Supplement of

Insights into the single particle composition, size, mixing state and aspect ratio of freshly emitted mineral dust from field measurements in the Moroccan Sahara using electron microscopy

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S.1 Scheme for particle classification

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;Silikate

[Quartz]
Name=Quartz-like
Class=silicates
Si/(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
F/(F+Si)=0 .. 0.499
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Ca-Si Mix]
Name=Ca-rich silicate/Ca-Si-mixture
Class=silicates
(Ca+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Ca/(Al+Si)=0.3 .. 3.333
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :


[Pyroxene]
Name=Pyroxene-like
Class=silicates
Al/Si=0 .. 0.1
(Ca+Mg+Fe+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
(Na+Mg+K+Ca+Al+Fe)/Si=0.8 .. 1.2
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[complex QuartzMix]
Name=Complex quartz-like
Class=silicates
(Al+Si+Na+Mg+K+Ca+Fe) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.05 .. 0.25
(Na+K+Ca)/Si=0 .. 1
Fe/Si=0 .. 0.5
Ca/Si=0 .. 0.5
K/Si=0 .. 0.5
Mg/Si=0 .. 0.5
Na/Si=0 .. 0.5
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[other silicate]
Name=Other silicate
Class=silicates
(Al+Si+Na+Mg+K+Ca+Fe+Ti) / (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
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
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;clay minerals

[Kaolinite]
Name=Kaolinite-like
Class=clay minerals
(Al+Si) / (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/(Al+Si)=0 .. 0.15
K/(Si)=0 .. 0.1
(Na+Cl+2*S)/(Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Illit]
Name=Illite-like
Class=clay minerals
(K+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.45 .. 1.5
Mg/(Al+Si)=0 .. 0.2
Fe/(Al+Si)=0 .. 0.2
(Na+Ca)/(Al+Si)=0 .. 0.2
K/(Si)=0.1 .. 1.01
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Smectit/Montmorrillonit später Plot da hier auch Palygorskit]
Name=Smectite-like
Class=clay minerals
(Mg+Al+Si) / (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
Ca/(Al+Si)=0 .. 0.2
Na/(Al+Si)=0 .. 0.2
K/(Si)=0 .. 0.1
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Chloritgruppe]
Name=Chlorite-like
Class=clay minerals
(Mg+Fe+Al+Si) / (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
Ca/(Al+Si)=0 .. 0.3
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
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;feldspar

[K-Feldspar]
Name=Microcline-like
Class=feldspar
(K+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.2 .. 0.45
K/Si=0.15 .. 0.5
Ca/Si=0 .. 0.1
Na/Si=0 .. 0.1
(Cl+2*S)/Na = 0 .. 0.3
(Cl+2*S) / (Al+Si)=0 .. 0.125
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl)   (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Na-Feldspar]
Name=Albite-like
Class=feldspar
(Na+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.2 .. 0.45
Na/Si=0.15 .. 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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Ca-Feldspar]
Name=Anorthite-like
Class=feldspar
(Ca+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.8 .. 1.2
Ca/Si=0.2 .. 0.7
Na/Si=0 .. 0.1
K/Si=0 .. 0.1
(Cl+2*S)/Na = 0 .. 0.3
(Cl+2*S) / (Al+Si)=0 .. 0.125
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :


[complex feldspar]
Name=Complex feldspar-like
Class=silicates
(Al+Si+Na+Mg+K+Ca+Fe) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.25 .. 0.5
(Na+K+Ca)/Si=0.125 .. 0.7
Fe/Si=0 .. 0.5
Ca/Si=0 .. 0.5
K/Si=0 .. 0.5
Mg/Si=0 .. 0.5
Na/Si=0 .. 0.5
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[complex clay/Fsp-Mix]
Name=Complex clay/feldspar mixture
Class=silicates
(Al+Si+Na+Mg+K+Ca+Fe) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.25 .. 0.5
(Na+K+Ca)/Si=0 .. 0.125
Fe/Si=0 .. 0.5
Ca/Si=0 .. 0.5
K/Si=0 .. 0.5
Mg/Si=0 .. 0.5
Na/Si=0 .. 0.5
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
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;phyllo-silicates

[Muscovite + Biotit]
Name=Mica-like
Class=(phyllo-)silicate/clay mineral
(Ca+Na+K+Fe+Mg+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.2 .. 3
(Na+K+Ca+Mg+Fe)/(Si)=0.5 .. 2.5
(Cl+2*S)/Na = 0 .. 0.3
(Cl+2*S) / (Al+Si)=0 .. 0.125
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[complex clay]
Name=Complex clay-mineral-like
Class=(phyllo-)silicate/clay mineral
(Al+Si+Na+Mg+K+Ca+Fe) / (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
Na/Si=0 .. 0.5
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Palygorskit]
Name=Palygorskite-like
Class=(phyllo-)silicate/clay mineral
(Mg+Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Al/Si=0.1 .. 0.5
(Mg)/(Al+Si)=0.2 .. 0.7
Ca/Si=0 .. 0.1
Fe/Si=0 .. 0.1
Na/Si=0 .. 0.1
K/Si=0 .. 0.1
(Na+Cl+2*S) / (Al+Si)=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
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;Oxides/Hydroxides

[Fe-rich]
Name=Hematite-like
Class=Oxides/Hydroxides
AdditionalTitle=Density
Additional=5
Fe/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.5 .. 0.98999
Cr/(Cr+Fe)=0 .. 0.1
Cl/(Cl+Fe)=0 .. 0.1
(F+Si)/(F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0 .. 0.499
Ti/Fe=0 .. 0.24999
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Ti-rich]
Name=Rutile-like
Class=Oxides/Hydroxides
AdditionalTitle=Density
Additional=4.1
Ti/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Ca/(Ca+Ti)=0 .. 0.3
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Ti-Ca-rich]
Name=Perovskite-like
Class=Oxides/Hydroxides
AdditionalTitle=Density
Additional=4.1
(Ti+Ca)/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Ca/(Ca+Ti)=0.3 .. 0.7
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Ilmenit]
Name=Ilmenite-like
Class=Oxides/Hydroxides
AdditionalTitle=Density
Additional=4.72
(Fe+Ti)/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Ti/Fe=0.25 .. 4
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
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; non-silicates

[Calcite]
Name=Calcite-like
Class=Ca-rich
Ca/(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
P/(Ca+P)=0 .. 0.19
S/(Ca+S)=0 .. 0.19
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Dolomite]
Name=Dolomite-like
Class=Ca-rich
(Mg+Ca) / (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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Apatite]
Name=Apatite-like
Class=Ca-rich
(Ca+P) / (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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Gypsum]
Name=Gypsum-like
Class=stable sulfates
(Ca+S) / (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
~kappa_upper=Cl+Na>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+Na>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Fluorite]
Name=Fluorite-like
Class=Ca-rich
(Ca+F) / (F+Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Ca/(Ca+S)=0 .. 0.1999
Ca/(Ca+F)=0.1667 .. 0.5
Mg/Ca=0 .. 0.3
Cl/Ca=0 .. 0.3
~kappa_upper=Cl+Na>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+Na>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[Mg-rich]
Name=Magnesite-like
Class=other
AdditionalTitle=Density
Additional=3.3
Mg/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
```

```
; salt/silicates mixtures

[Sea-salt]
Name=Sea-salt
Class=sea-salt
(Na+Mg+Cl) / (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
~SSRIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[aged Sea salt]
Name=Aged sea-salt
Class=sea-salt
(Na+Mg+Cl+S+Ca) / (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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~SSRIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[NaCl-Si-Mix]
Name=Sea-salt/silicate mixture
Class=sea-salt/silicate mixtures
(Al+Si+Mg+Fe+Na+Cl+S) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Fe / (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
F/(F+Si)=0 .. 0.499
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[NaClS-Si-Mix]
Name=Aged sea-salt/silicate mixture
Class=sea-salt/silicate mixtures
(Al+Si+Mg+Fe+Na+Cl+S) / (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 / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0 .. 0.3
S/Cl=0.5 .. 1
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[S-Si-Mix]
Name=Sulfate/silicate mixture
Class=sulfate/silicate mixtures
(Al+Si+Mg+Fe+Na+S) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
Fe / (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
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :

[complex mix]
Name=Complex mixture
Class=complex mixtures
(Na+Mg+Al+Si+S+Cl+K+Ca+Fe) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
(Na+Cl) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9
S/(Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9
(Ca+K+Mg+Fe) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9
(Al+Si) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.1 .. 0.9
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
```

```
;Sulfates

[Na Sulfate]
Name=Sodium sulfate
Class=soluble sulfates
(Na+Mg+S+Cl) / (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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~SSIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[sulfate]
Name=Ammonium-sulfate-like
Class=soluble sulfates
S/(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
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~SSRIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[complex sulfate]
Name=Complex sulfate
Class=soluble sulfates
(Na+Mg+K+Ca+S+Cl) / (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
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~SSRIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[complex sulfate-chloride]
Name=Complex soluble salt
Class=soluble sulfates
(Na+Mg+K+Ca+S+Cl) / (Na+Mg+Al+Si+P+S+Cl+K+Ca+Ti+Cr+Mn+Fe)=0.7 .. 1.01
(Al+Si)/S=0 .. 0.25
IsNotInOtherGroup=yes
~kappa_upper=Cl+S>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+S>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*S + 1.12*58.44/2.17*Cl)/(142.04/2.66*S + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
~SSRIB=(Na+2*Mg+K+2*Ca-Cl-2*S)/(Na+2*Mg+K+2*Ca+Cl+2*S)
~FI_Mg_Na=lg(Mg/Na)
~FI_Ca_Na=lg(Ca/Na)
~FI_Mg_Cl=lg(Mg/Cl)
~FI_Na_Cl=lg(Na/Cl)
~FI_S_Cl=lg(S/Cl)

[Alunite]
Name=Alunite-like
Class=stable sulfates
(Al+K+S) / (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 .. 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
~kappa_upper=Cl+Na>0 ? (1-f_dust_upper)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_upper)*(0.8) :
~kappa_lower=Cl+Na>0 ? (1-f_dust_lower)*(0.68*142.04/2.66*Na + 1.12*58.44/2.17*Cl)/(142.04/2.66*Na + 58.44/2.17*Cl) : (1-f_dust_lower)*(0.8) :
```

S.2 Determining the size distributions from the freewing impactor measurements

For calculating the atmospheric size distribution from the FWI, the collection efficiency of the FWI has to be considered.

The collection efficiency E(P) is parameterized from the experimentally determined values for discs given by May and Clifford (1967) as a function of impaction parameter *P*:

$$P = \frac{S}{D}, \tag{1}$$

where *S* is the stopping distance and *D* is the characteristic dimension, here 25 mm.

While *P* equals to the Stokes number within the Stokes regime, in the current work the particle Reynolds numbers are considerably higher. In this regime, in analogy to Hinds (1999) the stopping distance (*S*) can be approximated with better than 3 % accuracy as

$$S = \frac{\rho_{amb} \cdot d_{amb}}{\rho_a \cdot \sqrt{\gamma}} \left[Re_p^{1/3} - \sqrt{6} \tan \text{inverse} \left(\frac{Re_p^{1/3}}{\sqrt{6}} \right) \right], \tag{2}$$

where ρ_{amb} is the ambient particle density, estimated from chemical composition, ρ_a is air density, and γ is aerodynamic shape factor. Results of the trigonometric function must be given in radian. The dry aerodynamic shape factor is assumed as constant similar to Ott and Peters (2008).

The particle Reynolds number is calculated as

$$Re_p = \frac{\rho_a \cdot v_i \cdot d_{amb}}{\eta \cdot \sqrt{\gamma}} \tag{3}$$

where $v_i = \sqrt{v_r^2 + v^2}$ is the impaction velocity

$v_r = 2\pi l f_r$ is the speed of the collector in the plane of rotation

l is the collector arm length

f_r is the rotation frequency

v is the wind speed

η is air viscosity

The collection E(P) efficiency for P>0.125 is then parameterized and the according correction is

$$c_e = \frac{1}{E(P)} = exp\left(\frac{0.28}{P}\right) \tag{4}$$

The total investigated volume (V_i) for the concentration calculations is determined by

$V_i = A v_i t_i$, where

A is the analyzed area,

t_i is the sample collection time.

S.3 Calculation of the feldspar indices

The index values show the closeness of a particle composition to pure feldspar. They are composed of three properties, the overall contribution of feldspar-specific elements to the particle composition and the closeness to the feldspar Al/Si ratio as well as to the K/Si or alkali/Si ratio. The overall contribution of specific elements is calculated as

$$r_{Sil} = \frac{|Na| + |Al| + |Si| + |K| + |Ca|}{|Na| + |Al| + |Si| + |K| + |Ca| + |Mg| + |P| + |S| + |Cl| + |Ti| + |Fe|} \tag{5}$$

Closeness w.r.t Al/Si is determined as

$$r_{fsp,Al/Si} = \frac{|Al|}{|Si|} \frac{3|Na| + 3|K| + 2|Ca|}{|Na| + |K| + 2|Ca|} \tag{6}$$

$$Q_{fsp,Al/Si} = \begin{cases} 1 - \left| lg(r_{fsp,Al/Si}) \right| & \forall \quad 0.1 \leq r_{fsp,Al/Si} \leq 10 \\ 0 & \forall \quad r_{fsp,Al/Si} < 0.1 \\ 0 & \forall \quad r_{fsp,Al/Si} > 10 \end{cases} \tag{7}$$

Closeness w.r.t K and alkali ratio is calculated as

$$r_{fsp,K/Si} = \frac{3|K|}{|Si|} \tag{8}$$

$$Q_{fsp,Al/Si} = \begin{cases} 1 - \left| lg(r_{fsp,K/Si}) \right| & \forall \quad 0.1 \leq r_{fsp,K/Si} \leq 10 \\ 0 & \forall \quad r_{fsp,K/Si} < 0.1 \\ 0 & \forall \quad r_{fsp,K/Si} > 10 \end{cases} \tag{9}$$

$$r_{fsp,NaKCa/Si} = \frac{3|Na| + 3|K| + 2|Ca|}{|Si|} \tag{10}$$

$$Q_{fsp,Al/Si} = \begin{cases} 1 - \left| lg(r_{fsp,NaKCa/Si}) \right| & \forall \quad 0.1 \leq r_{fsp,NaKCa/Si} \leq 10 \\ 0 & \forall \quad r_{fsp,NaKCa/Si} < 0.1 \\ 0 & \forall \quad r_{fsp,NaKCa/Si} > 10 \end{cases} \tag{11}$$

The similarity of a particle's composition to pure feldspar in expressed then as

$$P_{fsp} = r_{Sil} Q_{fsp,Al/Si} Q_{fsp,NaKCa/Si} \quad (12)$$

and to pure K-feldspar as

$$P_{fsp,K} = r_{Sil} Q_{fsp,Al/Si} Q_{fsp,K/Si} \quad (13)$$

For example, the P_{fsp} value becomes 1 for pure microcline or plagioclase and 0 for sodium chloride or quartz.

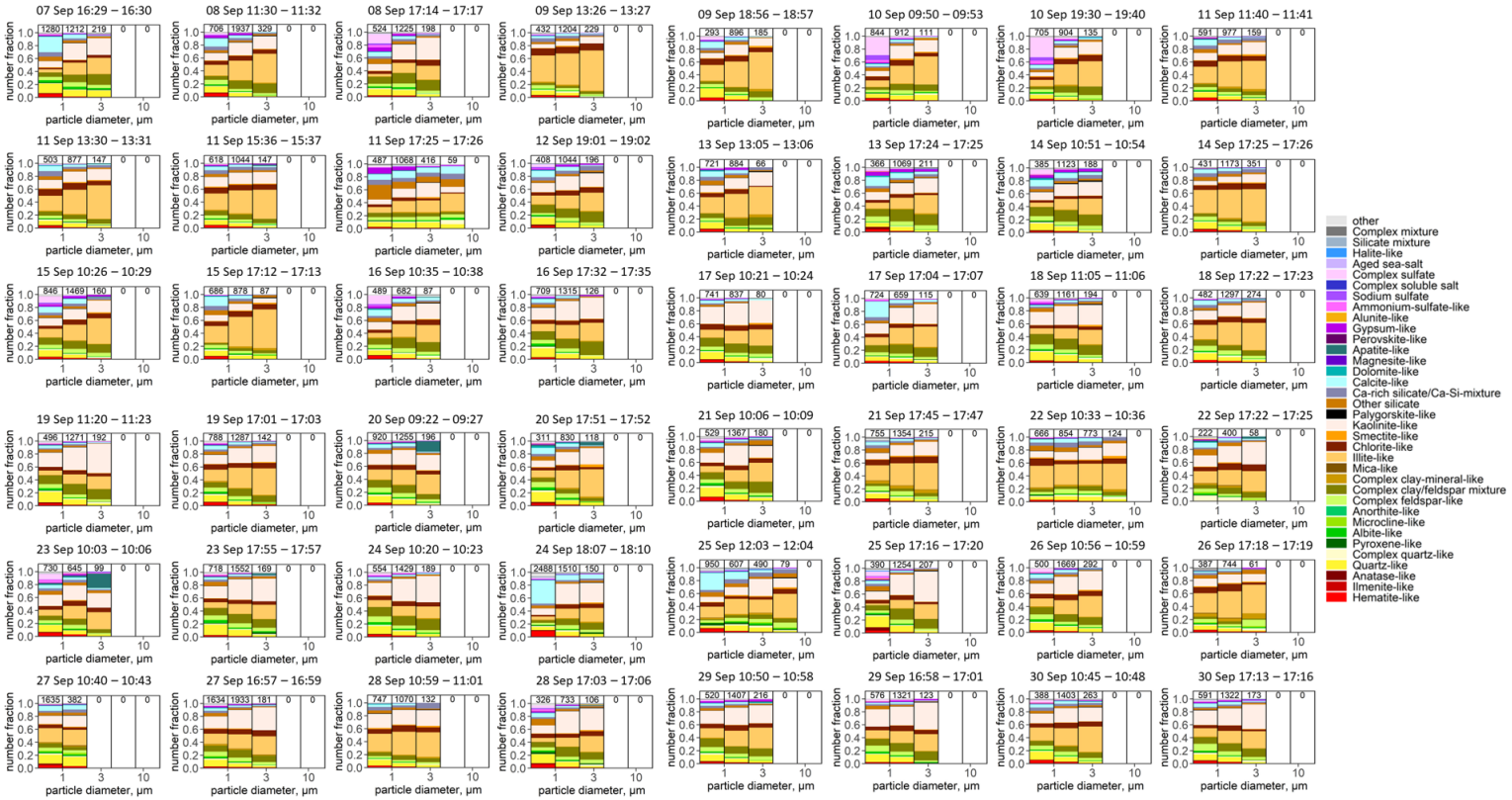

Figure S1. Number abundance for MOUDI stage 4. Abundance bars are not shown for size bins with fewer than 50 particles.

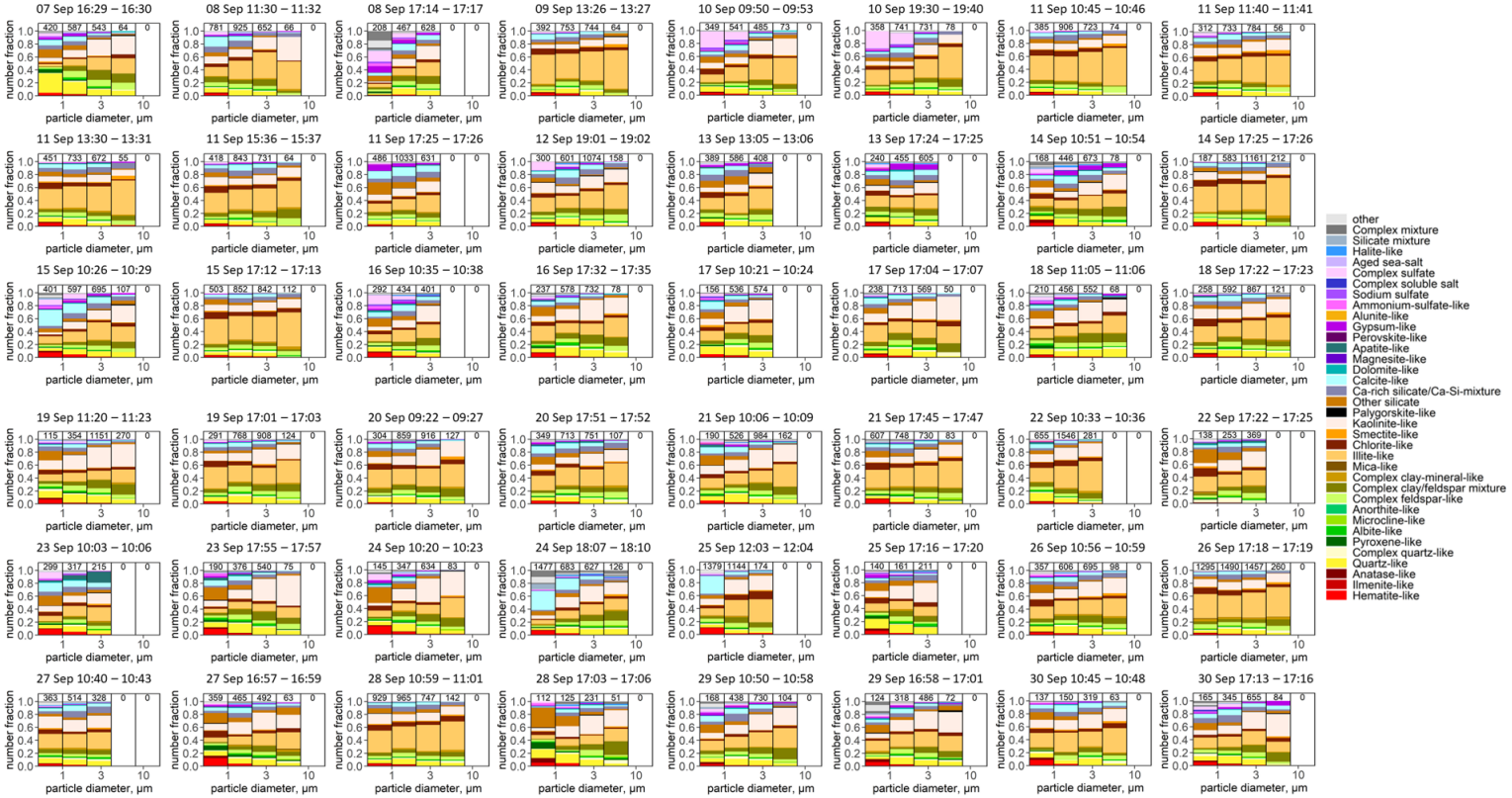

Figure S2. Number abundance for MOUDI stage 3. Abundance bars are not shown for size bins with fewer than 50 particles.

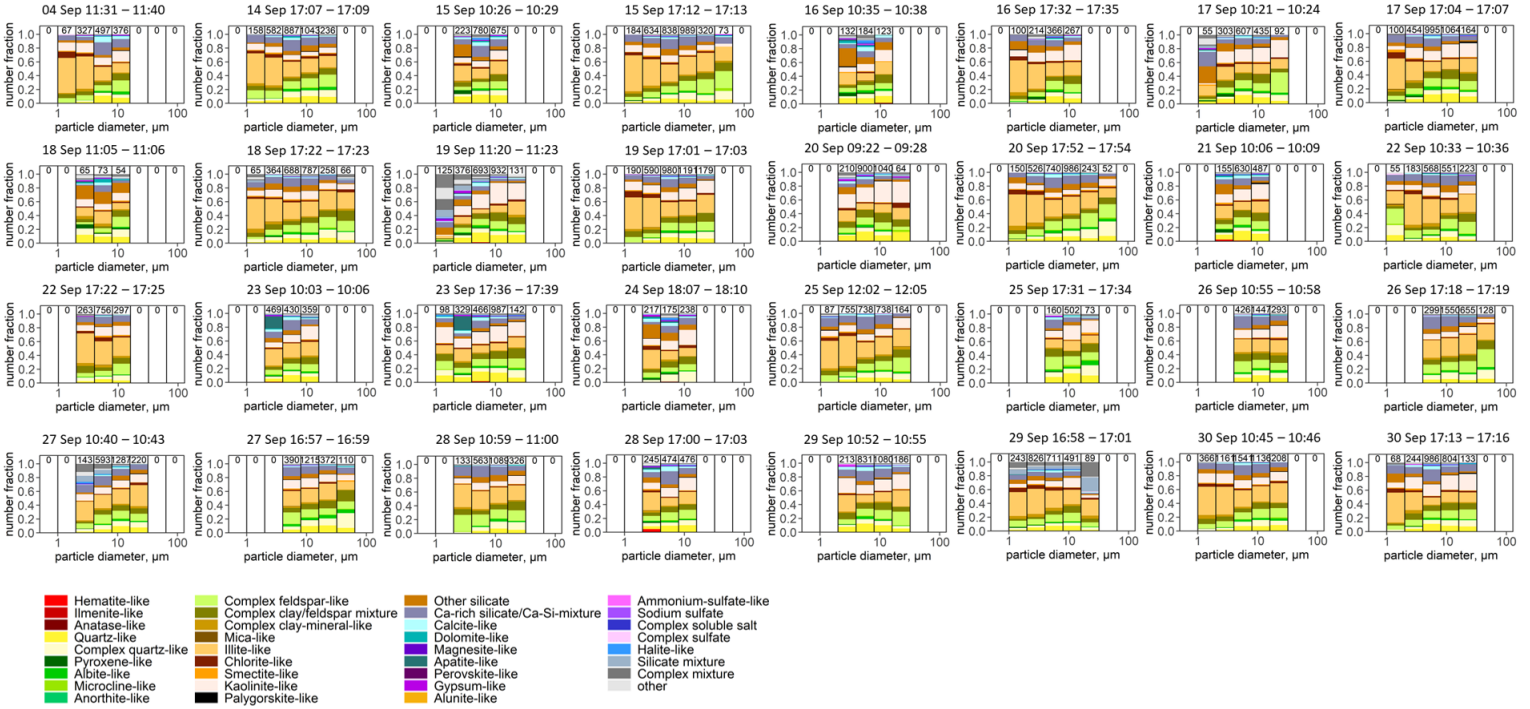

Figure S3. Number abundance for FWI. Abundance bars are not shown for size bins with fewer than 50 particles.

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