1979-2015	2,864	This study