



## Supplement of

## First direct observation of sea salt aerosol production from blowing snow above sea ice

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Figure S 1. Comparison between friction velocity  $u_*$  and horizontal wind speed U at 2 and 39 m above the sea ice surface. The legends shows respective correlation coefficients. Note that  $U_{2m}$  has been derived from the 3-D wind measurements of the sonic anemometer.



Figure S 2. Overview of atmospheric observations in the Weddell Sea from 14 August to 17 October 2013 (ANT-XXIX/7): (a) horizontal wind speed U at 39 m. (b) ambient temperature  $T_a$  and relative humidity with respect to ice  $RH_{ice}$  at 29 m. (c) total number densities  $N_{46-478}$  of airborne snow particles at 29 m. (d) aerosol Na<sup>+</sup> concentrations and (e) sulphate depletion factor  $DF_{SO_4^{2-}}$ , both at 29 m.



Figure S 3. Comparison of atmospheric sea salt mass concentrations during the 8 June to 26 July 2013 period estimated from filter (ss-filter) and CLASP (ss-CLASP) measurements at 29 m above the sea surface (R= 0.32, p<0.01). ss-filter was derived by multiplying the Na<sup>+</sup> concentration measured on aerosol filters with a conversion factor of 3.262 based on the Na<sup>+</sup> mass fraction in reference seawater. ss-CLASP was estimated based on median number densities  $N_{0.4-12}$  during filter sampling intervals assuming that all particles are spherical and consist of sea salt with the density of NaCl (= 2160 kg m<sup>-3</sup>) (see details in main text). Symbols are color coded based on wind speed  $U_{10m}$ .

Parameter	$\begin{array}{c} \rm ANT6\\ \rm at~0.2m \end{array}$	at $29\mathrm{m^a}$	at $29\mathrm{m}$	$ANT7$ at $29\mathrm{m}$
$N_{46-478} \ ({ m m}^{-3})$				
mean	$2.6 \times 10^5$	$4.0 \times 10^3$	$8.7{\times}10^3$	$7.2 \times 10^3$
σ	$7.4{ imes}10^3$	$9.5 \times 10^3$	$2.7{\times}10^4$	$2.2{\times}10^4$
median	$4.7 \times 10^3$	$7.7{\times}10^2$	$9.9{ imes}10^2$	$1.3 \times 10^3$
$d_p$ (µm)				
mean	138	132	133	143
σ	59	59	53	53
median	132	117	124	136
$N^{\mathrm{b}}$	8608	11766	42959	37123
sampling time $(days)^c$	6	8	30	26

Table S 1. Descriptive statistics of airborne snow particles observed for 8 June to 12 August 2013 (ANT6) and for 14 August to 16 October 2013 (ANT7): total number densities  $N_{46-478}$  and particle diameter  $d_p$ . Statistics refer to periods when airborne snow particles were present, i.e. times with no snow particles observed were removed prior to averaging.

 $^{\rm a}$  for direct comparison of vertical differences statistics of the 29 m measurements only for times when sea ice observations at 0.2 m were available  $^{\rm b}$ sample size  $^{\rm c}$ total aggregated time during which airborne snow particles were detected

Parameter	at $0.2\mathrm{m}$	at $2\mathrm{m}$	at $29\mathrm{m^a}$	at $29\mathrm{m}$
$N_{0.4-12} \ ({\rm m}^{-3})$				
mean	$1.7{ imes}10^6$	$1.4 \times 10^6$	$1.4{\times}10^6$	$2.1{\times}10^6$
$\sigma$	$2.5{ imes}10^6$	$1.9{ imes}10^6$	$1.6{\times}10^6$	$6.4 \times 10^{6}$
median	$8.6 \times 10^5$	$5.6 \times 10^5$	$8.0 \times 10^5$	$1.1 \times 10^6$
$d_p$ (µm)				
mean	0.67	0.60	0.67	0.69
σ	0.11	0.06	0.11	0.14
median	0.66	0.60	0.65	0.66
$N^{\mathrm{b}}$	13077	14907	9963	48892
sampling time $(days)^c$	9	10	7	34

Table S 2. Descriptive statistics of aerosol observed during 8 June - 26 July 2013 (ANT6): total number densities  $N_{0.4-12}$  and particle diameter  $d_p$ .

<sup>a</sup> for direct comparison of vertical differences statistics of the 29 m measurements only for times when sea ice observations at 2 m were available <sup>b</sup>sample size <sup>c</sup>total aggregated sampling time