



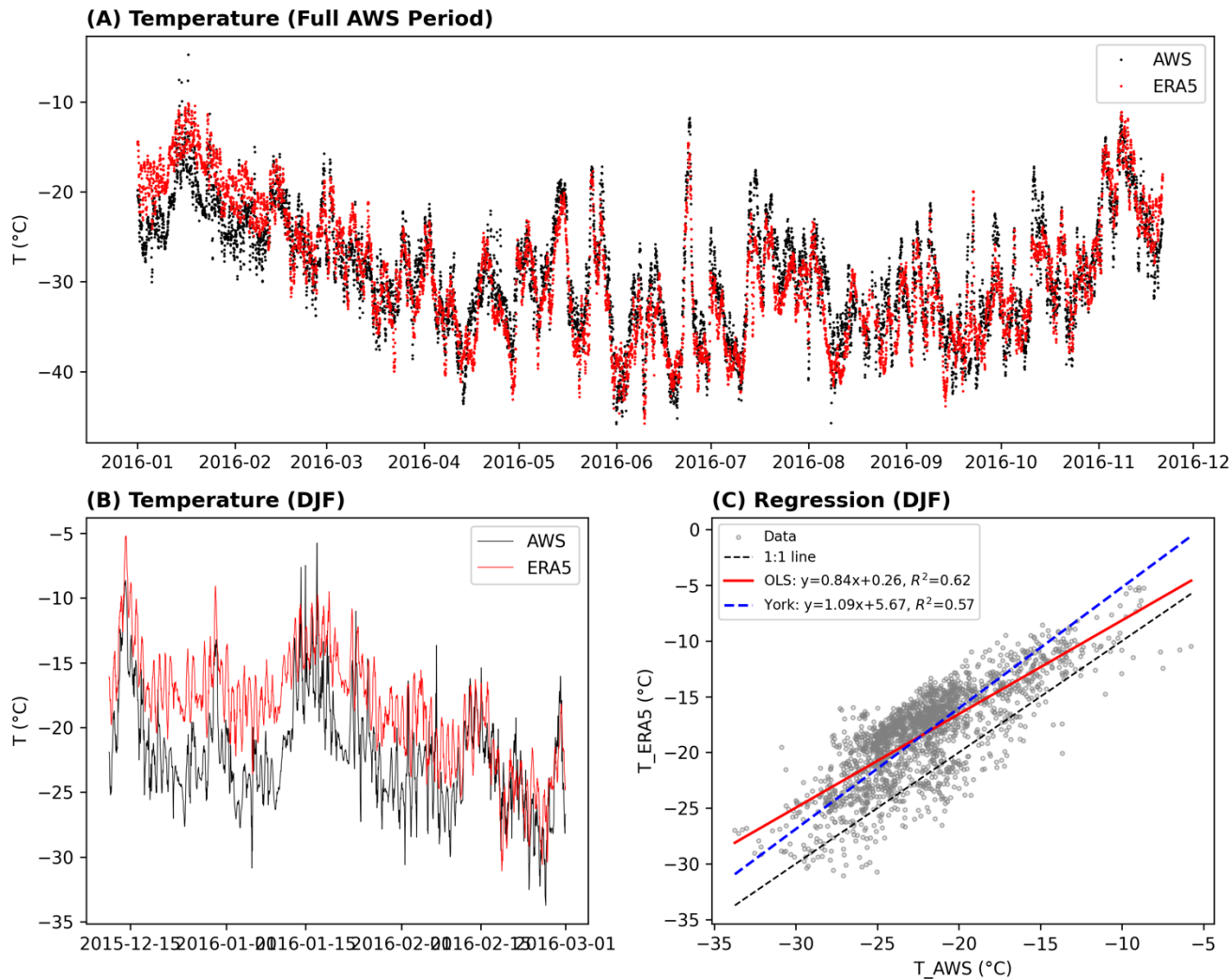
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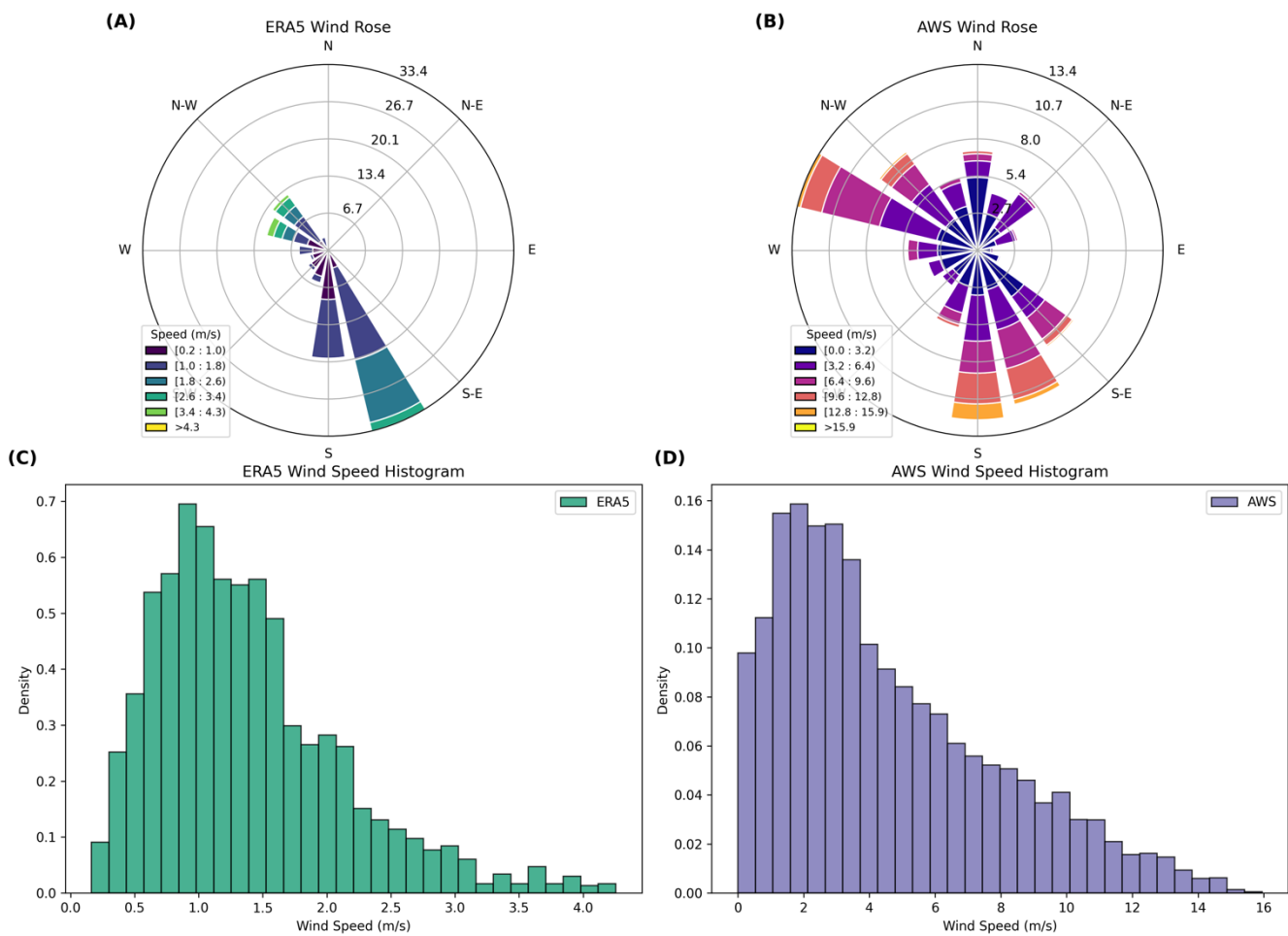
Imprints of sea ice, wind patterns, and atmospheric systems on summer water isotope signatures at Hercules Névé, East Antarctica

Songyi Kim et al.

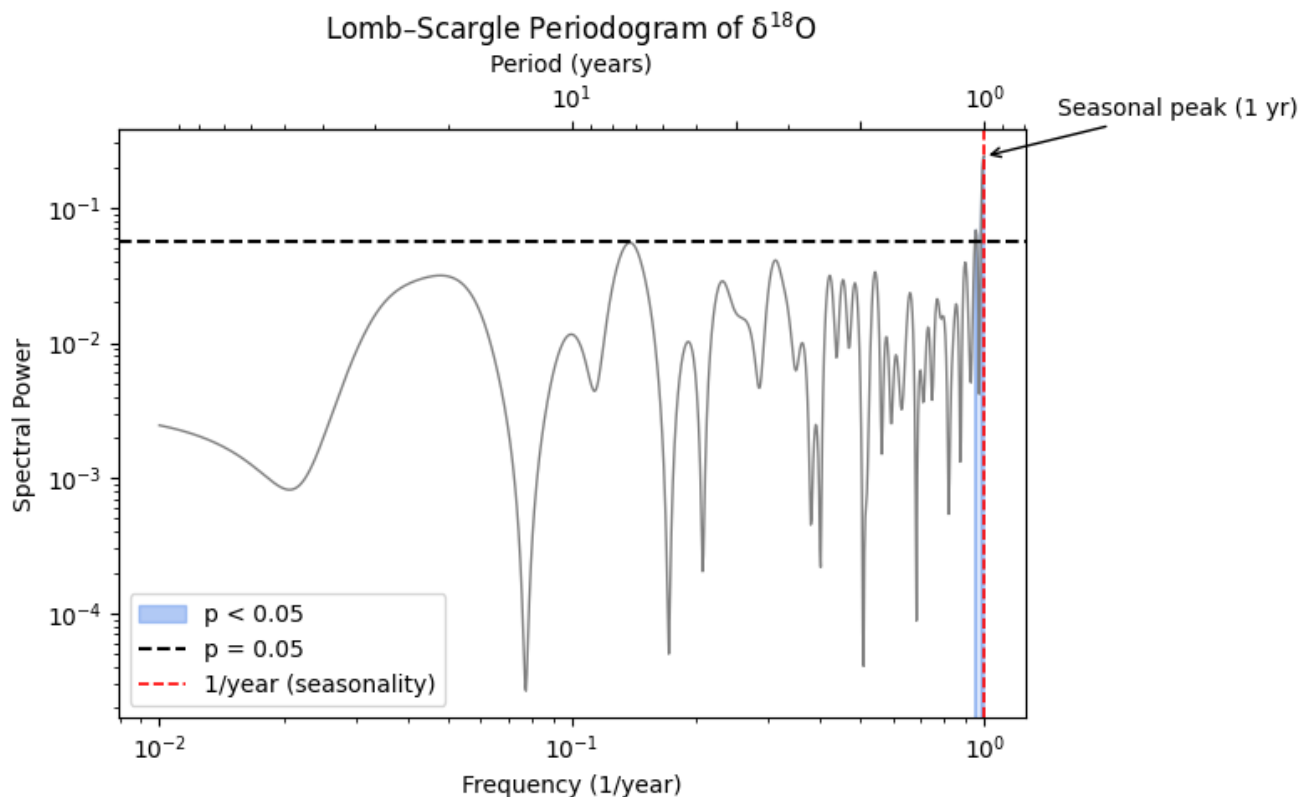
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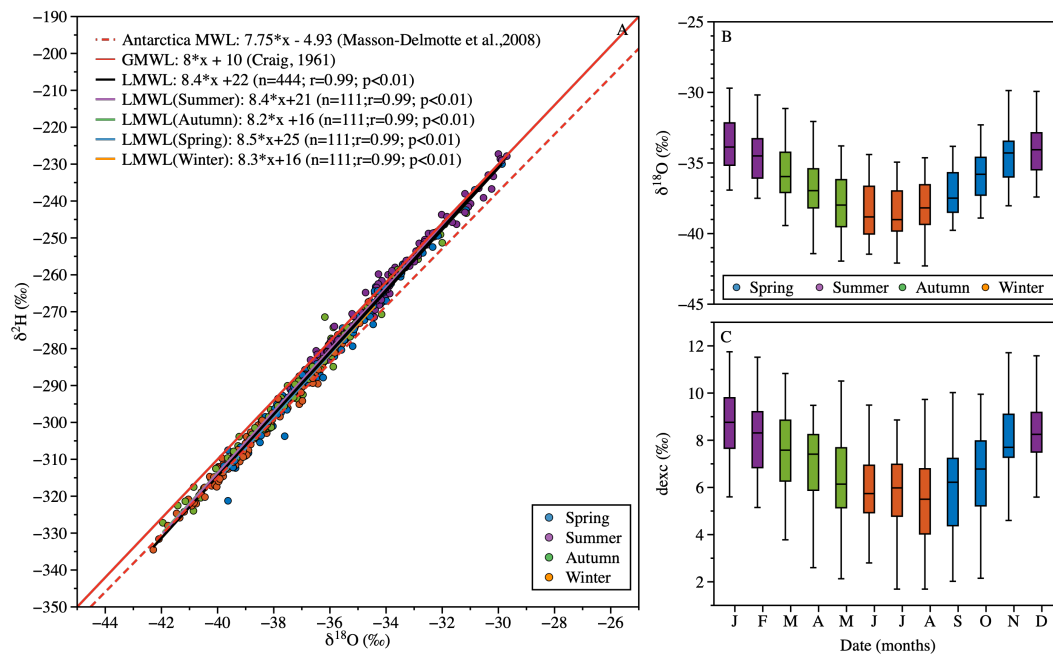




10 **Figure S2: Comparison of AWS and ERA5 wind data at Hercules Névé during DJF. (A–B) Wind rose diagrams for ERA5 and AWS, respectively, showing dominant wind directions. (C–D) Histograms of wind speed distributions. While ERA5 shows a more simplified and weaker wind regime, the AWS captures stronger, more variable local wind behaviour.**



- 15 **Figure S3: Lomb–Scargle periodogram of the $\delta^{18}\text{O}$ time series from the Hercules Névé ice core. The analysis reveals a statistically significant spectral peak at 1 cycle per year (red dashed line), corresponding to a seasonal (annual) signal. The shaded blue region denotes frequencies exceeding the 95% confidence level ($p < 0.05$). This result indicates the presence of a preserved seasonal cycle in the $\delta^{18}\text{O}$ record, justifying the use of DJF-averaged values in subsequent climate correlation analyses.**



20 **Figure S4: Seasonal variation in the isotopic composition ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) of ice core at Hercules Névé. (A) Comparison of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ 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 $\delta^{18}\text{O}$ 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.**

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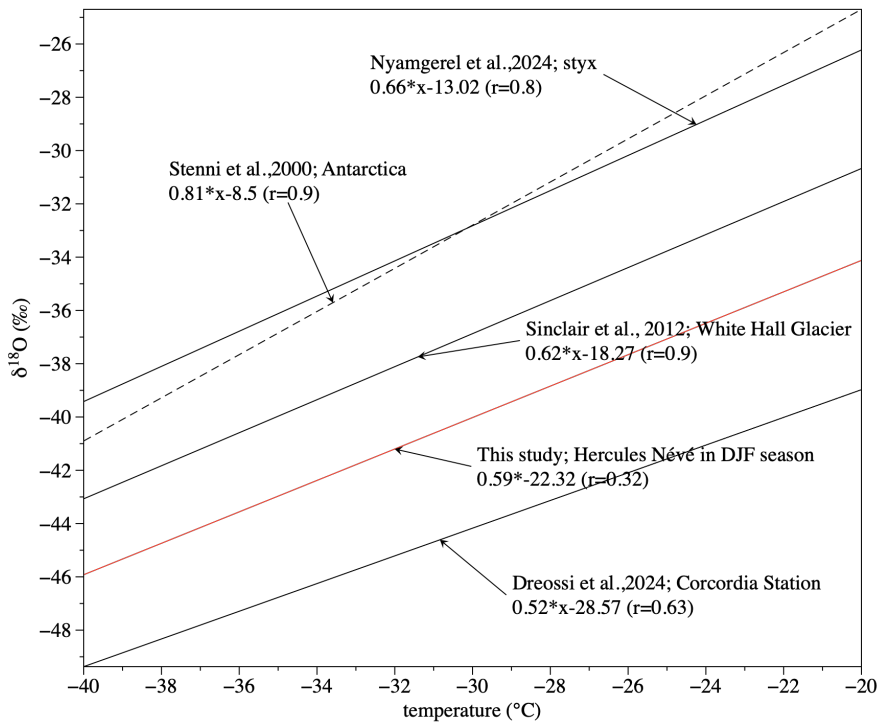


Figure S5: Relationship between $\delta^{18}\text{O}$ and temperature for various Antarctic studies. The linear regression depicts the correlation between $\delta^{18}\text{O}$ and temperature (°C) for different sites, including this study at Hercules Névé during the DJF season. The slopes and correlation coefficients (r) are shown for each dataset, with comparisons to previous studies from Dreossi et al., (2024); Nyamgerel et al., (2024); Sinclair et al., (2012); Stenni et al., (2000). The red line represents the regression calculated in the present study.

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

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

Reference

- 40 Dreossi, G., Masiol, M., Stenni, B., Zannoni, D., Scarchilli, C., Ciardini, V., Casado, M., Landais, A., Werner, M., Cauquoin, A., Casasanta, G., Del Guasta, M., Posocco, V., and Barbante, C.: A decade (2008–2017) of water stable isotope composition of precipitation at Concordia Station, East Antarctica, *The Cryosphere*, 18, 3911–3931, <https://doi.org/10.5194/tc-18-3911-2024>, 2024.
- Nyamgerel, Y., Han, Y., Hwang, H., Han, C., Hong, S.-B., Do Hur, S., and Lee, J.: Climate-related variabilities in the Styx-M ice core record from northern Victoria Land, East Antarctica, during 1979–2014, *Science of The Total Environment*, 935, 173319, <https://doi.org/10.1016/j.scitotenv.2024.173319>, 2024.
- 45 Sinclair, K. E., Bertler, N. A. N., and Ommen, T. D. van: Twentieth-Century Surface Temperature Trends in the Western Ross Sea, Antarctica: Evidence from a High-Resolution Ice Core, <https://doi.org/10.1175/JCLI-D-11-00496.1>, 2012.
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- 50 Stenni, B., Serra, F., Frezzotti, M., Maggi, V., Traversi, R., Becagli, S., and Udisti, R.: Snow accumulation rates in northern Victoria Land, Antarctica, by firn-core analysis, *Journal of Glaciology*, 2000.