atmosphere

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Article

A Year-Round Measurement of Water-Soluble Trace and Rare Earth Elements in Arctic Aerosol: Possible Inorganic Tracers of Specific Events

Clara Turetta [1,2], Matteo Feltracco [1,2,*], Elena Barbaro [1,2], Andrea Spolaor [1,2], Carlo Barbante [1,2] and Andrea Gambaro [1,2]

[1] Institute of Polar Sciences, National Research Council of Italy (ISP-CNR), 30172 Venice, Italy; clara.turetta@cnr.it (C.T.); elena.barbaro@cnr.it (E.B.); andrea.spolaor@cnr.it (A.S.); barbante@unive.it (C.B.); gambaro@unive.it (A.G.)

[2] Department of Environmental Sciences, Informatic and Statistics, University Ca' Foscari, 30172 Venice, Italy

* Correspondence: matteo.feltracco@unive.it; Tel.: +39-041-2348545

Table S1. Start and end date of each aerosol sample collected at Gruvebadet (Ny Ålesund) during 2018–2019 campaign.

Sample	Start Date	End Date	Sample	Start Date	End Date
C2018_01	26 February 2018	03 March 2018	C2018_24	13 July 2018	19 July 2018
C2018_02	03 March 2018	09 March 2018	C2018_25	19 July 2018	25 July 2018
C2018_03	09 March 2018	15 March 2018	C2018_26	25 July 2018	31 July 2018
C2018_04	15 March 2018	21 March 2018	C2018_27	31 July 2018	06 August 2018
C2018_05	21 March 2018	27 March 2018	C2018_28	07 August 2018	13 August 2018
C2018_06	27 March 2018	02 April 2018	C2018_29	13 August 2018	19 August 2018
C2018_07	02 April 2018	08 April 2018	C2018_30	19 August 2018	25 August 2018
C2018_08	08 April 2018	14 April 2018	C2018_31	03 October 2018	09 October 2018
C2018_09	14 April 2018	20 April 2018	C2018_32	09 October 2018	15 October 2018
C2018_10	20 April 2018	26 April 2018	C2018_33	15 October 2018	25 October 2018
C2018_11	26 April 2018	02 May 2018	C2018_34	25 October 2018	05 November 2018
C2018_12	02 May 2018	08 May 2018	C2018_35	05 November 2018	13 November 2018
C2018_13	08 May 2018	14 May 2018	C2018_36	13 November 2018	23 November 2018
C2018_14	14 May 2018	20 May 2018	C2018_37	23 November 2018	03 December 2018
C2018_15	20 May 2018	26 May 2018	C2018_38	03 December 2018	14 December 2018
C2018_16	26 May 2018	01 June 2018	C2018_39	14 December 2018	24 December 2018
C2018_17	01 June 2018	07 June 2018	C2018_40	24 December 2018	03 January 2019
C2018_18	07 June 2018	13 June 2018	C2019_01	03 January 2019	15 January 2019

C2018_19	13 June 2018	19 June 2018	C2019_02	15 January 2019	24 January 2019
C2018_20	19 June 2018	25 June 2018	C2019_03	24 January 2019	03 February 2019
C2018_21	25 June 2018	01 July 2018	C2019_04	03 February 2019	13 February 2019
C2018_22	01 July 2018	07 July 2018	C2019_05	13 February 2019	19 February 2019
C2018_23	07 July 2018	13 July 2018	C2019_06	19 February 2019	26 February 2019

Table S2. Seasonal PM_{10} concentration of wsTE. Concentrations are shown in pg m^{-3}, standard deviations are in brackets.

wsTE	Win '18	Spr	Sum	Aut	Win '18-'19
Li	9 (1)	5 (2)	5 (2)	6 (1)	10 (2)
Be	0,19 (0,04)	0,1 (0,1)	0,09 (0,04)	0,06 (0,03)	0,2 (0,1)
Mg (ng m^{-3})	30 (16)	25 (9)	24 (7)	33 (9)	49 (15)
K (ng m^{-3})	7 (3)	4 (2)	5 (1)	5 (1)	9 (1)
Ca (ng m^{-3})	1,3 (0,3)	1,4 (0,4)	0,9 (0,4)	0,7 (0,1)	0,9 (0,3)
Al (ng m^{-3})	4 (2)	10 (10)	2 (3)	1 (1)	4 (2)
V	25 (6)	24 (17)	18 (6)	23 (16)	50 (21)
Cr	195 (86)	198 (111)	153 (53)	80 (48)	154 (69)
Mn	186 (72)	189 (107)	109 (45)	150 (96)	227 (93)
Fe (ng m^{-3})	0,5 (0,2)	0,8 (0,6)	0,7 (0,2)	0,4 (0,3)	1,5 (0,9)
Co	7 (1)	4 (2)	2,4 (0,7)	3 (1)	4 (1)
Ni	166 (73)	134 (74)	105 (51)	63 (18)	71 (33)
Cu	378 (119)	456 (117)	422 (408)	192 (67)	398 (140)
Zn (ng m^{-3})	3,9 (0,9)	4 (2)	4 (2)	0,7 (0,2)	1,5 (0,6)
Ga	0,3 (0,1)	0,4 (0,3)	0,2 (0,1)	0,1 (0,2)	2 (2)
As	21 (8)	17 (16)	9 (4)	13 (9)	86 (66)
Rb	7 (2)	5 (4)	3 (1)	3 (1)	15 (6)
Sr	315 (107)	350 (73)	253 (124)	208 (46)	311 (87)
Ag	1,9 (0,4)	0,4 (0,5)	0,3 (0,3)	0,4 (0,4)	0,3 (0,3)
Cd	7 (3)	5 (5)	2 (1)	2 (2)	13 (9)
Cs	0,7 (0,2)	0,5 (0,5)	0,2 (0,1)	0,3 (0,1)	1,8 (0,9)
Ba	512 (290)	171 (134)	156 (64)	158 (177)	113 (59)
Tl	1,6 (0,6)	0,4 (0,4)	0,5 (0,6)	0,1 (0,1)	1,1 (0,8)
Pb	109 (31)	84 (76)	76 (40)	65 (53)	425 (281)
Bi	0,9 (0,6)	0,4 (0,5)	0,2 (0,2)	0,2 (0,2)	1 (1)
U	0,5 (0,1)	0,3 (0,2)	0,3 (0,2)	0,2 (0,1)	0,4 (0,2)

Table S3. Seasonal PM_{10} concentration of wsREE. Concentrations are shown in pg m^{-3}, standard deviations are in brackets.

wsREE	Win '18	Spr	Sum	Aut	Win '18-'19
Y	1.3 (0.2)	1.1 (0.6)	0.6 (0.1)	0.6 (0.2)	0.9 (0.3)
La	0.7 (0.1)	1 (0.7)	0.4 (0.1)	0.3 (0.2)	0.7 (0.2)
Ce	1.7 (0.5)	3 (2)	1.3 (0.7)	0.7 (0.4)	1.5 (0.6)
Pr	0.16 (0.05)	0.2 (0.1)	0.08 (0.02)	0.08 (0.04)	0.14 (0.04)
Nd	0.8 (0.2)	0.8 (0.6)	0.3 (0.1)	0.3 (0.2)	0.6 (0.2)
Sm	0.19 (0.05)	0.2 (0.1)	0.1 (0.02)	0.09 (0.04)	0.14 (0.04)
Eu	0.06 (0.02)	0.05 (0.03)	0.02 (0.01)	0.02 (0.01)	0.03 (0.01)
Gd	0.21 (0.04)	0.2 (0.1)	0.11 (0.03)	0.1 (0.04)	0.16 (0.04)
Tb	0.04 (0.01)	0.04 (0.02)	0.02 (0.005)	0.02 (0.01)	0.02 (0.01)
Dy	0.24 (0.04)	0.2 (0.1)	0.1 (0.03)	0.1 (0.03)	0.15 (0.05)
Ho	0.05 (0.01)	0.04 (0.03)	0.02 (0.01)	0.02 (0.01)	0.03 (0.01)
Er	0.13 (0.02)	0.1 (0.06)	0.06 (0.01)	0.05 (0.02)	0.07 (0.03)
Tm	0.015 (0.002)	0.016 (0.014)	0.007 (0.001)	0.006 (0.002)	0.009 (0.003)

Yb	0.11 (0.02)	0.08 (0.04)	0.05 (0.01)	0.04 (0.01)	0.06 (0.02)
Lu	0.016 (0.004)	0.016 (0.013)	0.007 (0.001)	0.007 (0.003)	0.01 (0.004)
Th	0.3 (0.1)	0.2 (0.1)	0.14 (0.05)	0.06 (0.04)	0.12 (0.09)
ΣwsREE	6 (1)	7 (4)	3 (1)	3 (1)	5 (1)

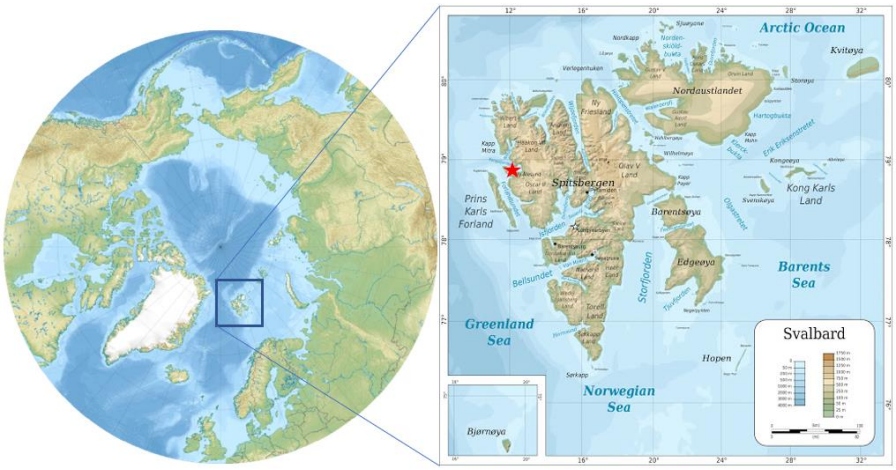
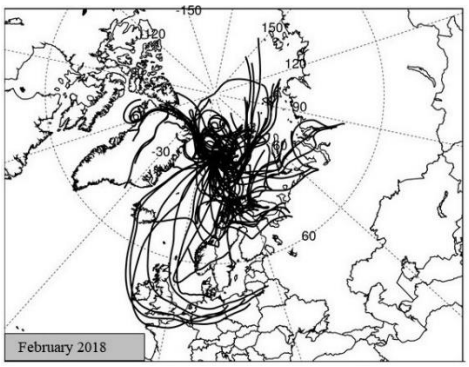
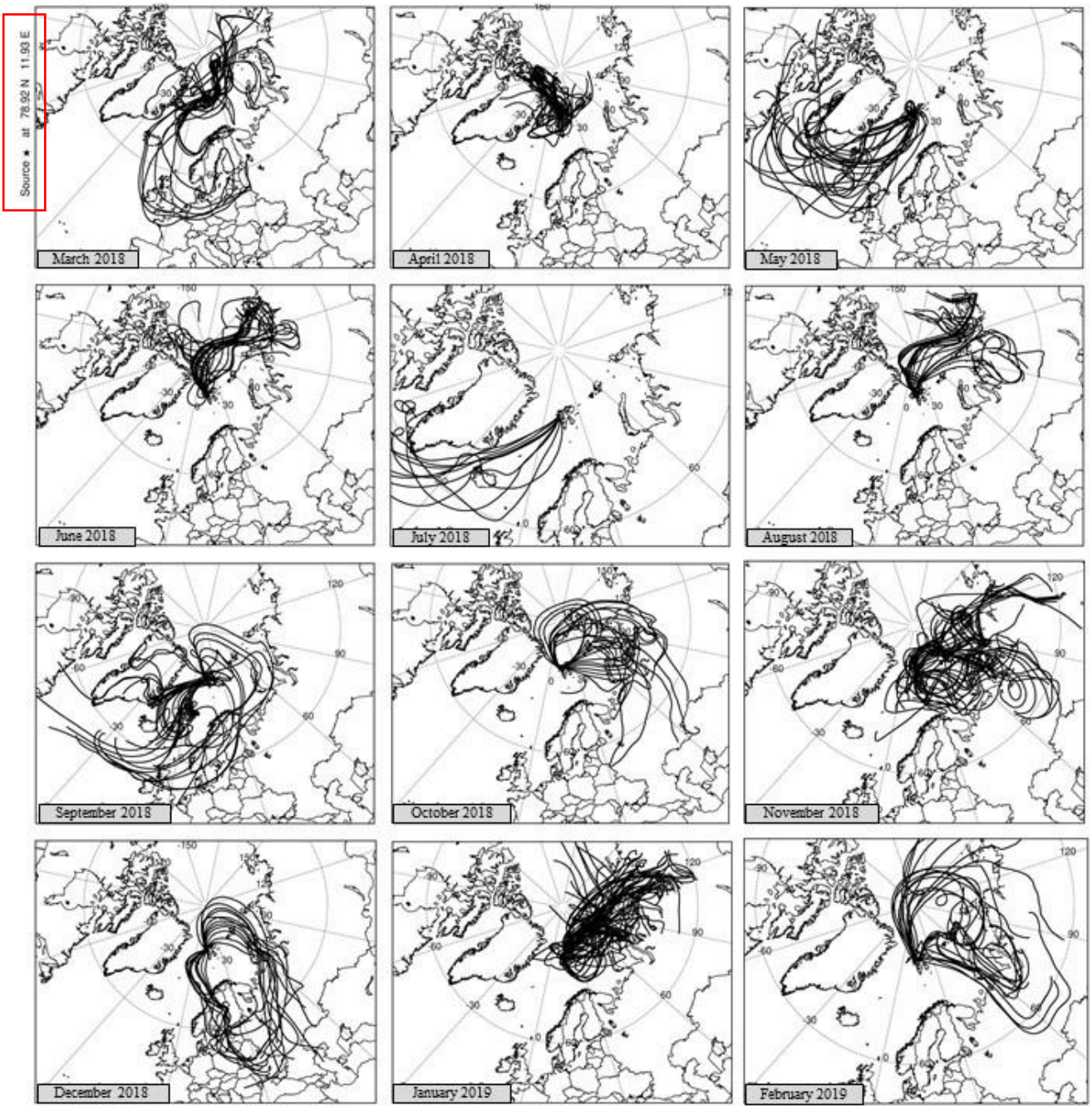


Figure S1. Glacial Arctic Ocean and Svalbard Archipelago. The red star points to the position of Ny-Ålesund.



A



B

Figure S2. (**A**) Montly back trajectories for February 2018. (**B**) Monthly back trajectories from March 2018 to February 2019. The black star points to the position of Ny-Ålesund.

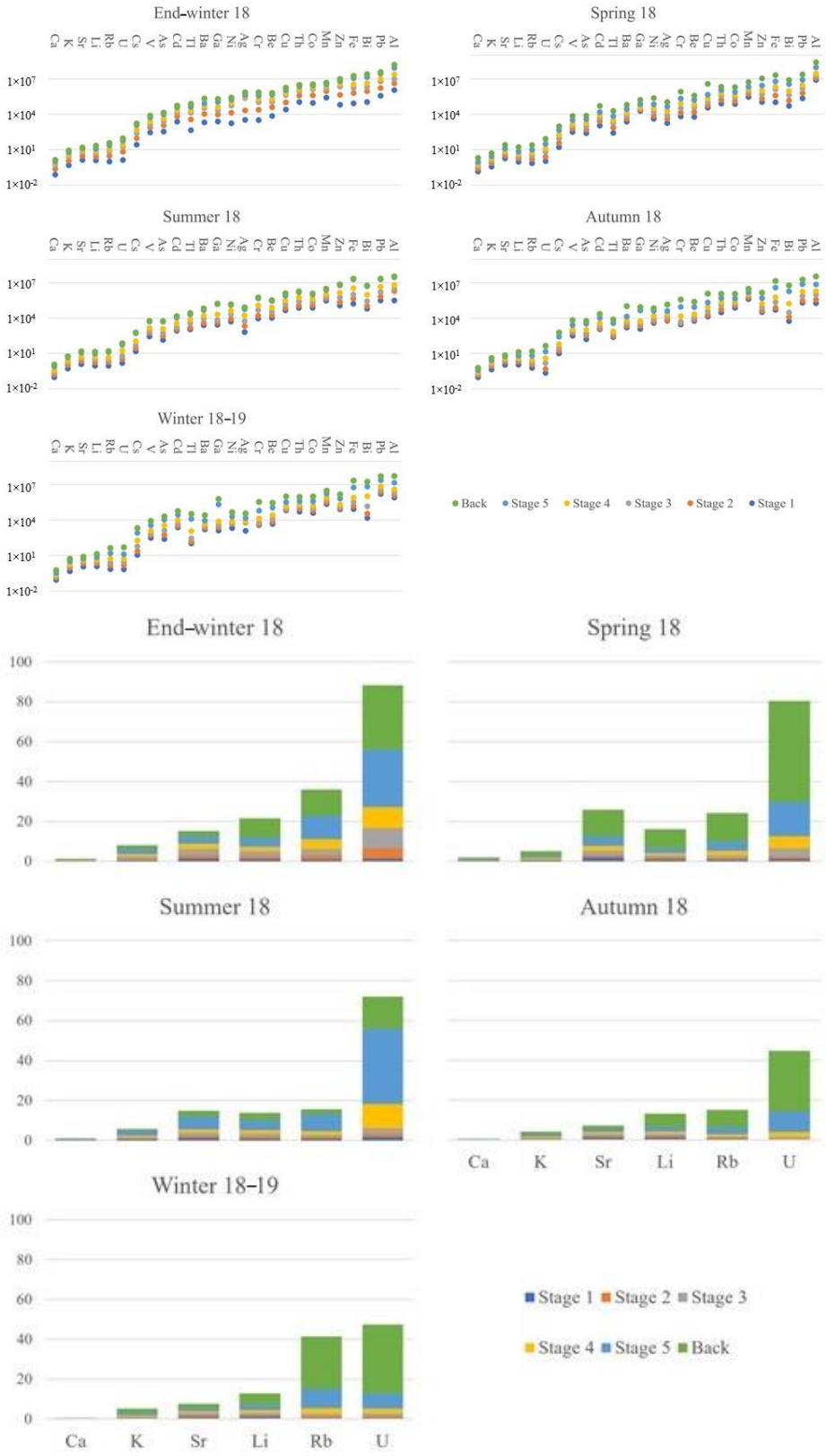


Figure S3. (**A**) Seawater mean composition Enrichment Factors calculated for seasonal averages. The composition of seawater is from Nozaki (2010) [27]. Dimensional size for: Back <0.49 μm, Stage 5: 0.95–0.49 μm, Stage 4—1.5–0.95 μm, Stage 3—3–1.5 μm, Stage 2—7.2–3, and Stage 1—10–7.2 μm. (**B**) Seawater mean composition Enrichment Factors calculated for seasonal averages. Only the marine source elements are reported to highlight the differences between seasons of the marine input. Dimensional size for: Back <0.49 μm, Stage 5—0.95–0.49 μm, Stage 4—1.5–0.95 μm, Stage 3—3–1.5 μm, Stage 2—7.2–3, and Stage 1—10–7.2 μm.

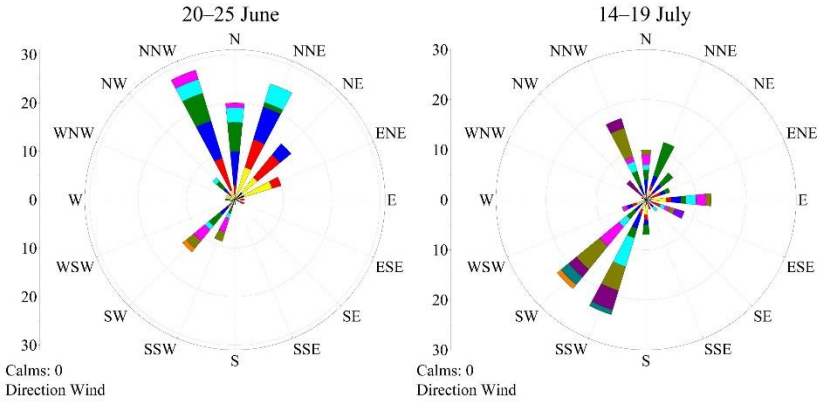


Figure S4. Wind roses for the 25 June and 19 July samples. Data od wind speed and direction are relative to AWI station at 10 m of elevation [1].

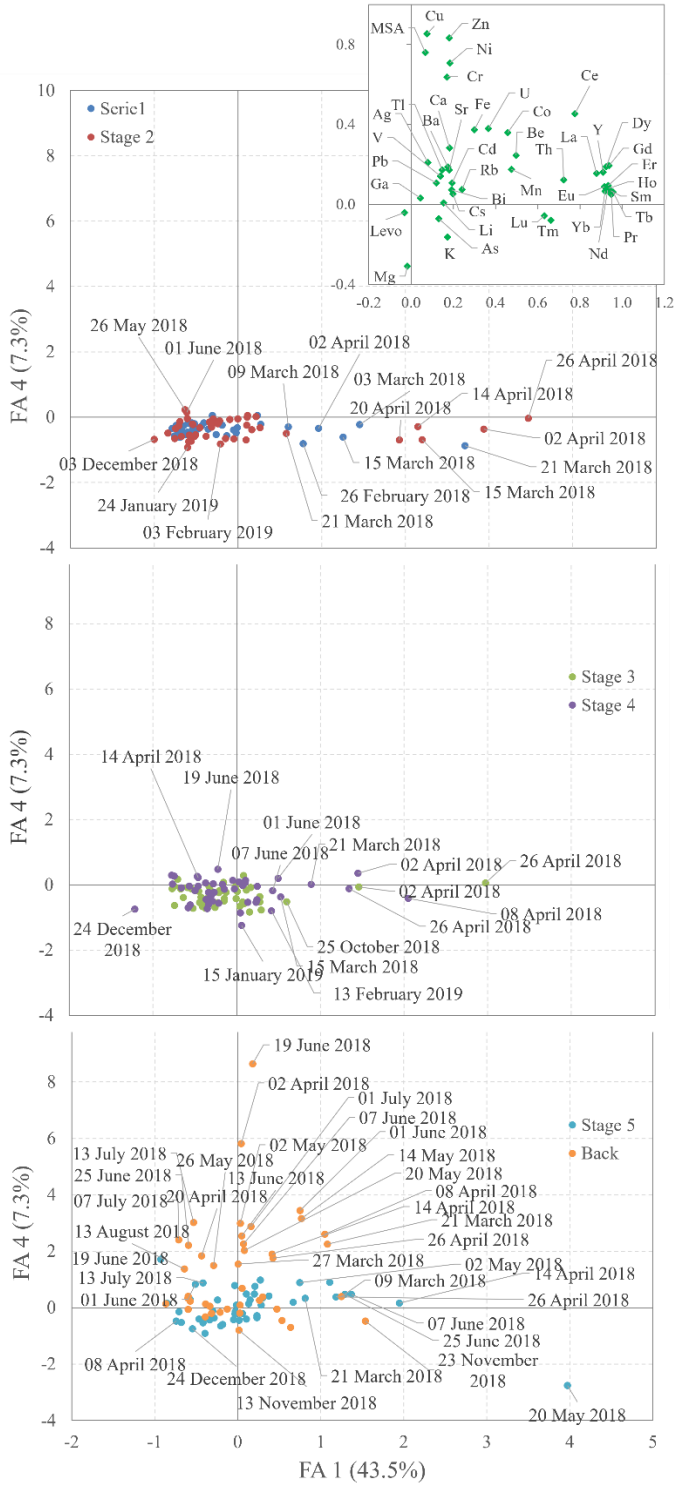


Figure S5. Results of the Factor Analysis: factor 1 vs. factor 4. The samples were subdivided in three separated graphs on dimensional basis. From top to bottom: 10–7.2 and 7.2–3.0 μm fractions, 3.0–1.5 and 1.5–0.95 μm fractions, and 0.95–0.49 and <0.49 μm fractions. The graph in the top right-hand corner shows factor loadings.

References

1. Maturilli, M. Continuous meteorological observations at station Ny-Ålesund (2011-08 et seq). Alfred Wegener Institute - Research Unit Potsdam, PANGAEA. 2020. Available online: https://doi.pangaea.de/10.1594/PANGAEA.914979 (accessed on 23 April 2021).