

Short-Term Meteorological and Environmental Signals Recorded in a Firn Core from a High-Accumulation Site on Plateau Laclavere, Antarctic Peninsula

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Supplementary Materials: The following are available online at www.mdpi.com/article/10.3390/geosciences11100428/s1, Equation (S1): Calculation of ssNa values, Equation (S2): Calculation of nssS values, Equation (S3): Calculation of wind directions at 850 mbar geopotential height, Supplementary Table S1: Coordinates and altitude of the geographic location and the nearest ERA5 grid point for the Antarctic stations Bernardo O'Higgins (OH), Bellingshausen (BH), Esperanza (EP) and Comandante Ferraz (CF), as well as for the OH-12 drill site on Plateau Laclavere (LCL), Supplementary Figure S1: Thickness distribution of OH-12 ice layers that are indicating surface melt, Supplementary Figure S2: Monthly distribution of precipitation samples collected at Bernardo O'Higgins station from (a) January 2008 to March 2009, from (b) March to November 2014, and from (c) December 2015 to December 2017, Supplementary Figure S3: Comparison of the (a) stable oxygen and hydrogen isotope and (b) δ excess records of firn core OH-12 and precipitation samples collected at Bernardo O'Higgins station (OH) in the year 2014, Supplementary Figure S4: Wind roses for the study site on Plateau Laclavere derived for the single years 2012–2015 as well as for the entire period based on ERA5 monthly records of the zonal and meridional components of the 850 mbar geopotential height wind extracted for the grid point closest to the OH-12 drill site.

Equation S1. Calculation of ssNa values.

Values of ssNa were calculated from Na and Ca concentrations using the following equations [38]:

$$\text{ssNa} = \text{Na} - \frac{\text{nssCa}}{R_t} \text{ and } \text{nssCa} = \text{Ca} - R_m \times \text{ssNa}$$

$$\text{Hence: } \text{ssNa} = \frac{\text{Na} \times R_t - \text{Ca}}{(R_t - R_m)}$$

where R_t is the ratio of Ca/Na in the Earth's crust (1.78) and R_m is the ratio of Ca/Na in seawater (0.038), according to Bowen [40].

Equation S2. Calculation of nssS values.

Values of nssS were calculated from S concentrations using the following equation [39]:

$$\text{nssS} = \text{S} - \text{ssNa} \times R_m$$

where the ratio of S/Na in seawater (0.084) from Bowen [40] is used for R_m .

Equation S3. Calculation of wind directions at 850 mbar geopotential height.

Monthly mean wind directions (ϕ) were calculated from monthly means of the zonal (u) and meridional (v) components of the wind at 850 mbar geopotential height using the following function (<https://confluence.ecmwf.int/pages/viewpage.action?pageId=133262398>; last access: 17 February 2021):

$$\phi = (180 + \frac{180}{\pi} \times \text{atan2}(u, v))$$

Table S1. Coordinates and altitude of the geographic location and the nearest ERA5 grid point for the Antarctic stations Bernardo O'Higgins (OH), Bellingshausen (BH), Esperanza (EP) and Comandante Ferraz (CF), as well as for the OH-12 drill site on Plateau Laclavere (LCL).

	OH	BH	EP	CF	LCL
Coordinates AWS/OH-12	63°19'15.42" S 57°53'59.21" W	62°11'53.46" S 58°57'38.19" W	63°23'49.05" S 56°59'52.99" W	62°05'07.70" S 58°23'55.40" W	63°27'25.09" S 57°45'15.03" W
Altitude site (m a.s.l.)	12	16	25	8	1090
Coordinates ERA5 grid point	63°15' S 58°00' W	62°15' S 59°00' W	– (not used)	– (not used)	63°30' S 57°45' W
Altitude ERA5 grid point (m a.s.l.)	121	31	– (not used)	– (not used)	278

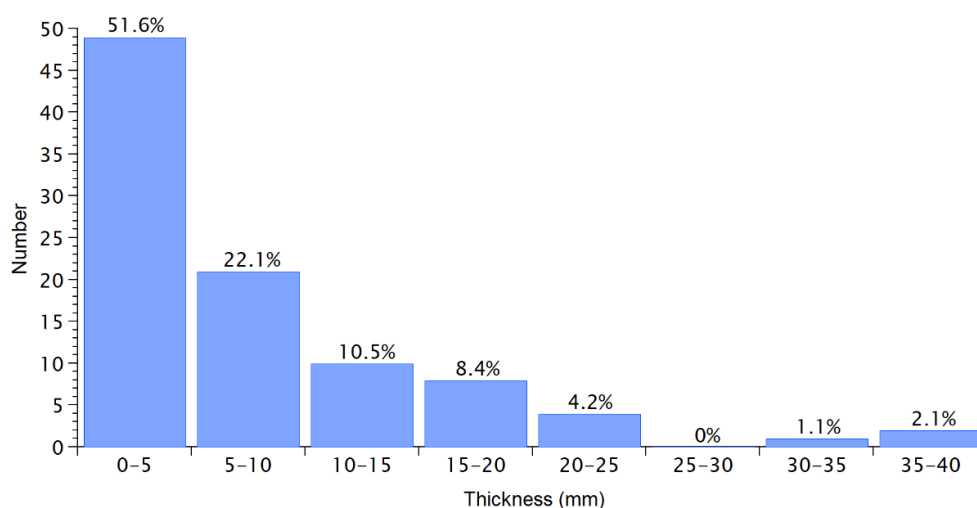


Figure S1. Thickness distribution of OH-12 ice layers that are indicating surface melt. For each thickness interval the percentage of the total number of ice layers indicating surface melt ($n = 95$) is given.

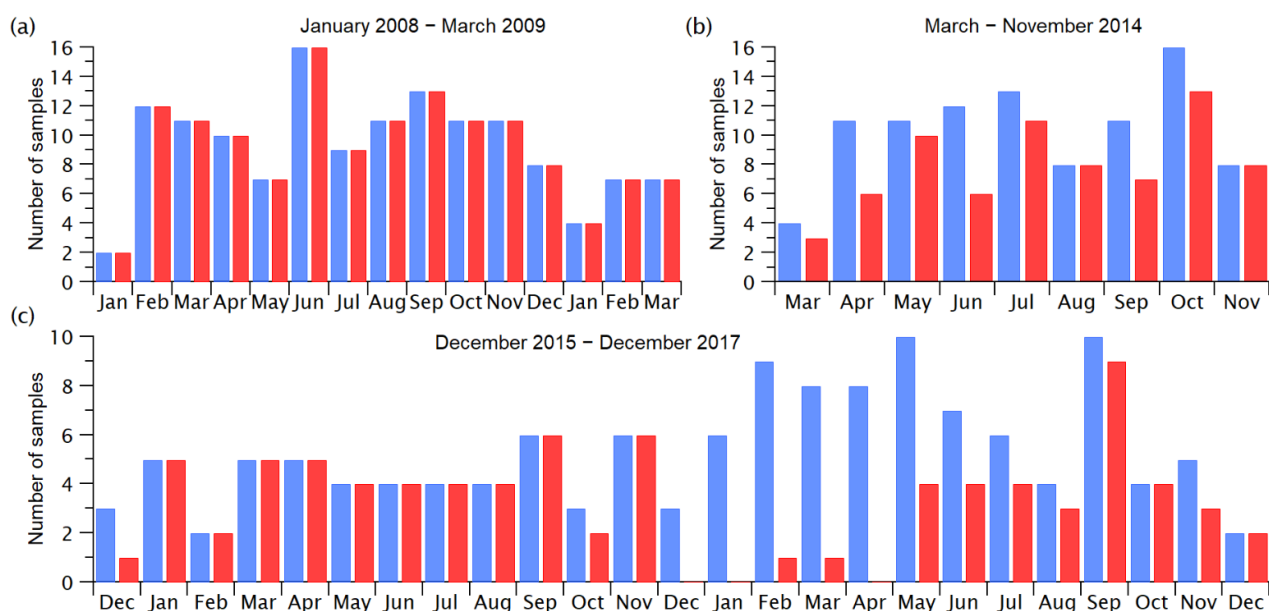


Figure S2. Monthly distribution of precipitation samples collected at Bernardo O'Higgins station from (a) January 2008 to March 2009, from (b) March to November 2014, and from (c) December 2015 to December 2017. The blue bars indicate the total number of samples collected each month; the red bars mark the number of samples considered for statistical analysis of stable water isotope data.

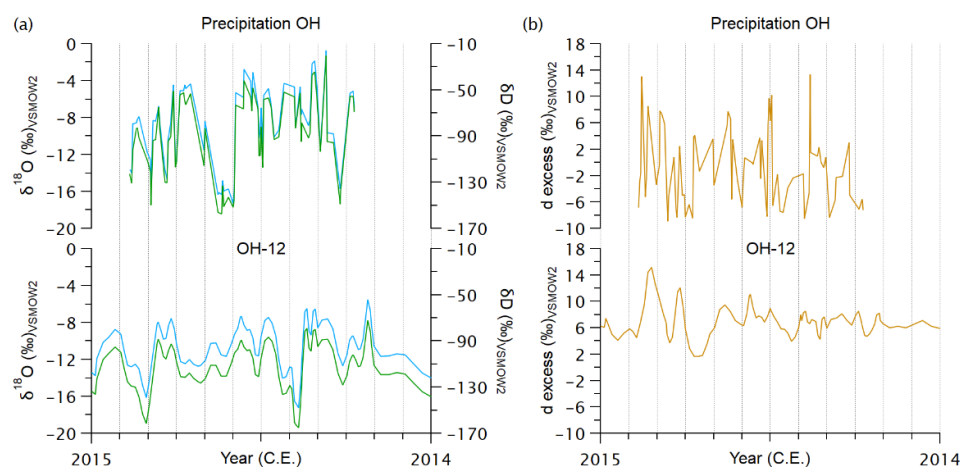


Figure S3. Comparison of the (a) stable oxygen (green) and hydrogen (light blue) isotope and (b) d excess (brown) records of firm core OH-12 and precipitation samples collected at Bernardo O'Higgins station (OH) in the year 2014.

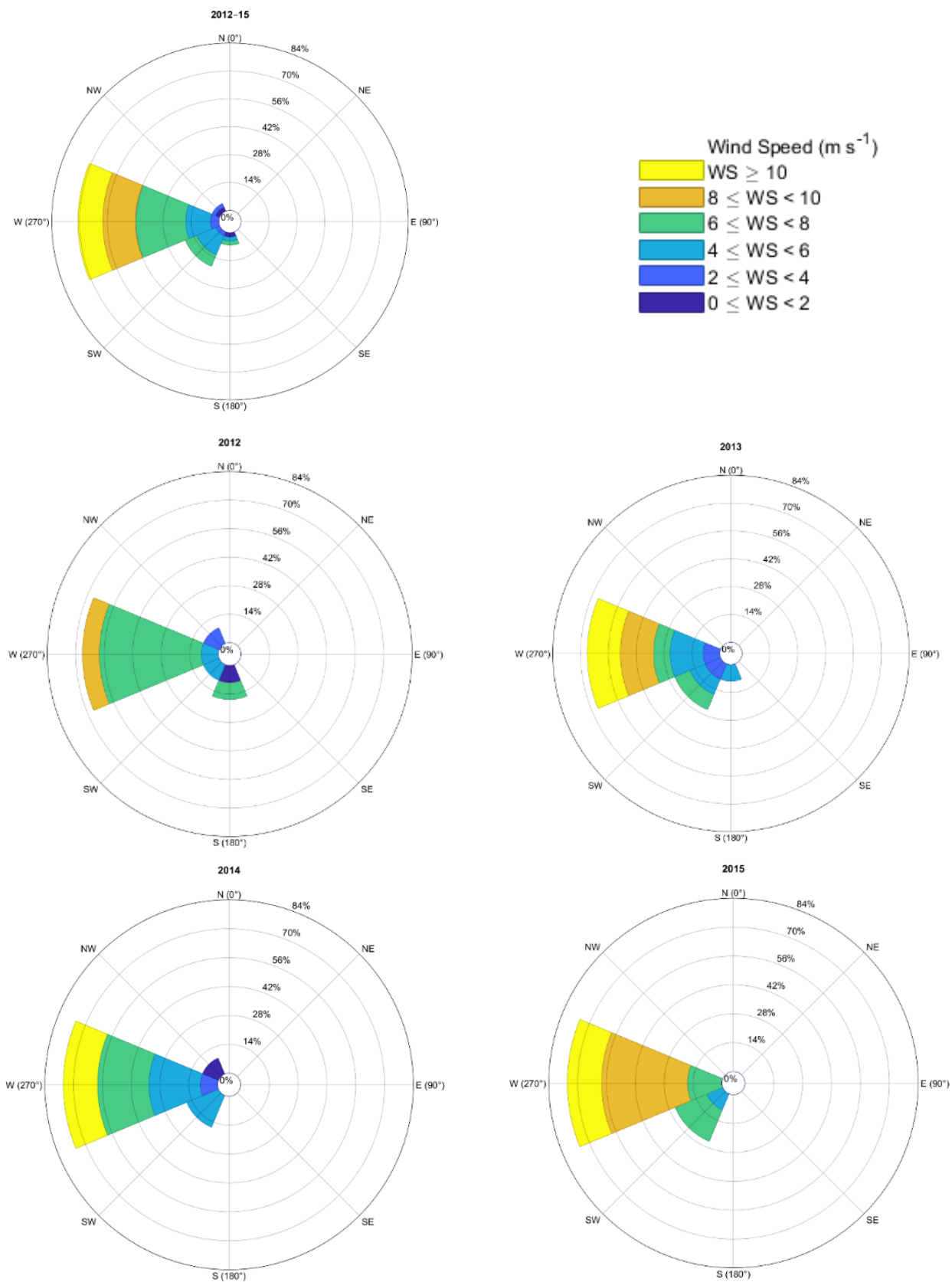


Figure S4. Wind roses for the study site on Plateau Laclavere derived for the single years 2012–2015 as well as for the entire period based on ERA5 monthly records of the zonal and meridional components of the 850 mbar geopotential height wind extracted for the grid point closest to the OH-12 drill site (WS = wind speed).