Electronic Supplement of

"Analysis of size distribution, chemical composition, and optical properties of mineral dust particles from dry deposition measurement in Tenerife: determined by single-particle characterization"

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1 Chemical composition

1.1 Definition of particle class

Table S1: Defintion of particle class

	Group name	Classification criteria	Class
1	Fe-rich [Fe-rich]	Fe/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe) =0.5... 1.01,Cr/ (Cr+Fe) =0... 0.1 And Cl/ (Cl+Fe) =0... 0.1	Oxides/Hydroxides
2	Mg-rich [Mg-rich]	Mg/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01	Others
3	Ti-rich [Ti-rich]	Ti/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe) =0.7... 1.01,Ca/ (Ca+Ti) =0... 0.3	Oxides/Hydroxides
4	Ti-rich [Ti-Ca-rich]	(Ti+Ca)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, Ca/ (Ca+Ti) =0.3... 0.7	Oxides/Hydroxides
5	FeTi-rich [Ilmenit]	(Fe+Ti)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, Ti/Fe=0.25... 4	Oxides/Hydroxides
6	Quartz [Quartz]	Si/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, (Na+Mg+K+Ca+Al)/Si=0... 0.2	Silicates
7	K-rich silicate [K-Feldspar]	(K+Al+Si)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, Al/Si=0.1... 0.5 , K/Si=0.1... 0.5 , Ca/Si=0... 0.1, Na/Si=0... 0.1	Silicates
8	Na-rich silicate [Na-Feldspar]	(Na+Al+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, Al/Si=0.1... 0.5, Na/Si=0.1... 0.5, Ca/Si=0... 0.1, K/Si=0... 0.1, (Cl+2*S)/Na = 0... 0.3, (Cl+2*S) / (Al+Si) =0... 0.125	Silicates
9	Al-rich silicate [Kaolinite]	(Al+Si)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7... 1.01, Al/Si=0.5... 1.5, Fe/ (Al+Si) =0... 0.2, Mg/ (Al+Si) =0... 0.2, Ca/ (Al+Si) =0... 0.2, (Na+Cl+2*S)/ (Al+Si) =0... 0.25	Silicates
10	MgAl-rich silicate [Mg-Clay]	(Mg+Al+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7...1.01, Al/Si=0.5... 1.5, Fe/ (Al+Si) =0... 0.2, Mg/ (Al+Si) =0.2... 1.01, (Na+Cl+2*S) / (Al+Si) =0... 0.25	Silicates
11	Fe(Mg)Al-rich silicate [Fe-Clay]	(Mg+Fe+Al+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe) =0.7... 1.01, Al/Si=0.5... 1.5, Fe/ (Al+Si) =0.2... 1.01, (Na+Cl+2*S) / (Al+Si) =0... 0.25	Silicates
12	Ca-rich silicate/Ca-Si-mixture[Ca-rich silicate]	(Ca+Al+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7... 1.01, Ca/ (Al+Si) =0.3... 3, (Na+Cl+2*S) / (Al+Si) =0... 0.25	Silicates

13	Complex silicate (low Al) [complex feldspar]	(Al+Si+Na+Mg+K+Ca+Fe)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Al/Si=0.05 .. 0.5, (Na+K+Ca)/Si=0.1 .. 1, Fe/Si=0 .. 0.5, Ca/Si=0 .. 0.5, K/Si=0.. .5, Mg/Si=0 .. 0.5, K/Si=0..0.5, (Na+Cl+2*S)/(Al+Si)=0..0.25	Silicates
14	complex silicate (high Al) [complex clay]	(Al+Si+Na+Mg+K+Ca+Fe) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Al/Si=0.5..1.5, (Mg+Fe+K)/Si=0.1 .. 1, Fe/Si=0 .. 0.5, Ca/Si=0 .. 0.5, K/Si=0..0.5, Mg/Si=0..0.5, K/Si=0..0.5, (Na+Cl+2*S)/(Al+Si)=0.. 0.25	Silicates
15	Ca-rich [Calcite]	Ca/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Al+Si)/Ca=0 .. 0.3, Mg/Ca=0 .. 0.3, S/Ca=0 .. 0.3, Cl/Ca=0 .. 0.3	Ca-rich
16	CaMg-rich [Dolomite]	(Mg+Ca) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Mg/Ca=0.3 .. 3, S/Ca=0 .. 0.3, Cl/Ca=0 .. 0.3, (Al+Si)/Ca=0 .. 0.3	Ca-rich
17	CaP-rich [Apatite]	(Ca+P) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Mg/Ca=0 .. 0.3, P/(Ca+P)=0.2 .. 0.8, Cl/Ca=0 .. 0.3, (Al+Si)/(P+Ca)=0 .. 0.25	Ca-rich
18	CaS-rich [Gypsum]	(Ca+S) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Ca/(Ca+S)=0.2 .. 0.8, Mg/Ca=0 .. 0.3, Cl/Ca=0 .. 0.3	stable sulfates
19	AlKS-rich [Alunite]	(Al+K+S) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Ca/(Ca+Al+K+S)=0..0.05, Si/(Si+Al+K+S)=0.. .1, K/(Al+K+S)=0.05..0.3 ,S/(Al+K+S)=0.15 .. 0.5, Al/(Al+K+S)=0.3..0.8	stable sulfates
20	NaCl-rich [Sea-salt]	(Na+Mg+Cl)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7..1.01, Cl/(Na+0.5*Mg)=0.5 .. 2, Cl / (Cl+S)=0.7 .. 1.01, S/(Na+0.5*Mg)=0 .. 0.2, K/Na=0 .. 0.5, Ca/Na=0 .. 0.5, Mg/Na=0 .. 0.5, (Al+Si) / (Na+Cl+S)=0 .. 0.25	sea-salt
21	NaClS-rich [aged Sea salt]	(Na+Mg+Cl+S+Ca) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Cl/(Na+0.5*Mg)=0.2 .. 0.8, S/(Na+0.5*Mg)=0.2 .. 0.8, (Cl+2*S) / (Na+0.5*Mg+0.5*Ca)=0.3 .. 3.333, Cl / (Cl+S)=0.3 .. 0.7, K / (K+Na)=0 .. 0.3, Ca / (Ca+Na)=0 .. 0.2, Mg / (Mg+Na)=0 .. 0.3, (Al+Si) / (Al+Si+Na+Cl+S)=0 .. 0.25	sea-salt
22	NaS-rich [Na Sulfate]	(Na+Mg+S+Cl)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, S/(Na+0.5*Mg)=0.8 .. 2, Cl/(Na+0.5*Mg)=0 .. 0.2, Cl / (Cl+S)=0 .. 0.3, K/Na=0 .. 0.5, Ca/Na=0 .. 0.5, Mg/Na=0 .. 0.5, (Al+Si)/(Na+Cl+S)=0 .. 0.25	soluble sulfates
23	S-rich [sulfate]	S/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Cl / (Cl+S)=0 .. 0.3, Na/S=0 .. 1.01, Cl/S=0 .. 0.2, Si/S=0 .. 0.5, (Al+Si)/S=0 .. 0.25	Sulfates
24	complex sulfate [complex sulfate]	(Na+Mg+K+Ca+S+Cl)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Al+Si)/S=0 .. 0.25, Cl / (Cl+S)=0 .. 0.3	soluble sulfates
25	complex soluble salt [complex sulfate-chloride]	(Na+Mg+K+Ca+S+Cl)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Al+Si)/S=0 .. 0.25	soluble sulfates

26	NaCl/Si mixture [NaCl-Si-Mix]	(Al+Si+Mg+Fe+Na+Cl+S)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Fe / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0 .. 0.3, (Na+Cl+2*S) / (Al+Si)=0.25 .. 4, S/Cl=0 .. 0.5	sea-salt/silicate mixtures
27	NaS/Si mixture [NaS-Si-Mix]	(Al+Si+Mg+Fe+Na+Cl+S)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Fe / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0 .. 0.3, (Na+Cl+2*S) / (Al+Si)=0.25 .. 4, S/Cl=0 .. 0.5, (Na+Cl+2*S) / (Al+Si)=0.25.. 4, (K+Ca+Fe)/(Si+Al)=0 .. 0.7, Cl/S=0 ..1, S/Na=0.. 0.5	sulfate/silicate mixtures
28	NaClS/Si mixture [NaClS-Si-Mix]	(Al+Si+Mg+Fe+Na+Cl+S)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Na+Cl+2*S) / (Al+Si)=0.25 .. 4, Fe / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.. .3,S/Cl=0.5..1	sea-salt/silicate mixtures
29	S/Si mixture [S-Si-Mix]	(Al+Si+Mg+Fe+Na+S)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, Fe / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0 .. 0.3, Si / (Al+Si+Mg+Fe) = 0.2..1.01, S/(Al+Si)=0.25 .. 4, Cl/S=0..1, Na/S=0.. 1	sulfate/silicate mixtures
30	other silicate [other silicate]	(Al+Si+Na+Mg+K+Ca+Fe+Ti)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Na+Cl+S) / (Al+Si+Fe)=0 .. 0.25	silicates
31	complex mixture [complex mix]	(Na+Mg+Al+Si+S+Cl+K+Ca+Fe)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01, (Na+Cl) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9, S/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9,(Ca+K+Mg+Fe)/ (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9, (Al+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1.. 0.9	complex mixtures

1.2 Inter-particle mixing state of Ca and Fe compounds

Table S2: Total Fe mass deposition rate in mg/(m^2xd). Ca>xx: relative fraction of Fe mass in with an R (Ca)>xx. An R (Ca) of 0.05 can be considered as roughly 10 % mass $CaCO_3$ in a particle (note that the scale is non-linear for higher R (Ca)).

	Total Fe, mg/(m^2d)	R(Ca)>0.01	R(Ca)>0.02	R(Ca)>0.05	R(Ca)>0.10
18. Jul 17	0.57	0.581	0.387	0.336	0.099
19. Jul 17	0.13	0.347	0.221	0.087	0.056
20. Jul 17	0.24	0.775	0.551	0.286	0.075
24. Jul 17	0.97	0.349	0.135	0.066	0.040
25. Jul 17	0.58	0.262	0.104	0.040	0.012
26. Jul 17	0.49	0.297	0.152	0.034	0.008
27. Jul 17	0.37	0.229	0.190	0.091	0.067
28. Jul 17	0.27	0.268	0.104	0.060	0.031
29. Jul 17	0.10	0.762	0.638	0.049	0.000
03. Aug 17	0.90	0.714	0.704	0.490	0.040
09. Aug 17	1.72	0.581	0.337	0.156	0.094
10. Aug 17	1.37	0.640	0.477	0.392	0.224
20. Aug 17	1.92	0.445	0.147	0.043	0.026
21. Aug 17	1.73	0.290	0.074	0.015	0.010
22. Aug 17	0.95	0.252	0.062	0.017	0.009
mean	0.82	0.453	0.285	0.144	0.053
median	0.70	0.397	0.206	0.077	0.040

- TFS17_Fe_mass_depo_rate.csv 'Daily mass deposition rate for iron in mg/(m^2*d).

The columns are a grid representation with the following meaning:

Table S3: grid representation of columns of the **csv** files

Fe0	0 < R(Fe) <= 0.02	Ca0	0 < R(Ca) <= 0.02
Fe1	0.02 < R(Fe) <= 0.05	Ca1	0.02 < R(Ca) <= 0.05
Fe2	0.05 < R(Fe) <= 0.1	Ca2	0.05 < R(Ca) <= 0.1
Fe3	0.1 < R(Fe) <= 0.3	Ca3	0.1 < R(Ca) <= 0.3
Fe4	0.3 < R(Fe) <= 0.6	Ca4	0.3 < R(Ca) <= 0.6
Fe5	0.6 < R(Fe) <= 1	Ca5	0.6 < R(Ca) <= 1

The column non-Sil-Cal means R(Ca) = 0 amd R(Fe) = 0.

- TFS17_Ca_mass_depo_rate.csv: Daily mass deposition rate for calcium in mg/(m^2*d). Columns as above.
- TFS17_Total_mass_depo_rate.csv: Daily total mass deposition rate in mg/(m^2*d). Columns as above.
- TFS17_Total_number_depo_rate.csv: Daily total number deposition rate in 1/(mm^2*d). Columns as above.

1.3 Relative abundance of different particle groups

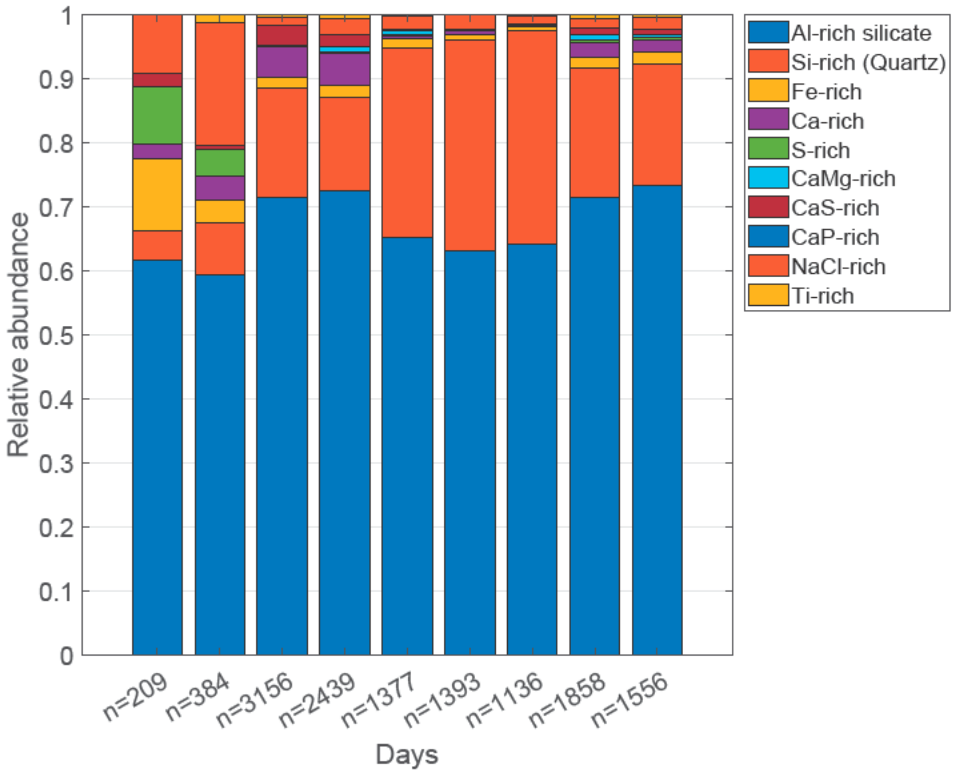


Figure S1A: *Chemical composition (relative number abundance of different particle groups) of major dust particles per unit of measurement. The total number of particles (n) analyzed on each measurement day is also shown.*

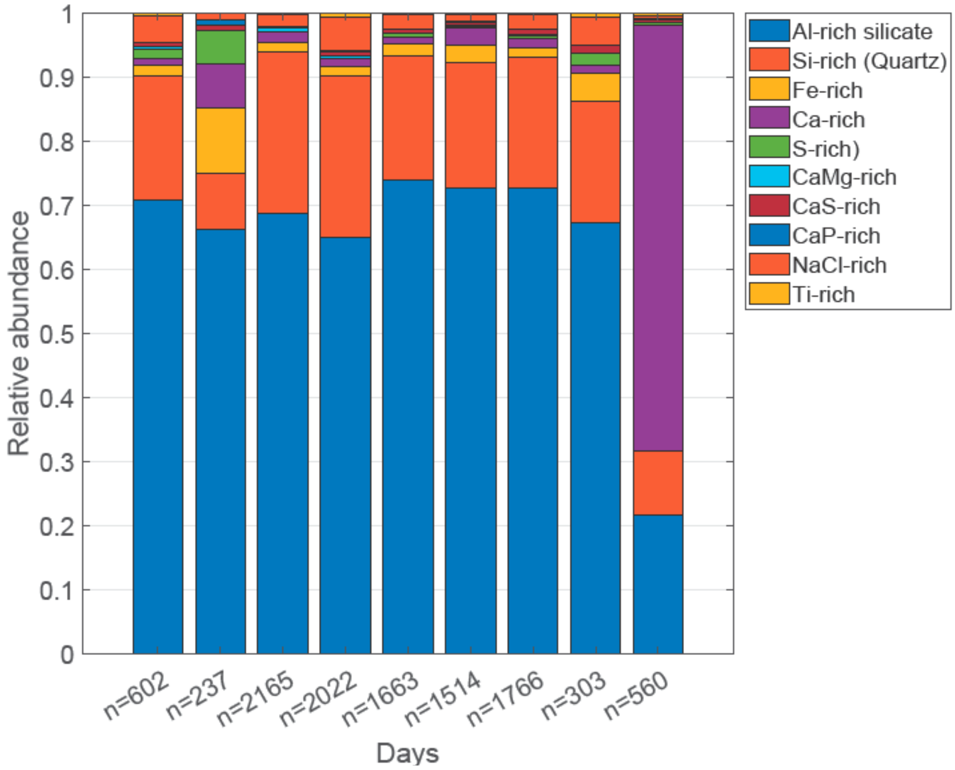


Figure S1B: *Chemical composition (relative number abundance of different particle groups) of dust samples per unit of measurement. The total number of particles (n) analyzed on each measurement day is also shown.*

2 Mass concentration (Barbados 2013)

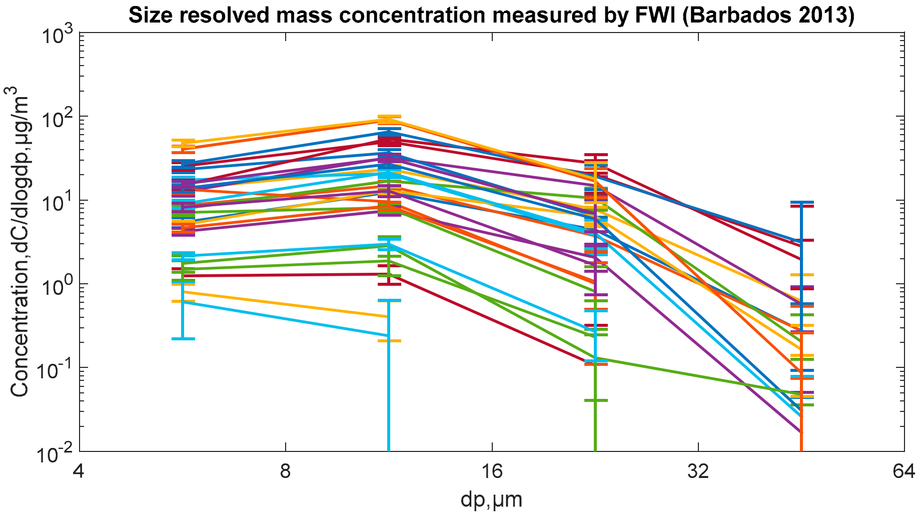


Figure S 2: *Atmospheric mass size distribution densities derived FWI measurements (Barbados 2013). Error bars represent 95% confidence intervals. Different curves represent different measurement*

3 Complex index of refraction

3.1 Real part

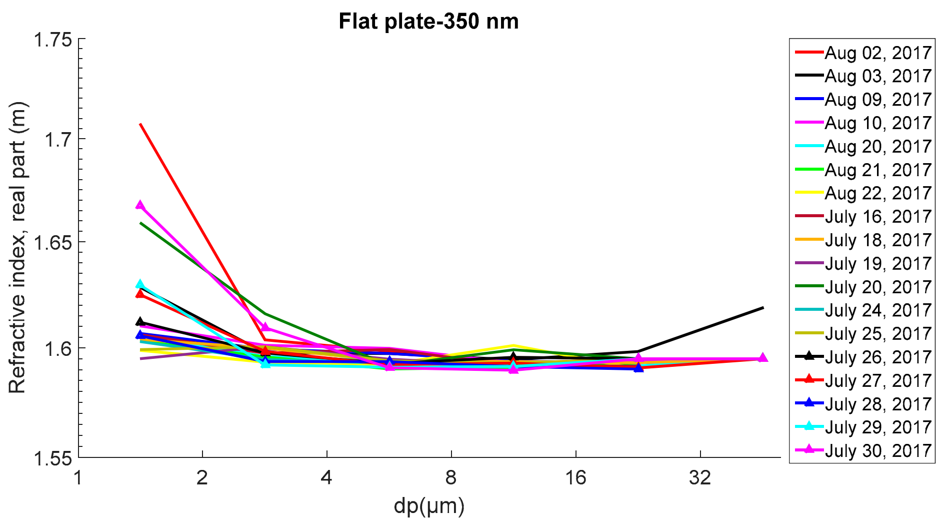


Figure S 3: *Average complex refractive index (real part) for different sampling days deduced from individual particle analysis (at wave length=350 nm).*

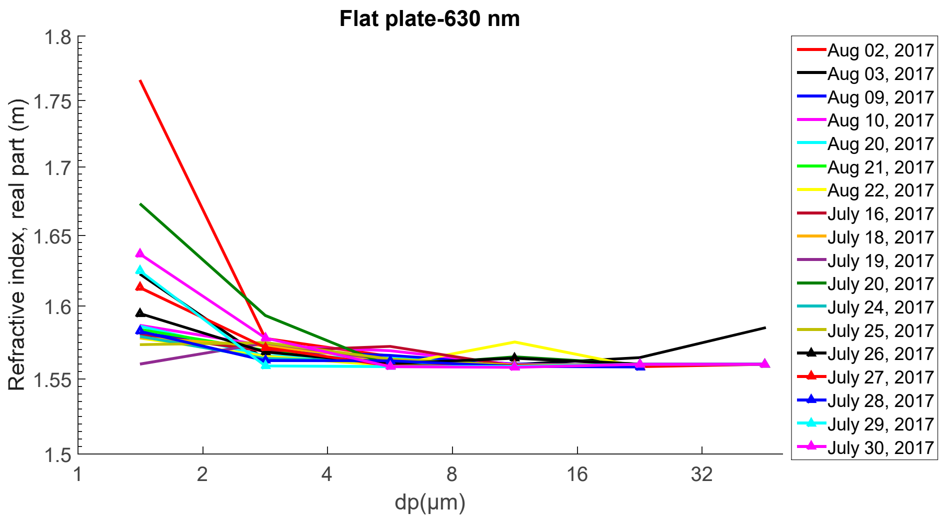


Figure S 4: *Average complex refractive index (real part) for different sampling days deduced from individual particle analysis (at wave length=630 nm).*

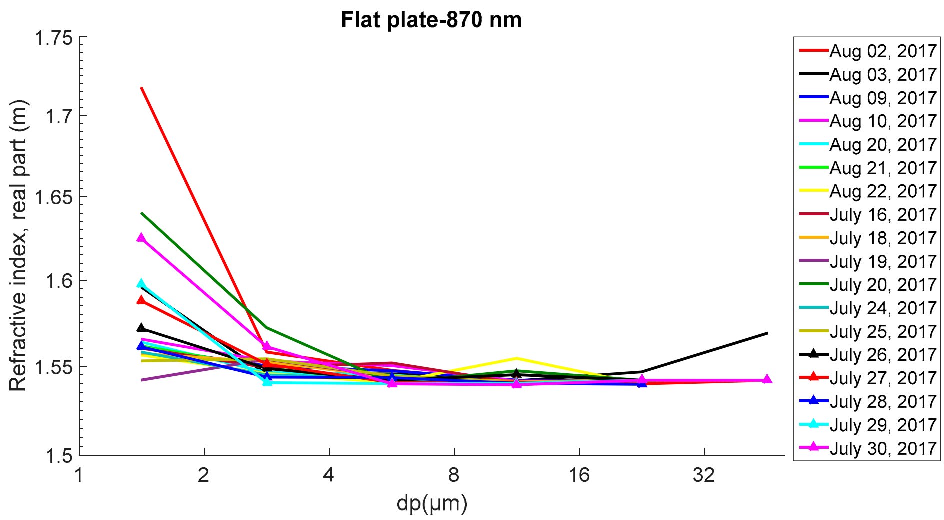


Figure S 5: *Average complex refractive index (real part) for different sampling days deduced from individual particles analysis (at wave length=870 nm).*

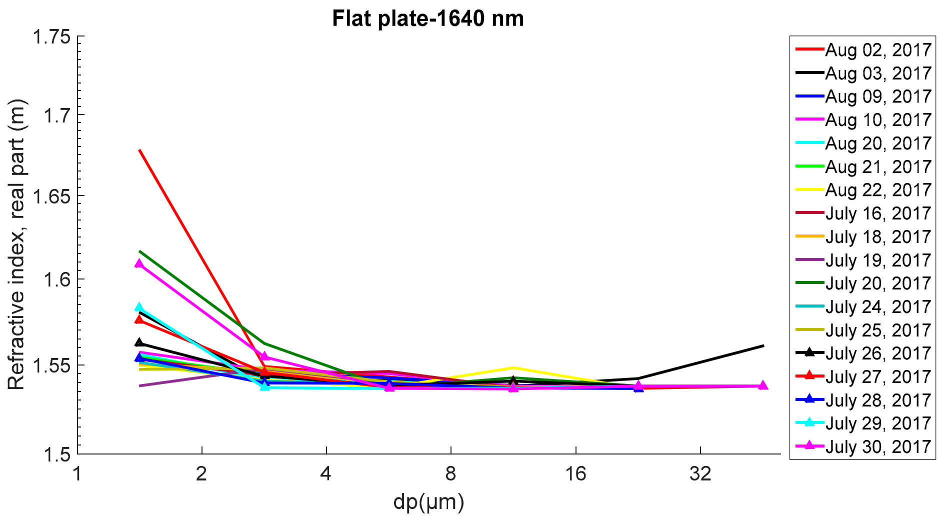


Figure S 6: *Average complex refractive index (real part) for different sampling days deduced from individual particle analysis (at wave length=1640 nm).*

3.2 Imaginary part

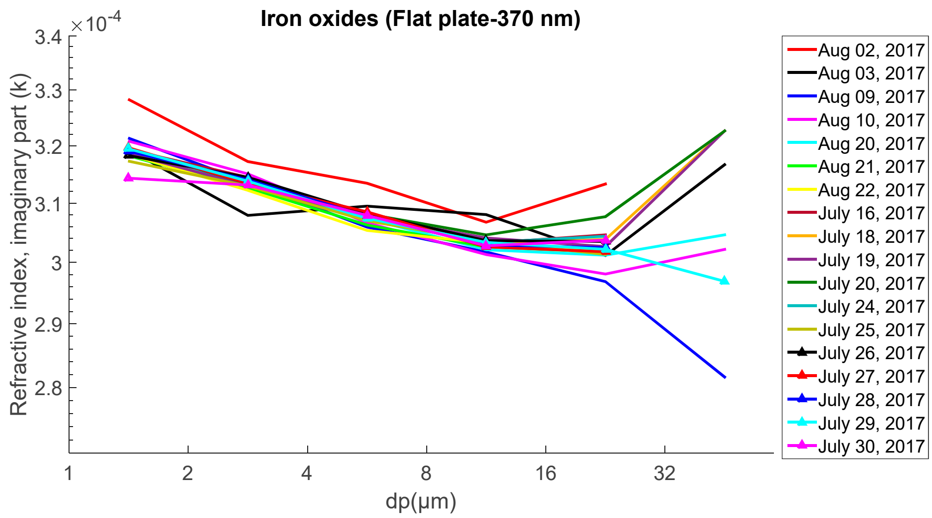


Figure S 7: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=370 nm).*

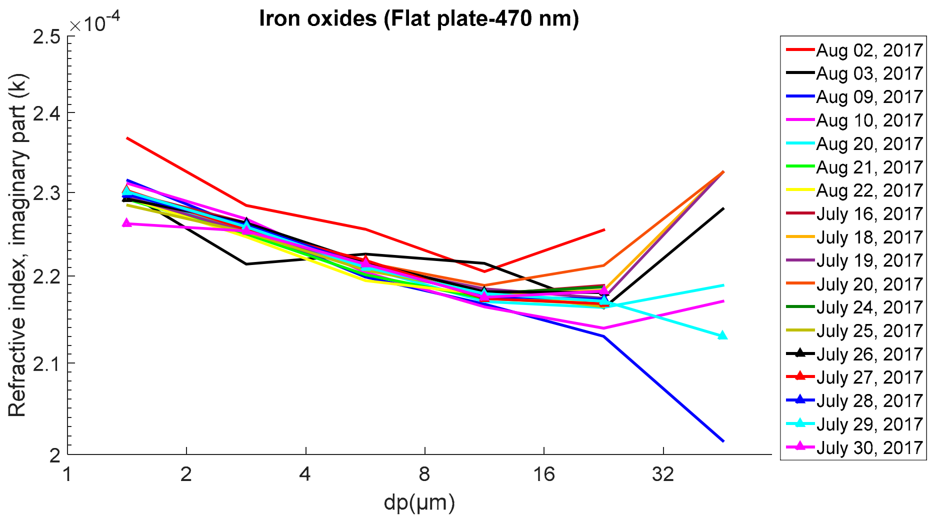


Figure S 8*: Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=470 nm).*

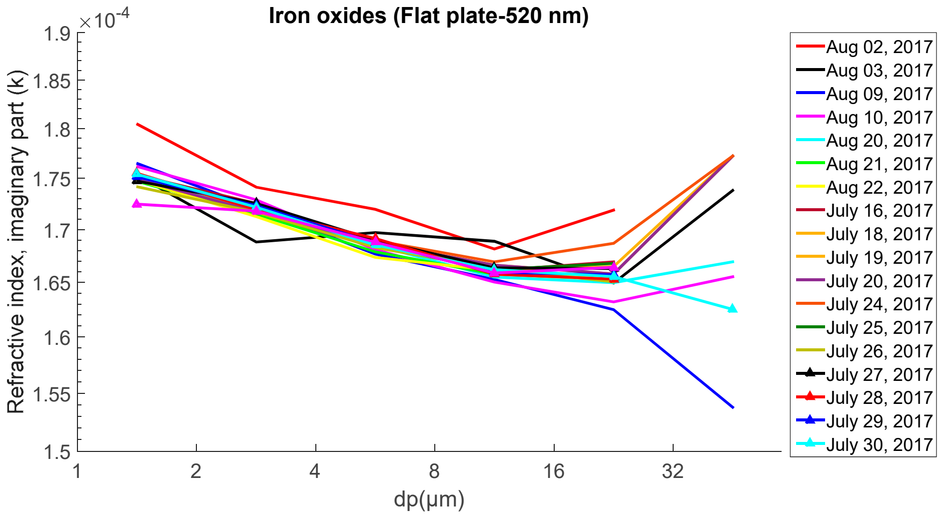


Figure S 9: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=520 nm).*

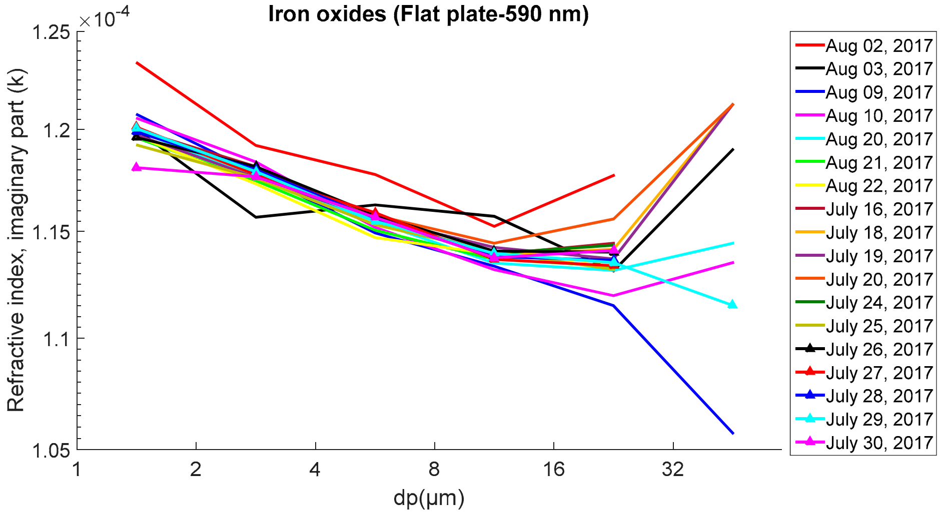


Figure S 10: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=590 nm).*

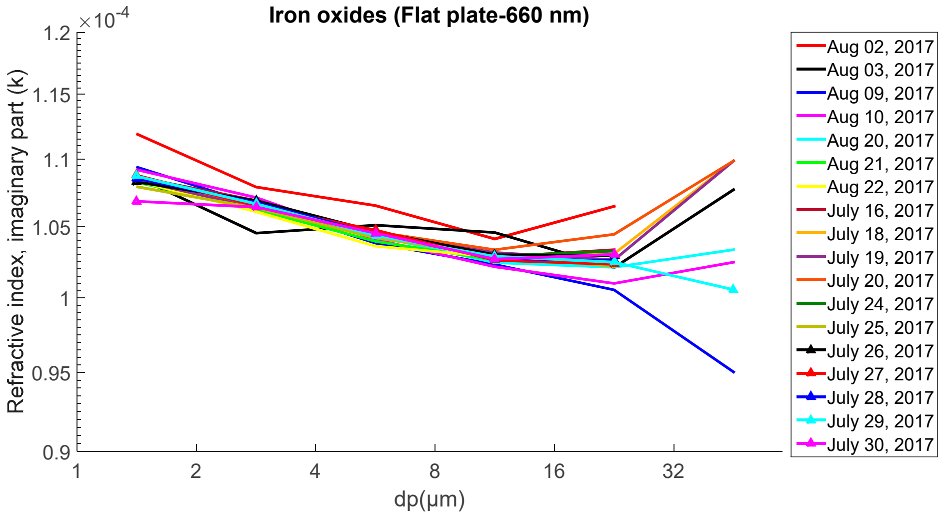


Figure S 11: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=660 nm).*

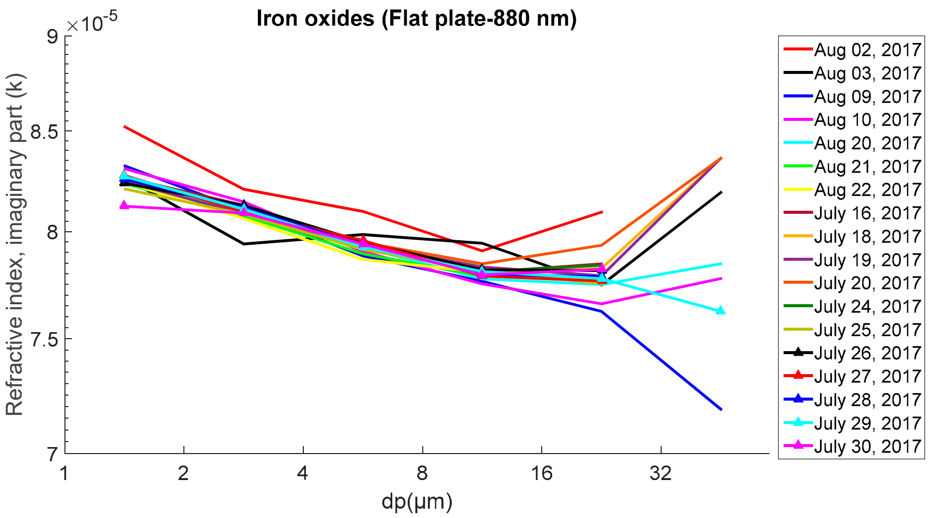


Figure S 12: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=880 nm).*

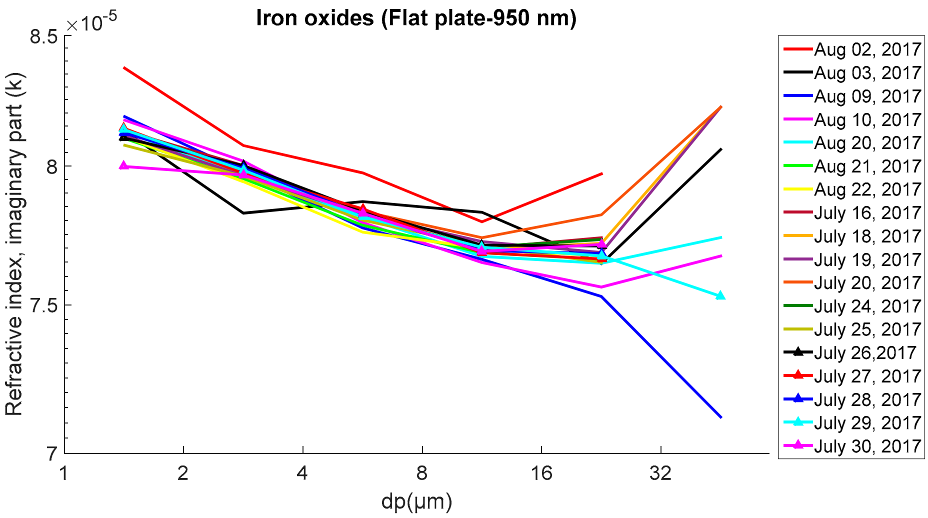
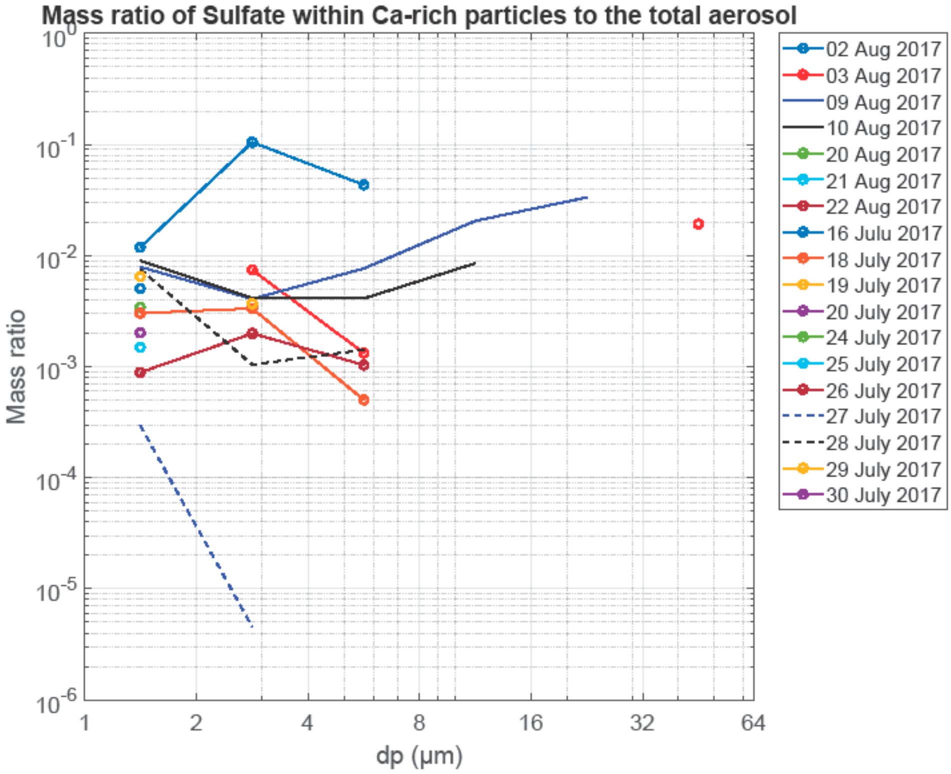
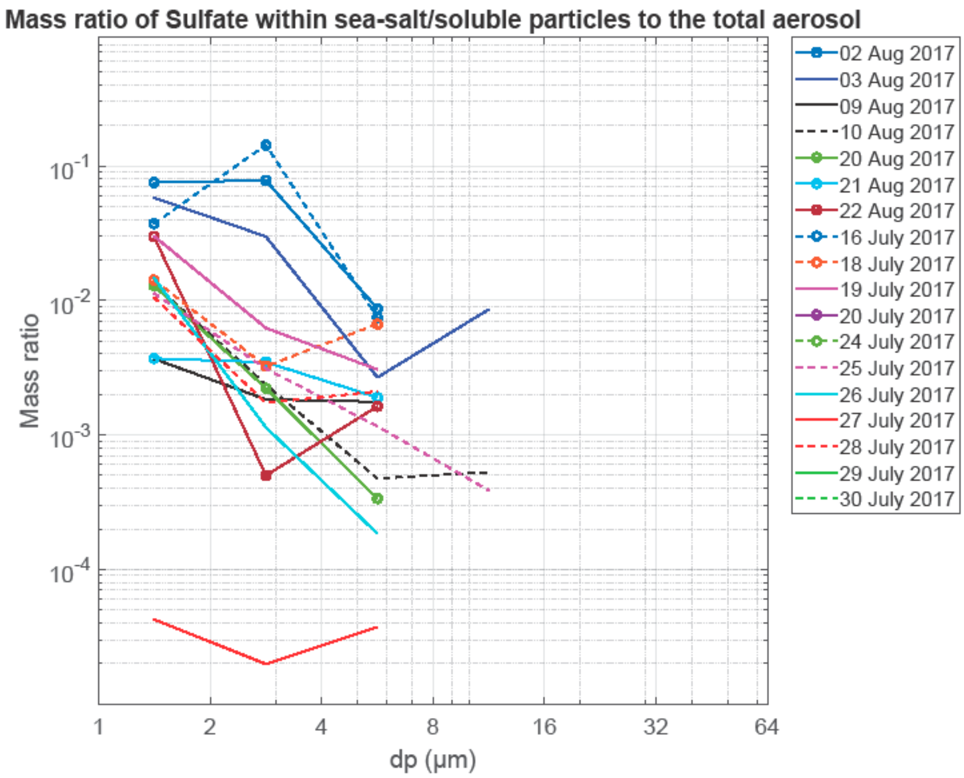


Figure S 13: *Average complex refractive index (imaginary part) of iron oxide particles for different sampling days deduced from individual particle analysis (at wave length=950 nm).*

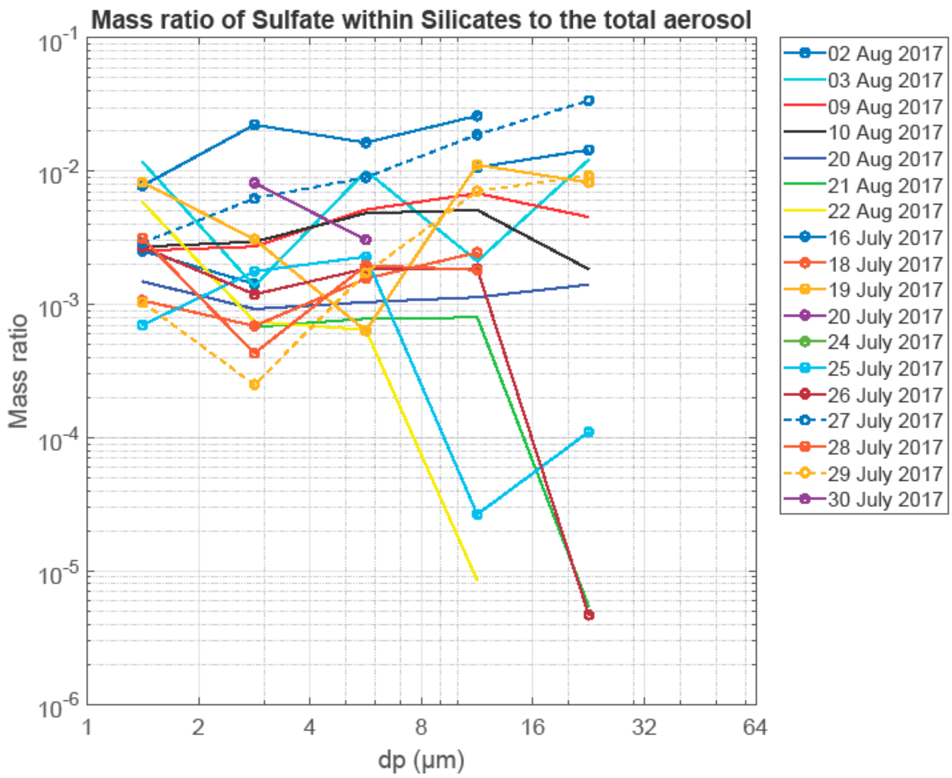
4 Internal mixing of dust particle with sulfate



(a)



(b)



(c)

Figure S 14: *Relative mass contribution of sulfate particles to the major components (**a**: Sulfate in Ca-rich; **b**: Sulfate in sea-salt/ soluble particles; **c**: Sulfate in Silicates) of dust aerosol particles in different sampling days deduced from individual particle analysis.*

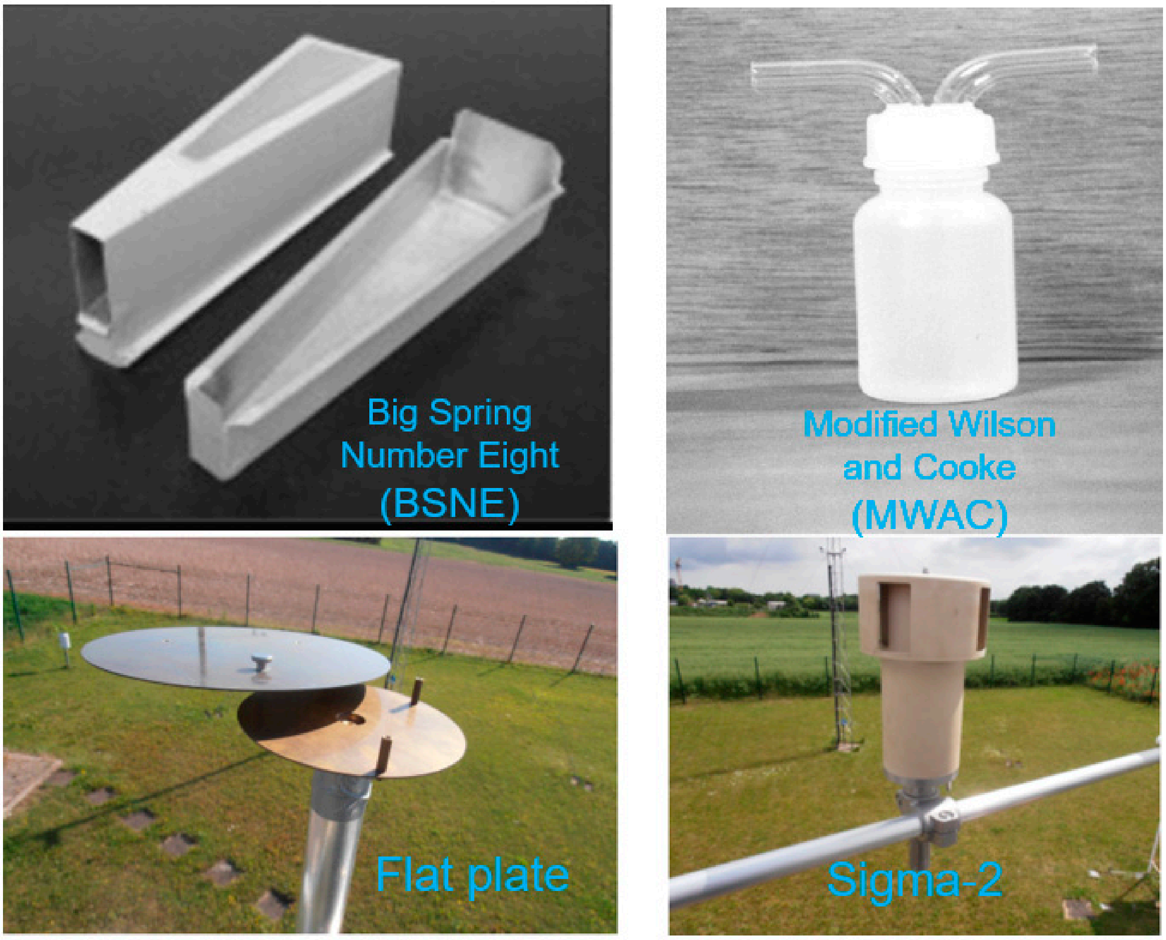


Figure S 15: *Photos of different kinds of passive (surrogate) samplers used in the field campaign (Note: The data for the last sampler (Sigma-2) has not been included in this work).*

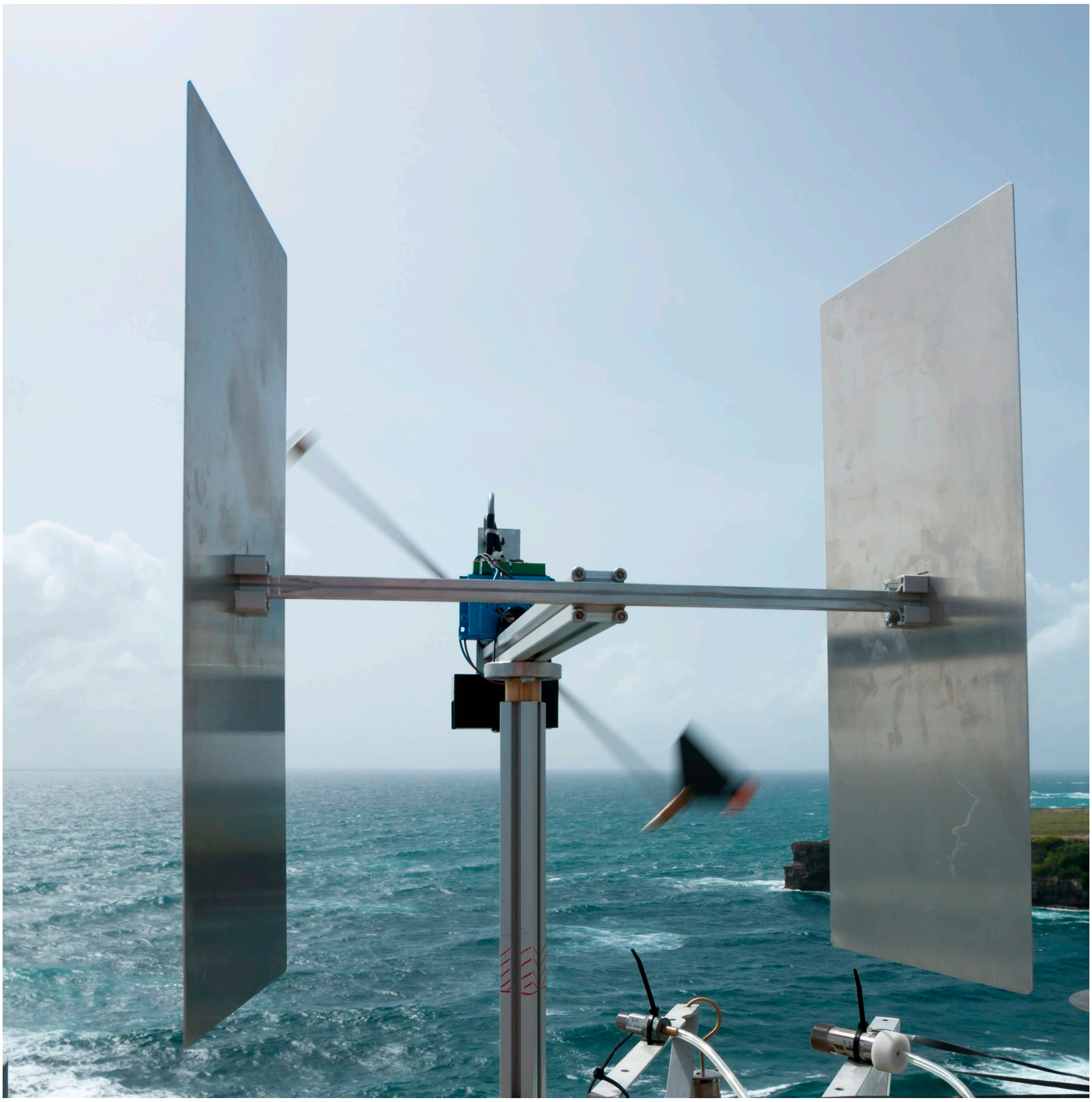


Figure S 16*: Photo of the free wing Impactor (FWI) used in the field campaign.*