

Figure S1. (a) Annual cycle of blowing snow frequency at PE station, for the period 2010-2017 (b) Detail of the monthly frequencies for each year of measurements. The crosses represent missing data periods

Table S1. Detail of the sensors and range used to measure the different meteorological variables by the AWS/IWS at PE station.

Variable measured	sensor	range \pm accuracy
2m temperature	Vaisala HMP35AC	-80 to 56 °C \pm 0,3 °C
2m humidity	Vaisala HMP35AC	0 to 100 % \pm 2%
2m wind direction	Young 05103	0 to 360 ° \pm 3 °
2m wind speed	Young 05103	0 to 60 $\mathrm{m}\cdot\mathrm{s}^{-1}\pm0.3~\mathrm{m}\cdot\mathrm{s}^{-1}$
2m pressure	Vaisala PTB1011B	600 to 1060 hPa \pm 4 hPa
2m short wave radiation	Kipp CNR1	0 to 2000 $\mathrm{W}\cdot\mathrm{m}^{-2}\pm2\%$
2m long wave radiation	Kipp CNR1	-250 to 250 $\mathrm{W}\cdot\mathrm{m}^{-2}\pm15~\mathrm{W}\cdot\mathrm{m}^{-2}$
height of the instrument	SR50	0,5 to 10 $\mathrm{m}\pm0,01~\mathrm{m}$

Table S2. Details of sensors used to measure the different meteorological variables at Neumayer station

variable measured	sensor
2 and 10 m temperature	Thies 2.1265.10.000 PT-100 platinium resistance sensors
2 m dew point temperature	Vaisala HMP233 hygrometers
relative humidity	dew point temperature and temperature
surface air pressure	Digiquartz 215-AW002
wind vector	Thies 4.3323.21.002 cup anemometer and wind vane combined

Table S3. WMO categorization of blowing snow

WMO code	description
0	snow haze
1	Drifting snow, light or moderate, with or without snow falling
2	Drifting snow, heavy, without snow falling
3	Drifting snow, heavy, with snow falling
4	Blowing snow, slight or moderate, without snow falling
5	Blowing snow, heavy, without snow falling
6	Blowing snow, slight or moderate, with snow falling
7	Blowing snow, heavy, with snow falling
8	Drifting and blowing snow, slight or moderate, impossible to determine whether sno is falling or not
9	Drifting and blowing snow, heavy, impossible to determine whether sno is falling or not

Table S4. Detection rate of the different categories of observations. N_{BSboth} stands for blowing snow detected by both the algorithm and the visual observations, N_{BSnone} is when both methods agree that there is no blowing snow. $N_{BSceilo}$ and N_{BSvis} represent detections by the algorithm and the observer only, respectively.

Type of event	$N_{BSboth}~(\%)$	N_{BSnone} (%)	$\mid N_{BSceilo}$ (%)	$N_{BSvis}\left(\%\right)$
blowing and drifting snow, with or without prec (WMO cat 01 to 09)	19	46	10	25
blowing and drifting snow, without prec (WMO cat 02, 04 and 05)	09	62	20	09
heavy blowing snow, without prec (WMO cat 05)	03	70	26	01
all blowing snow, without prec (WMO cat 04 and 05)	07	66	22	05
all blowing snow, with or without prec (WMO cat > 03)	15	60	15	10
heavy blowing snow, with or without prec (WMO cat 05, 07 and 09)	10	68	19	03



Figure S2. Detections for the different categories of observations at Neumayer III. N_{BSboth} stands for blowing snow detected by both the algorithm and the visual observations, N_{BSnone} is when both methods agree that there is no blowing snow. $N_{BSceilo}$ and N_{BSvis} represent detections by the algorithm and the observer only, respectively.



Figure S3. Mean profiles for each of the detection categories at Neumayer: BS_{both} when both methods detect blowing snow, BS_{ceilo} when blowing snow is reported by the BSD algorithm only, and BS_{vis} if blowing snow is detected by the visual observer, but not the BSD algorithm

variable (units)	BS_{both}	BS_{ceilo}	BS_{vis}	BS_{none}
number of occurences	3416	23344	1451	1113
temperature 10m (°C)	-14.8 ± 06	-15.3 ± 08	-10.5 ± 06	$\textbf{-13.1}\pm08$
temperature 2m (°C)	-14.8 ± 06	-15.5 ± 08	-10.5 ± 06	-13.2 ± 08
air temperature (°C)	-14.8 ± 06	-15.8 ± 09	-10.5 ± 06	$\textbf{-13.4}\pm08$
wind speed 10m $(m \cdot s^{-1})$	21.6 ± 04	13.3 ± 04	17.3 ± 03	11.4 ± 03
wind speed $2m (m \cdot s^{-1})$	18.2 ± 03	11.3 ± 03	14.6 ± 03	9.6 ± 03
wind direction 10m (°to N)	93.7 ± 30	118 ± 68	89.8 ± 27	111 ± 64
wind direction 2m (°to N)	93.7 ± 31	118.3 ± 68	89.8 ± 27	111.26 ± 65
relative humidity (%)	85.4 ± 04	81.0 ± 06	88.3 ± 05	81.9 ± 08
pressure (hPa)	972.3 ± 11	979.3 ± 09	972.6 ± 09	978.8 ± 10
dew/frost point (°C)	-16.4 ± 06	-18.0 ± 09	$\textbf{-11.8}\pm09$	$\textbf{-15.55}\pm09$
height (m)	340.0 ± 170	112.0 ± 122	-	-

Table S5. Meteorological conditions at Neumayer during the different events, for years 2011-2015 (mean \pm standard deviation).

Table S6. Meteorological conditions at Princess Elisabeth during the different events, for years 2010-2017 (mean \pm standard deviation)

variable (units)	all blowing snow	non blowing snow	blowing snow without precipitation	blowing snow with precipitation
number of hours	3362	23 398	1413	1111
cloud base temperature (°C)	-49.1 ± 25	-67 ± 22	-54.7 ± 23	-27.5 ± 13
wind direction (°to N)	99.6 ± 61	131.1 ± 67	118.3 ± 70	82.3 ± 49
wind speed $(m \cdot s^{-1})$	8.3 ± 5	4.2 ± 3	6.6 ± 4	9.7 ± 5
shortwave in $(W \cdot m^{-2})$	144.7 ± 208	184.9 ± 242	175.6 ± 231	167.6 ± 203
shortwave out $(W \cdot m^{-2})$	121.6 ± 171	149.2 ± 191	145.1 ± 187	144.4 ± 172
longwave in $(W \cdot m^{-2})$	208.6 ± 48	175.9 ± 39	193.5 ± 43	243.8 ± 33
longwave out $(W \cdot m^{-2})$	240.6 ± 32	227.6 ± 36	238.6 ± 32	259.9 ± 22
air temperature (°C)	-15.5 ± 7	-15.5 ± 7	-15.2 ± 6	-12.0 ± 4
specific humidity $(g \cdot kg^{-1})$	1.1 ± 0.7	0.8 ± 0.6	1.05 ± 0.6	1.6 ± 0.7
relative humidity (%)	79.4 ± 19	54.8 ± 19	72.3 ± 18	90.7 ± 15
pressure (hPa)	826.4 ± 10	827.4 ± 8	827.9 ± 8	828.6 ± 9
surface temperature (°C)	-18.3 ± 9	-21.9 ± 10	-18.8 ± 9	-13.1 ± 6
temperature inversion (° $ m C \cdot m^{-1}$)	2.8 ± 3	6.3 ± 4	3.5 ± 3	1.1 ± 2
temperature gradient (° $ m C \cdot m^{-1}$)	0.87 ± 1	1.9 ± 1	1.1 ± 1	0.4 ± 0.7
height of blowing snow layer (m)	170 ± 200	-	74 ± 70	234 ± 243