atmosphere

Contribution of Physical and Chemical Properties to Dithiothreitol-Measured Oxidative Potentials of Atmospheric Aerosol Particles at Urban and Rural Sites in Japan

Kazuki Kurihara [1], Ayumi Iwata [1,*], Samuel Gray Murray Horwitz [1], Kako Ogane [1], Tomoki Sugioka [1], Atsushi Matsuki [2], Tomoaki Okuda [1]

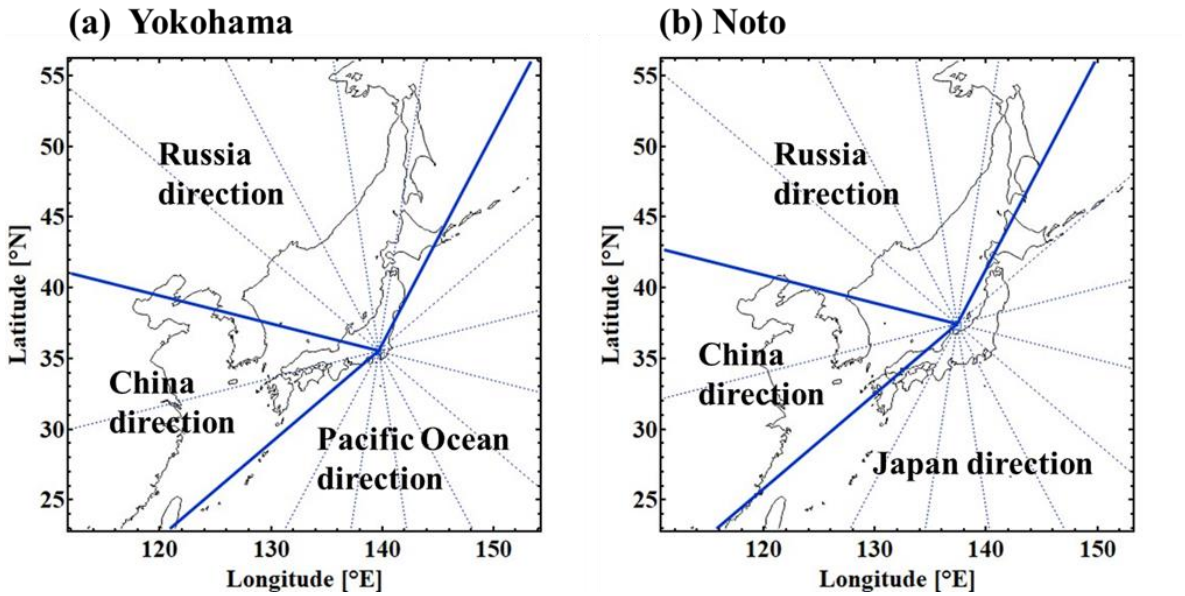

Figure S1. Classification maps of air mass backward trajectory at each observatory. The angles of each sector based on the line extended from each observation site to the east are as follows: (a) the Russia direction: 56.25–168.75°; (a) the China direction: 168.75–213.75°; (a) the Pacific Ocean / Japan direction: 0–56.25° and 213.75–360°. We calculated air mass positions every 1 hour and obtained 72 positions for each backward trajectory which were calculated from National Center for Atmospheric Research/National Centers for Environmental Prediction 2.5-deg global reanalysis data with vertical motion methods in NOAA HYSPLIT model. When >65% of 72 trajectory positions belong to a certain sector, we defined the air mass as that coming from that sector. Additionally, when a certain sector has the most positions but <65% (<46 positions) in trajectories, we used light colors in bar graphs of Fig. 2.

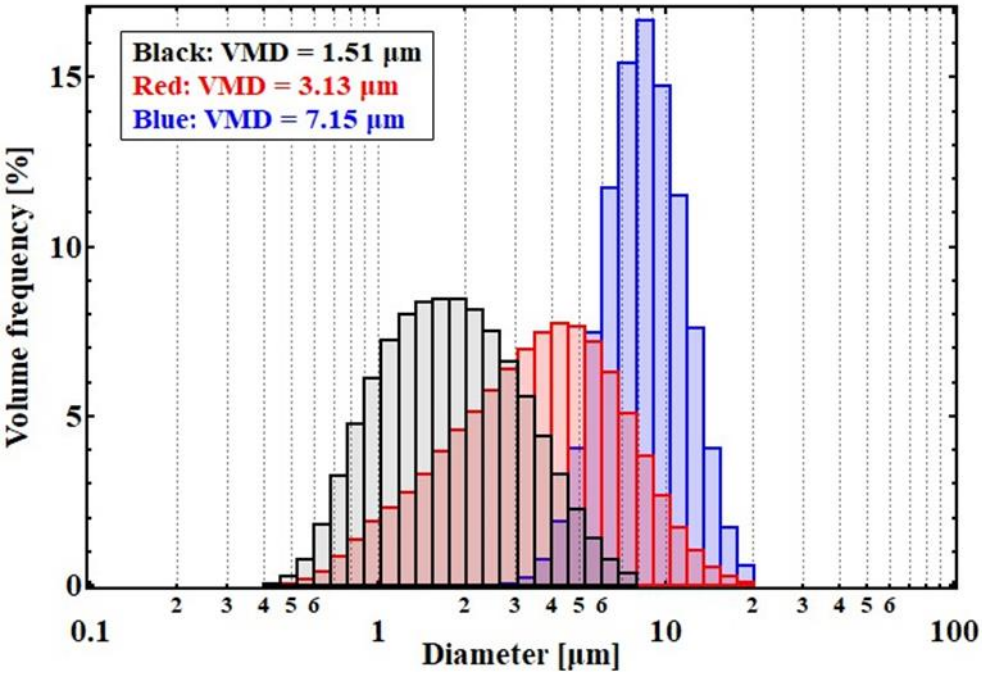

Figure S2. Size distributions of MnO_2 particles used in the laboratory experiment. The specific surface areas of the MnO_2 particles with volume median diameter of 1.51, 3.13, and 7.15 μm were 0.846, 0.482, and 0.164 $m^2\ g^{-1}$, respectively. These specific surface areas were calculated using the measured size distribution data and density of MnO_2 (ρ = 5.02 g cm^{-3}), assuming ideal spherical shape. Conditions of centrifugation are shown below. The MnO_2 particles were suspended in ultrapure water with density of ρ = 1.00 g cm^{-3} and viscosity of η = 0.01 g $cm^{-1}\ s^{-1}$. The maximum and minimum slewing radii in centrifugation were 6.6 and 3.0 cm, respectively. The MnO_2 particles with VMD = 1.51 μm were obtained from the supernatant liquid when the suspension was centrifugally classified with revolution speed of 5000 rpm and centrifugation time of 13 sec. Those with VMD = 3.13 μm were acquired from the precipitate centrifugally classified with revolution speed of 1000 rpm and centrifugation time of 13 sec. Those with VMD = 7.15 μm were acquired from the precipitate when the suspension was centrifugally classified with revolution speed of 300 rpm and centrifugation time of 37 sec.

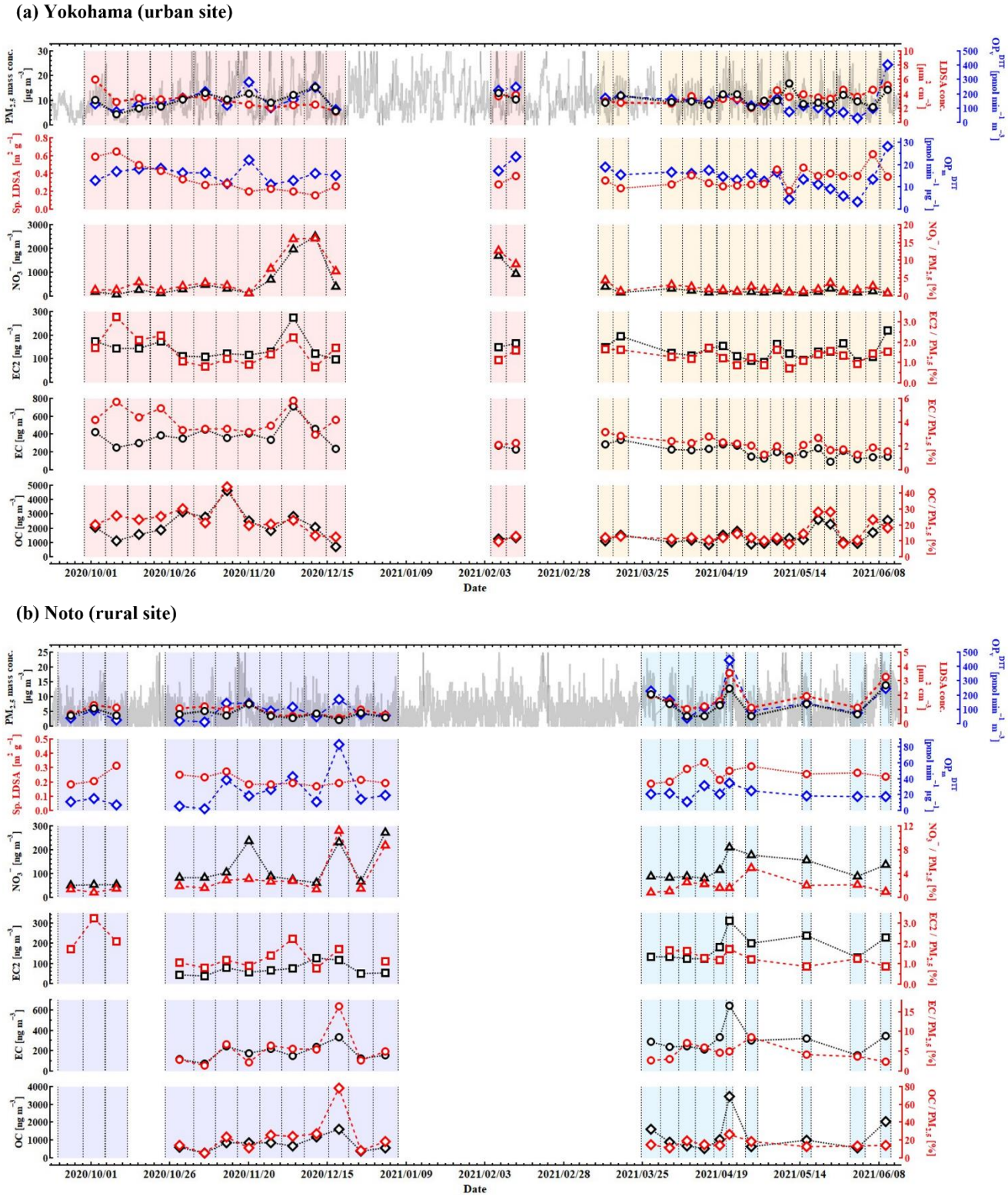

Figure S3. Temporal variations in physicochemical parameters and oxidative potentials at the two sites: (a) the urban Yokohama site; (b) the rural Noto site. Temporal variations in physicochemical parameters and oxidative potentials and at the two sites: (a) the urban Yokohama site; (b) the rural Noto site. Average PM2.5 mass concentration (black), LDSA concentration (red), and OPvDTT (blue) are shown in the first layer. In the second layer, the specific LDSA (red) and OPmDTT (blue) are shown. Atmospheric concentrations (black) and the proportion (red) of NO3–, EC2, total EC, and total OC are shown between the 3rd and 6th layers.

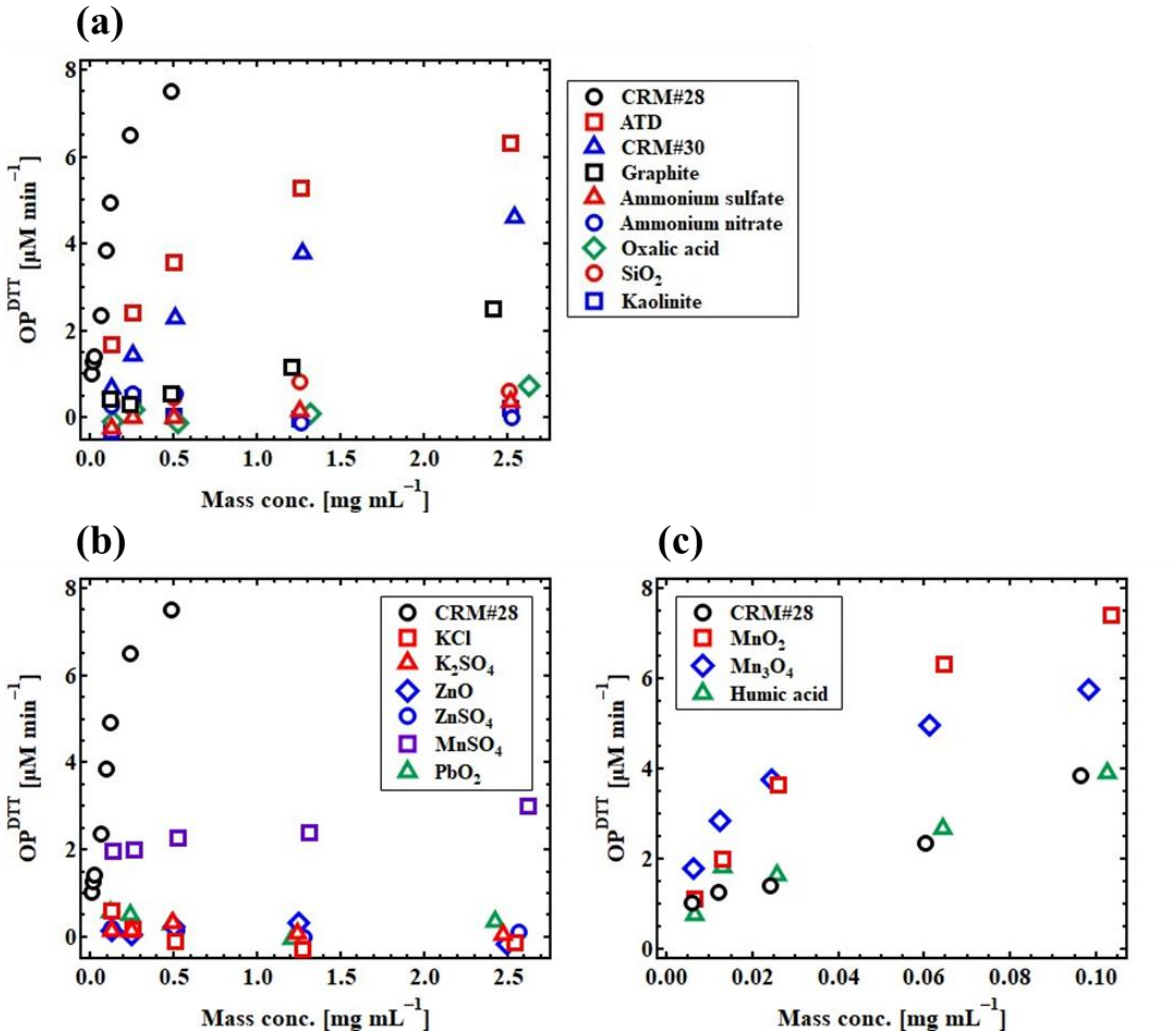

Figure S4. DTT activity of single component particles and standard materials: (a) CRM#28, ATD, CRM#30, graphite, ammonium sulfate, ammonium nitrate, oxalic acid, SiO_2, and kaolinite; (b) KCl, K_2SO_4, ZnO, $ZnSO_4$, $MnSO_4$, and PbO_2 compared to CRM#28; (c) MnO_2, Mn_3O_4, and humic acid compared to CRM#28.

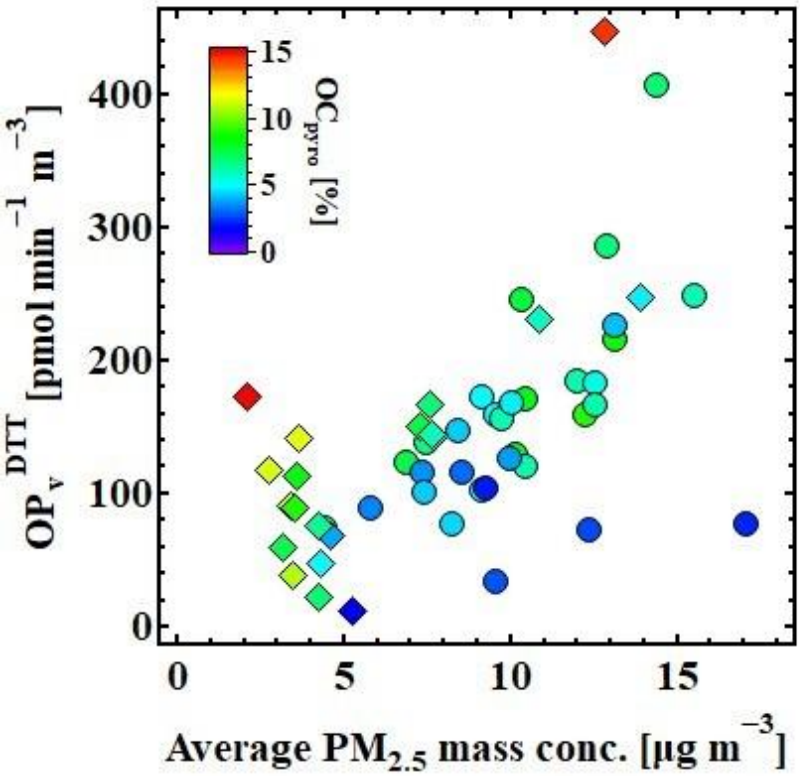

Figure S5. Relationship between the $PM_{2.5}$ mass concentration and OP_v^{DTT} colored by the proportion of OC_{pyro}.

Table S1. Correlation matrix for OP_v^{DTT}, $PM_{2.5}$ mass concentration, LDSA concentration, and chemical components: (a) the Yokohama site in fall/winter; (b) the Yokohama site in spring; (c) the Noto site in fall/winter; (d) the Noto site in spring. The matrix of the Noto site in spring (d) excludes the data of the extremely high OP_v^{DTT} event.

(a) Yokohama (fall/winter)

Parameter	$PM_{2.5}$	LDSA	OP_v	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Zn	Pb	Cl^-	NO_3^-	SO_4^{2-}	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	BC	OC	EC	TC	OC1	OC2	OC3	OC4	OC_{pyro}	$EC1_{corrected}$	EC2	EC3
$PM_{2.5}$ mass conc.	1.000	0.123	0.815	0.317	0.632	0.630	0.760	0.431	0.644	0.549	0.718	0.728	0.489	0.396	0.784	0.756	0.535	0.723	0.734	0.595	0.190	0.650	0.541	0.035	0.898	0.365	0.196	0.339	0.711	0.413	0.523	0.448	0.323	0.097	0.535	0.592	0.801	0.610	0.067	-0.072
LDSA conc.	0.123	1.000	0.111	0.558	0.581	0.257	-0.004	0.473	-0.247	-0.119	0.009	-0.051	-0.015	-0.007	-0.166	-0.038	0.118	0.143	-0.066	-0.147	-0.287	-0.207	0.689	-0.068	0.267	0.216	0.670	0.748	0.065	0.086	-0.018	0.079	0.062	0.014	-0.064	-0.040	0.301	-0.100	0.175	0.006
OP_v	0.815	0.111	1.000	0.592	0.687	0.618	0.652	0.693	0.356	0.714	0.819	0.816	0.469	0.268	0.798	0.779	0.313	0.593	0.740	0.826	-0.003	0.429	0.681	-0.050	0.720	0.375	-0.107	0.077	0.708	0.112	0.190	0.127	0.286	-0.143	0.227	0.245	0.651	0.271	-0.059	-0.424
Mg	0.317	0.558	0.592	1.000	0.706	0.289	0.162	0.915	0.094	0.586	0.491	0.482	0.350	0.318	0.440	0.604	0.232	0.389	0.476	0.530	-0.558	-0.319	0.839	0.105	0.247	0.450	0.216	0.289	0.535	0.053	-0.263	0.019	0.032	0.037	-0.273	-0.327	0.263	-0.151	-0.369	-0.333
Al	0.632	0.581	0.687	0.706	1.000	0.737	0.471	0.642	0.202	0.501	0.581	0.605	0.335	0.090	0.575	0.614	0.260	0.501	0.562	0.440	-0.153	0.077	0.783	0.127	0.597	0.519	0.307	0.421	0.580	0.348	0.189	0.348	0.194	0.171	0.204	0.182	0.586	0.278	-0.105	-0.177
Si	0.630	0.257	0.618	0.289	0.737	1.000	0.382	0.240	0.092	0.199	0.696	0.663	0.383	0.057	0.415	0.367	0.255	0.224	0.297	0.232	0.005	0.472	0.457	-0.208	0.605	0.138	-0.035	0.175	0.212	0.275	0.078	0.267	0.473	0.162	0.117	0.200	0.377	0.098	-0.001	-0.022
P	0.760	-0.004	0.652	0.162	0.471	0.382	1.000	0.151	0.451	0.340	0.340	0.504	0.121	0.124	0.595	0.518	0.368	0.519	0.523	0.613	0.082	0.539	0.300	0.013	0.661	0.236	0.081	0.151	0.710	0.144	0.402	0.182	0.180	-0.174	0.541	0.436	0.670	0.560	-0.142	-0.305
S	0.431	0.473	0.693	0.915	0.642	0.240	0.151	1.000	0.207	0.729	0.562	0.506	0.452	0.334	0.571	0.681	0.225	0.564	0.642	0.603	-0.248	-0.157	0.865	0.176	0.404	0.461	0.188	0.295	0.591	0.091	-0.002	0.085	-0.031	-0.004	-0.126	-0.090	0.418	0.028	-0.054	-0.265
Cl	0.644	-0.247	0.356	0.094	0.202	0.092	0.451	0.207	1.000	0.541	0.376	0.427	0.581	0.630	0.693	0.715	0.610	0.683	0.717	0.387	0.285	0.399	0.065	0.314	0.515	0.255	0.074	0.088	0.604	0.265	0.543	0.312	0.125	0.075	0.444	0.474	0.420	0.686	-0.066	-0.041
K	0.549	-0.119	0.714	0.586	0.501	0.199	0.340	0.729	0.541	1.000	0.620	0.673	0.544	0.237	0.907	0.903	0.126	0.724	0.918	0.826	0.027	-0.019	0.478	0.404	0.353	0.603	-0.038	-0.045	0.786	0.333	0.295	0.347	-0.129	0.188	0.238	0.221	0.488	0.437	-0.173	-0.164
Ca	0.718	0.009	0.819	0.491	0.581	0.696	0.340	0.562	0.376	0.620	1.000	0.900	0.714	0.481	0.717	0.766	0.410	0.418	0.597	0.640	-0.128	0.387	0.478	-0.208	0.534	0.139	-0.175	0.048	0.421	0.143	0.010	0.135	0.575	0.039	0.015	0.105	0.336	0.089	-0.156	-0.230
Ti	0.728	-0.051	0.816	0.482	0.605	0.663	0.504	0.506	0.427	0.673	0.900	1.000	0.716	0.328	0.764	0.780	0.376	0.404	0.669	0.767	-0.168	0.351	0.392	0.014	0.481	0.264	-0.148	-0.035	0.602	0.185	0.038	0.177	0.535	0.070	0.100	0.116	0.351	0.180	-0.296	-0.197
V	0.489	-0.015	0.469	0.350	0.335	0.383	0.121	0.452	0.581	0.544	0.714	0.716	1.000	0.598	0.604	0.646	0.570	0.507	0.601	0.399	-0.028	0.314	0.170	-0.101	0.353	-0.018	-0.149	-0.013	0.272	-0.046	0.114	-0.030	0.456	-0.084	-0.080	0.081	0.091	0.161	-0.047	-0.101
Cr	0.396	-0.007	0.268	0.318	0.090	0.057	0.124	0.334	0.630	0.237	0.481	0.328	0.598	1.000	0.361	0.526	0.859	0.342	0.348	0.145	-0.222	0.300	0.192	-0.253	0.359	-0.204	-0.108	0.054	0.153	-0.185	-0.092	-0.184	0.382	-0.171	-0.249	-0.139	-0.028	-0.007	-0.229	-0.246
Mn	0.784	-0.166	0.798	0.440	0.575	0.415	0.595	0.571	0.693	0.907	0.717	0.764	0.604	0.361	1.000	0.950	0.380	0.812	0.962	0.781	0.134	0.333	0.433	0.242	0.612	0.484	-0.088	-0.032	0.789	0.364	0.433	0.391	0.026	0.150	0.374	0.393	0.600	0.591	-0.139	-0.161
Fe	0.756	-0.038	0.779	0.604	0.614	0.367	0.518	0.681	0.715	0.903	0.766	0.780	0.646	0.526	0.950	1.000	0.459	0.761	0.916	0.787	-0.074	0.186	0.519	0.224	0.545	0.491	0.020	0.086	0.801	0.327	0.283	0.339	0.141	0.154	0.255	0.246	0.533	0.471	-0.281	-0.228
Ni	0.535	0.118	0.313	0.232	0.260	0.255	0.368	0.225	0.610	0.126	0.410	0.376	0.570	0.859	0.380	0.459	1.000	0.389	0.394	0.070	-0.118	0.546	0.209	-0.253	0.585	-0.169	-0.082	0.051	0.188	-0.147	0.064	-0.130	0.380	-0.201	-0.117	0.016	0.107	0.137	-0.131	-0.200
Cu	0.723	0.143	0.593	0.389	0.501	0.224	0.519	0.564	0.683	0.724	0.418	0.404	0.507	0.342	0.812	0.761	0.389	1.000	0.865	0.509	0.258	0.305	0.501	0.192	0.679	0.495	0.267	0.311	0.688	0.388	0.660	0.441	-0.216	0.100	0.508	0.576	0.753	0.733	0.161	-0.032
Zn	0.734	-0.066	0.740	0.476	0.562	0.297	0.523	0.642	0.717	0.918	0.597	0.669	0.601	0.348	0.962	0.916	0.394	0.865	1.000	0.724	0.193	0.277	0.473	0.355	0.622	0.575	-0.003	0.005	0.808	0.350	0.506	0.387	-0.096	0.122	0.387	0.425	0.631	0.633	-0.036	-0.148
Pb	0.595	-0.147	0.826	0.530	0.440	0.232	0.613	0.603	0.387	0.826	0.640	0.767	0.399	0.145	0.781	0.787	0.070	0.509	0.724	1.000	-0.123	0.101	0.421	0.195	0.334	0.439	-0.088	-0.049	0.828	0.110	0.126	0.118	0.160	-0.092	0.262	0.149	0.498	0.298	-0.304	-0.405
Cl^-	0.190	-0.287	-0.003	-0.558	-0.153	0.005	0.082	-0.248	0.285	0.027	-0.128	-0.168	-0.028	-0.222	0.134	-0.074	-0.118	0.258	0.193	-0.123	1.000	0.488	-0.206	0.271	0.363	-0.028	-0.063	-0.006	0.019	0.158	0.798	0.241	-0.178	-0.063	0.586	0.740	0.358	0.612	0.808	0.234
NO_3^-	0.650	-0.207	0.429	-0.319	0.077	0.472	0.539	-0.157	0.399	-0.019	0.387	0.351	0.314	0.300	0.333	0.186	0.546	0.305	0.277	0.101	0.488	1.000	-0.023	-0.359	0.746	-0.232	-0.278	-0.089	0.086	-0.053	0.428	0.000	0.387	-0.287	0.345	0.524	0.383	0.366	0.366	-0.096
SO_4^{2-}	0.541	0.689	0.681	0.839	0.783	0.457	0.300	0.865	0.065	0.478	0.478	0.392	0.170	0.192	0.433	0.519	0.209	0.501	0.473	0.421	-0.206	-0.023	1.000	0.108	0.593	0.482	0.395	0.538	0.548	0.270	0.074	0.262	-0.028	0.117	0.019	0.043	0.599	0.076	0.043	-0.137
Na^+	0.035	-0.068	-0.050	0.105	0.127	-0.208	0.013	0.176	0.314	0.404	-0.208	0.014	-0.101	-0.253	0.242	0.224	-0.253	0.192	0.355	0.195	0.271	-0.359	0.108	1.000	-0.038	0.570	0.351	0.132	0.531	0.544	0.393	0.556	-0.447	0.516	0.338	0.241	0.237	0.449	0.026	0.409
NH_4^+	0.898	0.267	0.720	0.247	0.597	0.605	0.661	0.404	0.515	0.353	0.534	0.481	0.353	0.359	0.612	0.545	0.585	0.679	0.622	0.334	0.363	0.746	0.593	-0.038	1.000	0.246	0.148	0.338	0.520	0.261	0.569	0.311	0.189	-0.060	0.449	0.587	0.778	0.546	0.343	-0.094
K^+	0.365	0.216	0.375	0.450	0.519	0.138	0.236	0.461	0.255	0.603	0.139	0.264	-0.018	-0.204	0.484	0.491	-0.169	0.495	0.575	0.439	-0.028	-0.232	0.482	0.570	0.246	1.000	0.429	0.212	0.681	0.662	0.342	0.661	-0.386	0.485	0.500	0.372	0.637	0.482	-0.166	0.044
Mg^{2+}	0.196	0.670	-0.107	0.216	0.307	-0.035	0.081	0.188	0.074	-0.038	-0.175	-0.148	-0.149	-0.108	-0.088	0.020	-0.082	0.267	-0.003	-0.088	-0.063	-0.278	0.395	0.351	0.148	0.429	1.000	0.910	0.291	0.575	0.366	0.582	-0.119	0.437	0.434	0.367	0.485	0.363	0.156	0.437
Ca^{2+}	0.339	0.748	0.077	0.289	0.421	0.175	0.151	0.295	0.088	-0.045	0.048	-0.035	-0.013	0.054	-0.032	0.086	0.051	0.311	0.005	-0.049	-0.006	-0.089	0.538	0.132	0.338	0.212	0.910	1.000	0.251	0.425	0.352	0.440	0.107	0.253	0.354	0.354	0.523	0.296	0.287	0.310
BC	0.711	0.065	0.708	0.535	0.580	0.212	0.710	0.591	0.604	0.786	0.421	0.602	0.272	0.153	0.789	0.801	0.188	0.688	0.808	0.828	0.019	0.086	0.548	0.531	0.520	0.681	0.291	0.251	1.000	0.425	0.422	0.448	-0.064	0.160	0.508	0.380	0.730	0.608	-0.211	-0.156
OC	0.413	0.086	0.112	0.053	0.348	0.275	0.144	0.091	0.265	0.333	0.143	0.185	-0.046	-0.185	0.364	0.327	-0.147	0.388	0.350	0.110	0.158	-0.053	0.270	0.544	0.261	0.662	0.575	0.425	0.425	1.000	0.489	0.995	-0.282	0.901	0.567	0.539	0.541	0.567	0.016	0.671
EC	0.523	-0.018	0.190	-0.263	0.189	0.078	0.402	-0.002	0.543	0.295	0.010	0.038	0.114	-0.092	0.433	0.283	0.064	0.660	0.506	0.126	0.798	0.428	0.074	0.393	0.569	0.342	0.366	0.352	0.422	0.489	1.000	0.575	-0.211	0.150	0.866	0.945	0.730	0.939	0.616	0.278
TC	0.448	0.079	0.127	0.019	0.348	0.267	0.182	0.085	0.312	0.347	0.135	0.177	-0.030	-0.184	0.391	0.339	-0.130	0.441	0.387	0.118	0.241	0.000	0.262	0.556	0.311	0.661	0.582	0.440	0.448	0.995	0.575	1.000	-0.289	0.862	0.633	0.616	0.593	0.641	0.086	0.662
OC1	0.323	0.062	0.286	0.032	0.194	0.473	0.180	-0.031	0.125	-0.129	0.575	0.535	0.456	0.382	0.026	0.141	0.380	-0.216	-0.096	0.160	-0.178	0.387	-0.028	-0.447	0.189	-0.386	-0.119	0.107	-0.064	-0.282	-0.211	-0.289	1.000	-0.310	-0.095	-0.057	-0.087	-0.197	-0.116	-0.289
OC2	0.097	0.014	-0.143	0.037	0.171	0.162	-0.174	-0.004	0.075	0.188	0.039	0.070	-0.084	-0.171	0.150	0.154	-0.201	0.100	0.122	-0.092	-0.063	-0.287	0.117	0.516	-0.060	0.485	0.437	0.253	0.160	0.901	0.150	0.862	-0.310	1.000	0.198	0.176	0.139	0.230	-0.164	0.780
OC3	0.535	-0.064	0.227	-0.273	0.204	0.117	0.541	-0.126	0.444	0.238	0.015	0.100	-0.080	-0.249	0.374	0.255	-0.117	0.508	0.387	0.262	0.586	0.345	0.019	0.338	0.449	0.500	0.434	0.354	0.508	0.567	0.866	0.633	-0.095	0.198	1.000	0.936	0.790	0.903	0.333	0.153
OC4	0.592	-0.040	0.245	-0.327	0.182	0.200	0.436	-0.090	0.474	0.221	0.105	0.116	0.081	-0.139	0.393	0.246	0.016	0.576	0.425	0.149	0.740	0.524	0.043	0.241	0.587	0.372	0.367	0.354	0.380	0.539	0.945	0.616	-0.057	0.176	0.936	1.000	0.779	0.896	0.565	0.255
OC_{pyro}	0.801	0.301	0.651	0.263	0.586	0.377	0.670	0.418	0.420	0.488	0.336	0.351	0.091	-0.028	0.600	0.533	0.107	0.753	0.631	0.498	0.358	0.383	0.599	0.237	0.778	0.637	0.485	0.523	0.730	0.541	0.730	0.593	-0.087	0.139	0.790	0.779	1.000	0.757	0.303	-0.015
$EC1_{corrected}$	0.610	-0.100	0.271	-0.151	0.278	0.098	0.560	0.028	0.686	0.437	0.089	0.180	0.161	-0.007	0.591	0.471	0.137	0.733	0.633	0.298	0.612	0.366	0.076	0.449	0.546	0.482	0.363	0.296	0.608	0.567	0.939	0.641	-0.197	0.230	0.903	0.896	0.757	1.000	0.308	0.192
EC2	0.067	0.175	-0.059	-0.369	-0.105	-0.001	-0.142	-0.054	-0.066	-0.173	-0.156	-0.296	-0.047	-0.229	-0.139	-0.281	-0.131	0.161	-0.036	-0.304	0.808	0.366	0.043	0.026	0.343	-0.166	0.156	0.287	-0.211	0.016	0.616	0.086	-0.116	-0.164	0.333	0.565	0.303	0.308	1.000	0.274
EC3	-0.072	0.006	-0.424	-0.333	-0.177	-0.022	-0.305	-0.265	-0.041	-0.164	-0.230	-0.197	-0.101	-0.246	-0.161	-0.228	-0.200	-0.032	-0.148	-0.405	0.234	-0.096	-0.137	0.409	-0.094	0.044	0.437	0.310	-0.156	0.671	0.278	0.662	-0.289	0.780	0.153	0.255	-0.015	0.192	0.274	1.000

(b) Yokohama (spring)

Parameter	$PM_{2.5}$	LDSA	OP_v	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Zn	Pb	Cl^-	NO_3^-	SO_4^{2-}	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	BC	OC	EC	TC	OC1	OC2	OC3	OC4	OC_{pyro}	$EC1_{corrected}$	EC2	EC3
$PM_{2.5}$ mass conc.	1.000	0.321	0.335	0.418	0.133	0.140	-0.041	0.537	-0.156	0.398	0.082	0.115	-0.003	-0.038	0.167	0.116	-0.339	0.061	0.230	0.221	-0.445	-0.267	0.533	-0.581	0.603	0.379	-0.467	0.330	N/A	0.207	0.162	0.225	0.098	-0.049	0.225	0.144	0.546	-0.033	0.462	0.069
LDSA conc.	0.321	1.000	0.297	-0.289	-0.519	-0.501	-0.553	0.266	-0.525	-0.204	-0.532	-0.498	0.325	-0.282	-0.375	-0.464	0.007	-0.272	-0.127	-0.010	-0.412	-0.286	0.275	-0.471	0.289	-0.194	-0.261	-0.430	N/A	0.410	-0.252	0.376	-0.143	0.321	0.357	0.359	0.242	-0.446	0.362	0.362
OP_v	0.335	0.297	1.000	0.598	0.262	0.246	0.120	0.900	0.044	0.619	0.235	0.284	0.611	0.207	0.618	0.413	-0.076	0.161	0.757	0.596	-0.328	-0.119	0.883	-0.296	0.873	0.560	-0.405	0.266	N/A	0.389	0.264	0.419	0.144	0.016	0.337	-0.117	0.839	0.100	0.685	-0.003
Mg	0.418	-0.289	0.598	1.000	0.829	0.820	0.678	0.698	0.486	0.935	0.762	0.786	0.225	0.605	0.903	0.842	-0.054	0.546	0.777	0.346	-0.279	0.062	0.728	-0.192	0.702	0.863	-0.031	0.663	N/A	-0.068	0.472	-0.010	0.410	-0.416	-0.038	-0.515	0.730	0.464	0.305	-0.162
Al	0.133	-0.519	0.262	0.829	1.000	0.995	0.920	0.310	0.642	0.868	0.879	0.952	-0.021	0.814	0.868	0.940	0.168	0.600	0.574	0.126	-0.176	0.373	0.368	0.003	0.345	0.817	0.286	0.767	N/A	-0.249	0.558	-0.180	0.315	-0.491	-0.106	-0.488	0.444	0.620	0.059	-0.185
Si	0.140	-0.501	0.246	0.820	0.995	1.000	0.902	0.299	0.593	0.854	0.852	0.935	-0.041	0.837	0.869	0.920	0.135	0.575	0.565	0.085	-0.208	0.395	0.372	-0.014	0.338	0.801	0.316	0.758	N/A	-0.237	0.573	-0.166	0.331	-0.466	-0.122	-0.486	0.426	0.620	0.088	-0.214
P	-0.041	-0.553	0.120	0.678	0.920	0.902	1.000	0.096	0.786	0.762	0.888	0.942	-0.086	0.682	0.761	0.920	0.268	0.696	0.514	0.001	-0.162	0.426	0.132	-0.007	0.132	0.743	0.257	0.652	N/A	-0.309	0.580	-0.236	0.314	-0.506	-0.073	-0.513	0.305	0.709	-0.104	-0.167
S	0.537	0.266	0.900	0.698	0.310	0.299	0.096	1.000	0.045	0.663	0.242	0.277	0.489	0.251	0.594	0.390	-0.165	0.252	0.723	0.655	-0.319	-0.147	0.970	-0.293	0.966	0.582	-0.315	0.367	N/A	0.381	0.098	0.391	0.221	0.017	0.220	-0.111	0.869	-0.042	0.600	0.029
Cl	-0.156	-0.525	0.044	0.486	0.642	0.593	0.786	0.045	1.000	0.568	0.671	0.727	-0.135	0.414	0.488	0.703	0.312	0.551	0.362	0.063	0.067	0.122	0.030	0.178	0.048	0.567	0.170	0.412	N/A	-0.180	0.242	-0.149	0.249	-0.342	0.003	-0.272	0.252	0.438	-0.253	0.117
K	0.398	-0.204	0.619	0.935	0.868	0.854	0.762	0.663	0.568	1.000	0.798	0.871	0.192	0.639	0.900	0.905	0.004	0.522	0.785	0.359	-0.379	0.126	0.694	-0.277	0.693	0.972	0.011	0.717	N/A	0.039	0.587	0.110	0.365	-0.359	0.152	-0.406	0.806	0.567	0.357	-0.111
Ca	0.082	-0.532	0.235	0.762	0.879	0.852	0.888	0.242	0.671	0.798	1.000	0.856	-0.014	0.552	0.769	0.877	0.194	0.666	0.605	0.083	-0.131	0.373	0.275	-0.032	0.298	0.795	0.117	0.770	N/A	-0.266	0.625	-0.188	0.390	-0.519	-0.116	-0.525	0.466	0.743	-0.009	-0.292
Ti	0.115	-0.498	0.284	0.786	0.952	0.935	0.942	0.277	0.727	0.871	0.856	1.000	-0.052	0.751	0.842	0.978	0.141	0.544	0.625	0.127	-0.202	0.344	0.322	-0.056	0.321	0.840	0.231	0.667	N/A	-0.230	0.584	-0.158	0.189	-0.489	-0.008	-0.493	0.452	0.650	0.071	-0.091
V	-0.003	0.325	0.611	0.225	-0.021	-0.041	-0.086	0.489	-0.135	0.192	-0.014	-0.052	1.000	-0.051	0.226	0.069	0.306	0.043	0.259	0.291	-0.186	-0.248	0.482	-0.218	0.484	0.177	-0.362	-0.106	N/A	-0.175	-0.027	-0.177	0.131	-0.385	-0.112	-0.349	0.432	-0.164	0.306	0.180
Cr	-0.038	-0.282	0.207	0.605	0.814	0.837	0.682	0.251	0.414	0.639	0.552	0.751	-0.051	1.000	0.718	0.744	0.302	0.466	0.429	-0.054	-0.170	0.346	0.351	0.083	0.259	0.521	0.456	0.395	N/A	-0.184	0.284	-0.149	0.062	-0.284	-0.191	-0.445	0.223	0.325	0.025	-0.005
Mn	0.167	-0.375	0.618	0.903	0.868	0.869	0.761	0.594	0.488	0.900	0.769	0.842	0.226	0.718	1.000	0.910	0.046	0.550	0.854	0.270	-0.292	0.248	0.652	-0.128	0.603	0.832	0.028	0.655	N/A	-0.065	0.623	0.011	0.414	-0.368	-0.052	-0.554	0.635	0.579	0.398	-0.257
Fe	0.116	-0.464	0.413	0.842	0.940	0.920	0.920	0.390	0.703	0.905	0.877	0.978	0.069	0.744	0.910	1.000	0.181	0.607	0.739	0.184	-0.252	0.289	0.430	-0.113	0.423	0.862	0.125	0.653	N/A	-0.221	0.600	-0.146	0.256	-0.506	-0.043	-0.570	0.531	0.648	0.142	-0.134
Ni	-0.339	0.007	-0.076	-0.054	0.168	0.135	0.268	-0.165	0.312	0.004	0.194	0.141	0.306	0.302	0.046	0.181	1.000	0.458	-0.083	-0.319	0.138	-0.043	-0.154	0.173	-0.159	-0.052	-0.068	-0.129	N/A	-0.519	-0.080	-0.525	0.026	-0.477	-0.388	-0.335	-0.150	-0.033	-0.305	0.491
Cu	0.061	-0.272	0.161	0.546	0.600	0.575	0.696	0.252	0.551	0.522	0.666	0.544	0.043	0.466	0.550	0.607	0.458	1.000	0.436	0.011	-0.099	0.243	0.222	-0.038	0.221	0.426	-0.058	0.417	N/A	-0.219	0.213	-0.191	0.416	-0.340	-0.188	-0.486	0.236	0.350	-0.196	-0.063
Zn	0.230	-0.127	0.757	0.777	0.574	0.565	0.514	0.723	0.362	0.785	0.605	0.625	0.259	0.429	0.854	0.739	-0.083	0.436	1.000	0.374	-0.428	0.169	0.751	-0.313	0.739	0.741	-0.185	0.487	N/A	0.115	0.530	0.178	0.389	-0.211	0.012	-0.465	0.744	0.435	0.567	-0.233
Pb	0.221	-0.010	0.596	0.346	0.126	0.085	0.001	0.655	0.063	0.359	0.083	0.127	0.291	-0.054	0.270	0.184	-0.319	0.011	0.374	1.000	0.001	-0.095	0.495	-0.028	0.537	0.337	-0.174	0.360	N/A	0.435	-0.102	0.420	-0.059	0.208	0.398	0.217	0.523	-0.059	0.170	-0.180
Cl^-	-0.445	-0.412	-0.328	-0.279	-0.176	-0.208	-0.162	-0.319	0.067	-0.379	-0.131	-0.202	-0.186	-0.170	-0.292	-0.252	0.138	-0.099	-0.428	0.001	1.000	-0.046	-0.403	0.915	-0.429	-0.412	0.194	-0.136	N/A	-0.047	-0.381	-0.093	-0.240	0.164	-0.033	0.181	-0.463	-0.216	-0.447	0.281
NO_3^-	-0.267	-0.286	-0.119	0.062	0.373	0.395	0.426	-0.147	0.122	0.126	0.373	0.344	-0.248	0.346	0.248	0.289	-0.043	0.243	0.169	-0.095	-0.046	1.000	-0.084	0.227	-0.060	0.104	0.457	0.449	N/A	-0.091	0.146	-0.073	-0.054	-0.049	-0.159	-0.048	-0.075	0.215	-0.044	-0.359
SO_4^{2-}	0.533	0.275	0.883	0.728	0.368	0.372	0.132	0.970	0.030	0.694	0.275	0.322	0.482	0.351	0.652	0.430	-0.154	0.222	0.751	0.495	-0.403	-0.084	1.000	-0.326	0.980	0.614	-0.237	0.376	N/A	0.317	0.176	0.336	0.274	-0.050	0.138	-0.182	0.877	-0.013	0.690	0.020
Na^+	-0.581	-0.471	-0.296	-0.192	0.003	-0.014	-0.007	-0.293	0.178	-0.277	-0.032	-0.056	-0.218	0.083	-0.128	-0.113	0.173	-0.038	-0.313	-0.028	0.915	0.227	-0.326	1.000	-0.381	-0.337	0.430	-0.005	N/A	-0.051	-0.364	-0.095	-0.174	0.157	-0.123	0.160	-0.426	-0.199	-0.397	0.205
NH_4^+	0.603	0.289	0.873	0.702	0.345	0.338	0.132	0.966	0.048	0.693	0.298	0.321	0.484	0.259	0.603	0.423	-0.159	0.221	0.739	0.537	-0.429	-0.060	0.980	-0.381	1.000	0.632	-0.315	0.424	N/A	0.300	0.165	0.318	0.233	-0.092	0.164	-0.133	0.913	-0.028	0.685	0.035
K^+	0.379	-0.194	0.560	0.863	0.817	0.801	0.743	0.582	0.567	0.972	0.795	0.840	0.177	0.521	0.832	0.862	-0.052	0.426	0.741	0.337	-0.412	0.104	0.614	-0.337	0.632	1.000	0.026	0.730	N/A	0.059	0.673	0.141	0.419	-0.354	0.217	-0.365	0.817	0.644	0.375	-0.149
Mg^{2+}	-0.467	-0.261	-0.405	-0.031	0.286	0.316	0.257	-0.315	0.170	0.011	0.117	0.231	-0.362	0.456	0.028	0.125	-0.068	-0.058	-0.185	-0.174	0.194	0.457	-0.237	0.430	-0.315	0.026	1.000	0.110	N/A	-0.065	-0.102	-0.077	-0.024	0.059	-0.079	-0.057	-0.254	0.050	-0.351	-0.080
Ca^{2+}	0.330	-0.430	0.266	0.663	0.767	0.758	0.652	0.367	0.412	0.717	0.770	0.667	-0.106	0.395	0.655	0.653	-0.129	0.417	0.487	0.360	-0.136	0.449	0.376	-0.005	0.424	0.730	0.110	1.000	N/A	0.044	0.529	0.109	0.433	-0.228	0.076	-0.052	0.546	0.525	0.238	-0.385
BC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OC	0.207	0.410	0.389	-0.068	-0.249	-0.237	-0.309	0.381	-0.180	0.039	-0.266	-0.230	-0.175	-0.184	-0.065	-0.221	-0.519	-0.219	0.115	0.435	-0.047	-0.091	0.317	-0.051	0.300	0.059	-0.065	0.044	N/A	1.000	-0.011	0.993	-0.022	0.885	0.809	0.673	0.352	-0.049	0.386	-0.124
EC	0.162	-0.252	0.264	0.472	0.558	0.573	0.580	0.098	0.242	0.587	0.625	0.584	-0.027	0.284	0.623	0.600	-0.080	0.213	0.530	-0.102	-0.381	0.146	0.176	-0.364	0.165	0.673	-0.102	0.529	N/A	-0.011	1.000	0.111	0.476	-0.239	0.159	-0.332	0.395	0.899	0.437	-0.409
TC	0.225	0.376	0.419	-0.010	-0.180	-0.166	-0.236	0.391	-0.149	0.110	-0.188	-0.158	-0.177	-0.149	0.011	-0.146	-0.525	-0.191	0.178	0.420	-0.093	-0.073	0.336	-0.095	0.318	0.141	-0.077	0.109	N/A	0.993	0.111	1.000	0.036	0.850	0.823	0.629	0.398	0.061	0.437	-0.173
OC1	0.098	-0.143	0.144	0.410	0.315	0.331	0.314	0.221	0.249	0.365	0.390	0.189	0.131	0.062	0.414	0.256	0.026	0.416	0.389	-0.059	-0.240	-0.054	0.274	-0.174	0.233	0.419	-0.024	0.433	N/A	-0.022	0.476	0.036	1.000	-0.186	-0.148	-0.283	0.366	0.378	0.301	-0.262
OC2	-0.049	0.321	0.016	-0.416	-0.491	-0.466	-0.506	0.017	-0.342	-0.359	-0.519	-0.489	-0.385	-0.284	-0.368	-0.506	-0.477	-0.340	-0.211	0.208	0.164	-0.049	-0.050	0.157	-0.092	-0.354	0.059	-0.228	N/A	0.885	-0.239	0.850	-0.186	1.000	0.615	0.733	-0.111	-0.210	0.106	-0.140
OC3	0.225	0.357	0.337	-0.038	-0.106	-0.122	-0.073	0.220	0.003	0.152	-0.116	-0.008	-0.112	-0.191	-0.052	-0.043	-0.388	-0.188	0.012	0.398	-0.033	-0.159	0.138	-0.123	0.164	0.217	-0.079	0.076	N/A	0.809	0.159	0.823	-0.148	0.615	1.000	0.601	0.354	0.145	0.256	0.014
OC4	0.144	0.359	-0.117	-0.515	-0.488	-0.486	-0.513	-0.111	-0.272	-0.406	-0.525	-0.493	-0.349	-0.445	-0.554	-0.570	-0.335	-0.486	-0.465	0.217	0.181	-0.048	-0.182	0.160	-0.133	-0.365	-0.057	-0.052	N/A	0.673	-0.332	0.629	-0.283	0.733	0.601	1.000	-0.095	-0.371	0.081	0.092
OC_{pyro}	0.546	0.242	0.839	0.730	0.444	0.426	0.305	0.869	0.252	0.806	0.466	0.452	0.432	0.223	0.635	0.531	-0.150	0.236	0.744	0.523	-0.463	-0.075	0.877	-0.426	0.913	0.817	-0.254	0.546	N/A	0.352	0.395	0.398	0.366	-0.111	0.354	-0.095	1.000	0.249	0.647	-0.015
$EC1_{corrected}$	-0.033	-0.446	0.100	0.464	0.620	0.620	0.709	-0.042	0.438	0.567	0.743	0.650	-0.164	0.325	0.579	0.648	-0.033	0.350	0.435	-0.059	-0.216	0.215	-0.013	-0.199	-0.028	0.644	0.050	0.525	N/A	-0.049	0.899	0.061	0.378	-0.210	0.145	-0.371	0.249	1.000	0.053	-0.501
EC2	0.462	0.362	0.685	0.305	0.059	0.088	-0.104	0.600	-0.253	0.357	-0.009	0.071	0.306	0.025	0.398	0.142	-0.305	-0.196	0.567	0.170	-0.447	-0.044	0.690	-0.397	0.685	0.375	-0.351	0.238	N/A	0.386	0.437	0.437	0.301	0.106	0.256	0.081	0.647	0.053	1.000	-0.025
EC3	0.069	0.362	-0.003	-0.162	-0.185	-0.214	-0.167	0.029	0.117	-0.111	-0.292	-0.091	0.180	-0.005	-0.257	-0.134	0.491	-0.063	-0.233	-0.180	0.281	-0.359	0.020	0.205	0.035	-0.149	-0.080	-0.385	N/A	-0.124	-0.409	-0.173	-0.262	-0.140	0.014	0.092	-0.015	-0.501	-0.025	1.000

(c) Noto (fall/winter)

Parameter	$PM_{2.5}$	LDSA	OP_v	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Zn	Pb	Cl^-	NO_3^-	SO_4^{2-}	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	BC	OC	EC	TC	OC1	OC2	OC3	OC4	OC_{pyro}	$EC1_{corrected}$	EC2	EC3
$PM_{2.5}$ mass conc.	1.000	0.860	-0.059	0.333	0.468	0.424	-0.278	0.072	0.134	-0.149	0.431	0.448	0.377	0.111	0.020	0.345	N/A	-0.085	-0.108	-0.160	-0.187	-0.010	-0.041	0.211	-0.195	-0.306	0.194	0.034	0.888	-0.341	-0.436	-0.360	0.252	-0.088	-0.449	-0.400	-0.405	-0.382	-0.408	-0.192
LDSA conc.	0.860	1.000	-0.226	0.265	0.438	0.390	-0.283	-0.032	0.323	-0.274	0.382	0.430	0.506	0.178	-0.025	0.301	N/A	0.115	-0.171	-0.282	-0.363	-0.185	-0.145	0.029	-0.241	-0.442	0.038	-0.199	0.778	-0.508	-0.554	-0.519	0.382	-0.296	-0.581	-0.507	-0.454	-0.435	-0.579	-0.373
OP_v	-0.059	-0.226	1.000	0.752	0.557	0.567	-0.029	0.912	-0.210	0.930	0.596	0.544	0.066	-0.315	0.915	0.722	N/A	0.312	0.899	0.887	0.207	0.494	0.868	0.546	0.826	0.740	0.534	0.774	-0.012	0.640	0.718	0.657	-0.486	0.200	0.615	0.762	0.820	0.789	0.459	0.046
Mg	0.333	0.265	0.752	1.000	0.917	0.905	-0.324	0.860	-0.184	0.665	0.951	0.912	0.216	-0.277	0.884	0.970	N/A	0.569	0.674	0.686	0.002	0.385	0.625	0.546	0.493	0.247	0.548	0.544	0.361	0.279	0.377	0.297	-0.310	0.077	0.139	0.390	0.420	0.494	0.141	-0.153
Al	0.468	0.438	0.557	0.917	1.000	0.962	-0.216	0.629	0.075	0.488	0.980	0.991	0.290	0.025	0.742	0.966	N/A	0.560	0.480	0.413	-0.068	0.351	0.497	0.555	0.270	0.092	0.560	0.443	0.530	0.041	0.093	0.050	-0.020	-0.061	-0.096	0.137	0.188	0.232	-0.099	-0.288
Si	0.424	0.390	0.567	0.905	0.962	1.000	-0.228	0.674	0.102	0.522	0.960	0.954	0.267	-0.009	0.777	0.957	N/A	0.644	0.548	0.427	-0.147	0.259	0.514	0.472	0.351	0.104	0.438	0.369	0.459	0.189	0.230	0.197	-0.050	0.170	-0.094	0.148	0.226	0.280	0.120	-0.055
P	-0.278	-0.283	-0.029	-0.324	-0.216	-0.228	1.000	-0.280	0.604	0.209	-0.289	-0.177	-0.248	0.442	-0.134	-0.215	N/A	-0.361	-0.084	-0.266	0.018	0.098	0.033	0.034	-0.013	0.465	0.024	0.109	-0.303	0.239	0.140	0.224	0.534	-0.052	0.479	0.230	0.345	0.211	-0.003	0.078
S	0.072	-0.032	0.912	0.860	0.629	0.674	-0.280	1.000	-0.281	0.806	0.686	0.632	0.238	-0.381	0.949	0.796	N/A	0.492	0.918	0.885	0.031	0.303	0.727	0.371	0.783	0.467	0.353	0.552	0.029	0.541	0.662	0.566	-0.473	0.243	0.400	0.608	0.660	0.708	0.457	0.052
Cl	0.134	0.323	-0.210	-0.184	0.075	0.102	0.604	-0.281	1.000	-0.107	-0.069	0.073	0.229	0.711	-0.107	-0.016	N/A	0.141	-0.102	-0.486	-0.161	-0.074	-0.002	-0.031	-0.034	0.005	-0.063	-0.124	0.070	-0.229	-0.316	-0.245	0.811	-0.259	-0.129	-0.228	-0.133	-0.256	-0.320	-0.131
K	-0.149	-0.274	0.930	0.665	0.488	0.522	0.209	0.806	-0.107	1.000	0.536	0.496	-0.088	-0.294	0.843	0.653	N/A	0.202	0.806	0.765	0.183	0.499	0.802	0.541	0.732	0.854	0.508	0.729	-0.095	0.796	0.846	0.810	-0.373	0.352	0.750	0.821	0.911	0.897	0.569	0.231
Ca	0.431	0.382	0.596	0.951	0.980	0.960	-0.289	0.686	-0.069	0.536	1.000	0.973	0.178	-0.147	0.773	0.974	N/A	0.548	0.504	0.513	-0.083	0.325	0.518	0.545	0.310	0.131	0.544	0.449	0.518	0.133	0.210	0.147	-0.184	0.041	-0.055	0.186	0.248	0.334	0.005	-0.208
Ti	0.448	0.430	0.544	0.912	0.991	0.954	-0.177	0.632	0.073	0.496	0.973	1.000	0.313	0.063	0.749	0.964	N/A	0.546	0.494	0.404	-0.121	0.292	0.433	0.484	0.236	0.078	0.491	0.380	0.497	0.046	0.109	0.057	0.031	-0.050	-0.094	0.115	0.188	0.246	-0.080	-0.277
V	0.377	0.506	0.066	0.216	0.290	0.267	-0.248	0.238	0.229	-0.088	0.178	0.313	1.000	0.448	0.243	0.270	N/A	0.264	0.337	-0.011	-0.372	-0.232	-0.035	-0.225	0.107	-0.329	-0.208	-0.221	0.135	-0.338	-0.393	-0.350	0.477	-0.272	-0.392	-0.299	-0.228	-0.381	-0.253	-0.362
Cr	0.111	0.178	-0.315	-0.277	0.025	-0.009	0.442	-0.381	0.711	-0.294	-0.147	0.063	0.448	1.000	-0.218	-0.099	N/A	0.030	-0.158	-0.589	-0.104	-0.152	-0.367	-0.228	-0.375	-0.279	-0.227	-0.308	0.037	-0.478	-0.565	-0.496	0.949	-0.319	-0.376	-0.507	-0.470	-0.580	-0.372	-0.207
Mn	0.020	-0.025	0.915	0.884	0.742	0.777	-0.134	0.949	-0.107	0.843	0.773	0.749	0.243	-0.218	1.000	0.885	N/A	0.581	0.927	0.840	-0.061	0.287	0.763	0.392	0.768	0.501	0.383	0.549	0.051	0.482	0.590	0.504	-0.339	0.164	0.332	0.537	0.658	0.664	0.373	-0.037
Fe	0.345	0.301	0.722	0.970	0.966	0.957	-0.215	0.796	-0.016	0.653	0.974	0.964	0.270	-0.099	0.885	1.000	N/A	0.586	0.674	0.612	-0.091	0.326	0.617	0.517	0.470	0.248	0.513	0.496	0.399	0.220	0.304	0.236	-0.165	0.045	0.054	0.286	0.374	0.425	0.086	-0.195
Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cu	-0.085	0.115	0.312	0.569	0.560	0.644	-0.361	0.492	0.141	0.202	0.548	0.546	0.264	0.030	0.581	0.586	N/A	1.000	0.472	0.304	-0.126	-0.013	0.292	0.033	0.355	-0.166	0.034	0.020	-0.010	-0.024	0.092	-0.004	-0.059	-0.014	-0.257	0.026	0.056	0.074	0.120	-0.085
Zn	-0.108	-0.171	0.899	0.674	0.480	0.548	-0.084	0.918	-0.102	0.806	0.504	0.494	0.337	-0.158	0.927	0.674	N/A	0.472	1.000	0.838	-0.098	0.143	0.716	0.180	0.861	0.546	0.159	0.446	-0.143	0.553	0.644	0.573	-0.326	0.236	0.401	0.547	0.694	0.648	0.518	0.085
Pb	-0.160	-0.282	0.887	0.686	0.413	0.427	-0.266	0.885	-0.486	0.765	0.513	0.404	-0.011	-0.589	0.840	0.612	N/A	0.304	0.838	1.000	0.026	0.243	0.760	0.319	0.828	0.575	0.331	0.577	-0.093	0.524	0.664	0.551	-0.739	0.156	0.452	0.623	0.715	0.744	0.412	-0.039
Cl^-	-0.187	-0.363	0.207	0.002	-0.068	-0.147	0.018	0.031	-0.161	0.183	-0.083	-0.121	-0.372	-0.104	-0.061	-0.091	N/A	-0.126	-0.098	0.026	1.000	0.840	0.218	0.640	-0.024	0.316	0.635	0.617	-0.135	0.108	0.143	0.115	-0.136	-0.104	0.485	0.486	0.110	0.186	0.013	0.035
NO_3^-	-0.010	-0.185	0.494	0.385	0.351	0.259	0.098	0.303	-0.074	0.499	0.325	0.292	-0.232	-0.152	0.287	0.326	N/A	-0.013	0.143	0.243	0.840	1.000	0.559	0.929	0.199	0.513	0.921	0.872	0.029	0.337	0.327	0.338	-0.201	-0.048	0.653	0.737	0.445	0.454	0.038	-0.046
SO_4^{2-}	-0.041	-0.145	0.868	0.625	0.497	0.514	0.033	0.727	-0.002	0.802	0.518	0.433	-0.035	-0.367	0.763	0.617	N/A	0.292	0.716	0.760	0.218	0.559	1.000	0.680	0.875	0.754	0.656	0.836	0.026	0.642	0.660	0.649	-0.572	0.131	0.654	0.838	0.884	0.775	0.335	-0.011
Na^+	0.211	0.029	0.546	0.546	0.555	0.472	0.034	0.371	-0.031	0.541	0.545	0.484	-0.225	-0.228	0.392	0.517	N/A	0.033	0.180	0.319	0.640	0.929	0.680	1.000	0.269	0.517	0.985	0.903	0.296	0.334	0.309	0.332	-0.289	-0.023	0.541	0.674	0.467	0.476	-0.032	-0.110
NH_4^+	-0.195	-0.241	0.826	0.493	0.270	0.351	-0.013	0.783	-0.034	0.732	0.310	0.236	0.107	-0.375	0.768	0.470	N/A	0.355	0.861	0.828	-0.024	0.199	0.875	0.269	1.000	0.667	0.241	0.549	-0.215	0.666	0.733	0.682	-0.573	0.212	0.588	0.740	0.874	0.772	0.512	0.096
K^+	-0.306	-0.442	0.740	0.247	0.092	0.104	0.465	0.467	0.005	0.854	0.131	0.078	-0.329	-0.279	0.501	0.248	N/A	-0.166	0.546	0.575	0.316	0.513	0.754	0.517	0.667	1.000	0.485	0.741	-0.212	0.795	0.796	0.801	-0.368	0.264	0.929	0.861	0.940	0.865	0.488	0.251
Mg^{2+}	0.194	0.038	0.534	0.548	0.560	0.438	0.024	0.353	-0.063	0.508	0.544	0.491	-0.208	-0.227	0.383	0.513	N/A	0.034	0.159	0.331	0.635	0.921	0.656	0.985	0.241	0.485	1.000	0.904	0.305	0.225	0.216	0.225	-0.291	-0.179	0.500	0.637	0.439	0.430	-0.157	-0.263
Ca^{2+}	0.034	-0.199	0.774	0.544	0.443	0.369	0.109	0.552	-0.124	0.729	0.449	0.380	-0.221	-0.308	0.549	0.496	N/A	0.020	0.446	0.577	0.617	0.872	0.836	0.903	0.549	0.741	0.904	1.000	0.124	0.504	0.502	0.507	-0.453	-0.018	0.750	0.861	0.725	0.661	0.139	-0.088
BC	0.888	0.778	-0.012	0.361	0.530	0.459	-0.303	0.029	0.070	-0.095	0.518	0.497	0.135	0.037	0.051	0.399	N/A	-0.010	-0.143	-0.093	-0.135	0.029	0.026	0.296	-0.215	-0.212	0.305	0.124	1.000	-0.399	-0.452	-0.411	0.095	-0.175	-0.504	-0.435	-0.394	-0.371	-0.455	-0.273
OC	-0.341	-0.508	0.640	0.279	0.041	0.189	0.239	0.541	-0.229	0.796	0.133	0.046	-0.338	-0.478	0.482	0.220	N/A	-0.024	0.553	0.524	0.108	0.337	0.642	0.334	0.666	0.795	0.225	0.504	-0.399	1.000	0.951	0.999	-0.449	0.765	0.785	0.797	0.842	0.818	0.872	0.706
EC	-0.436	-0.554	0.718	0.377	0.093	0.230	0.140	0.662	-0.316	0.846	0.210	0.109	-0.393	-0.565	0.590	0.304	N/A	0.092	0.644	0.664	0.143	0.327	0.660	0.309	0.733	0.796	0.216	0.502	-0.452	0.951	1.000	0.966	-0.526	0.670	0.778	0.813	0.856	0.920	0.843	0.593
TC	-0.360	-0.519	0.657	0.297	0.050	0.197	0.224	0.566	-0.245	0.810	0.147	0.057	-0.350	-0.496	0.504	0.236	N/A	-0.004	0.573	0.551	0.115	0.338	0.649	0.332	0.682	0.801	0.225	0.507	-0.411	0.999	0.966	1.000	-0.465	0.754	0.789	0.805	0.850	0.841	0.873	0.691
OC1	0.252	0.382	-0.486	-0.310	-0.020	-0.050	0.534	-0.473	0.811	-0.373	-0.184	0.031	0.477	0.949	-0.339	-0.165	N/A	-0.059	-0.326	-0.739	-0.136	-0.201	-0.572	-0.289	-0.573	-0.368	-0.291	-0.453	0.095	-0.449	-0.526	-0.465	1.000	-0.291	-0.320	-0.483	-0.466	-0.511	-0.402	-0.159
OC2	-0.088	-0.296	0.200	0.077	-0.061	0.170	-0.052	0.243	-0.259	0.352	0.041	-0.050	-0.272	-0.319	0.164	0.045	N/A	-0.014	0.236	0.156	-0.104	-0.048	0.131	-0.023	0.212	0.264	-0.179	-0.018	-0.175	0.765	0.670	0.754	-0.291	1.000	0.268	0.273	0.312	0.358	0.906	0.948
OC3	-0.449	-0.581	0.615	0.139	-0.096	-0.094	0.479	0.400	-0.129	0.750	-0.055	-0.094	-0.392	-0.376	0.332	0.054	N/A	-0.257	0.401	0.452	0.485	0.653	0.654	0.541	0.588	0.929	0.500	0.750	-0.504	0.785	0.778	0.789	-0.320	0.268	1.000	0.936	0.873	0.834	0.480	0.292
OC4	-0.400	-0.507	0.762	0.390	0.137	0.148	0.230	0.608	-0.228	0.821	0.186	0.115	-0.299	-0.507	0.537	0.286	N/A	0.026	0.547	0.623	0.486	0.737	0.838	0.674	0.740	0.861	0.637	0.861	-0.435	0.797	0.813	0.805	-0.483	0.273	0.936	1.000	0.914	0.873	0.504	0.240
OC_{pyro}	-0.405	-0.454	0.820	0.420	0.188	0.226	0.345	0.660	-0.133	0.911	0.248	0.188	-0.228	-0.470	0.658	0.374	N/A	0.056	0.694	0.715	0.110	0.445	0.884	0.467	0.874	0.940	0.439	0.725	-0.394	0.842	0.856	0.850	-0.466	0.312	0.873	0.914	1.000	0.919	0.546	0.234
$EC1_{corrected}$	-0.382	-0.435	0.789	0.494	0.232	0.280	0.211	0.708	-0.256	0.897	0.334	0.246	-0.381	-0.580	0.664	0.425	N/A	0.074	0.648	0.744	0.186	0.454	0.775	0.476	0.772	0.865	0.430	0.661	-0.371	0.818	0.920	0.841	-0.511	0.358	0.834	0.873	0.919	1.000	0.566	0.254
EC2	-0.408	-0.579	0.459	0.141	-0.099	0.120	-0.003	0.457	-0.320	0.569	0.005	-0.080	-0.253	-0.372	0.373	0.086	N/A	0.120	0.518	0.412	0.013	0.038	0.335	-0.032	0.512	0.488	-0.157	0.139	-0.455	0.872	0.843	0.873	-0.402	0.906	0.480	0.504	0.546	0.566	1.000	0.876
EC3	-0.192	-0.373	0.046	-0.153	-0.288	-0.055	0.078	0.052	-0.131	0.231	-0.208	-0.277	-0.362	-0.207	-0.037	-0.195	N/A	-0.085	0.085	-0.039	0.035	-0.046	-0.011	-0.110	0.096	0.251	-0.263	-0.088	-0.273	0.706	0.593	0.691	-0.159	0.948	0.292	0.240	0.234	0.254	0.876	1.000

(d) Noto (spring) without the extremely high OP_v^{DTT} event

Parameter	$PM_{2.5}$	LDSA	OP_v	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Zn	Pb	Cl^-	NO_3^-	SO_4^{2-}	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	BC	OC	EC	TC	OC1	OC2	OC3	OC4	OC_{pyro}	$EC1_{corrected}$	EC2	EC3
$PM_{2.5}$ mass conc.	1.000	0.952	0.946	0.828	0.649	0.641	0.215	0.865	N/A	0.477	0.668	0.579	0.078	0.571	0.902	0.778	N/A	0.787	0.804	0.675	0.153	0.125	0.935	-0.083	0.948	0.610	-0.045	0.217	0.843	0.973	0.609	0.967	-0.351	0.929	0.804	0.816	0.934	0.407	0.455	-0.040
LDSA conc.	0.952	1.000	0.870	0.790	0.468	0.435	0.019	0.945	N/A	0.305	0.529	0.424	-0.063	0.571	0.805	0.625	N/A	0.896	0.695	0.621	0.355	0.270	0.921	-0.159	0.964	0.430	-0.115	0.345	0.693	0.932	0.635	0.933	-0.330	0.934	0.759	0.824	0.819	0.235	0.606	0.162
OP_v	0.946	0.870	1.000	0.818	0.774	0.761	0.341	0.772	N/A	0.514	0.786	0.696	0.138	0.532	0.959	0.859	N/A	0.665	0.836	0.616	0.148	0.074	0.884	0.043	0.877	0.615	0.009	0.113	0.868	0.899	0.564	0.894	-0.546	0.849	0.728	0.717	0.894	0.459	0.366	-0.132
Mg	0.828	0.790	0.818	1.000	0.611	0.583	-0.117	0.808	N/A	0.505	0.689	0.550	0.084	0.653	0.784	0.737	N/A	0.665	0.808	0.799	-0.138	-0.338	0.837	-0.311	0.836	0.518	-0.285	-0.121	0.737	0.758	0.195	0.721	-0.263	0.758	0.381	0.380	0.751	0.270	0.071	-0.276
Al	0.649	0.468	0.774	0.611	1.000	0.976	0.396	0.426	N/A	0.607	0.877	0.899	0.141	0.560	0.858	0.976	N/A	0.256	0.903	0.373	-0.193	-0.142	0.616	0.058	0.555	0.473	-0.088	-0.338	0.838	0.587	0.227	0.567	-0.412	0.519	0.366	0.328	0.686	0.487	-0.038	-0.502
Si	0.641	0.435	0.761	0.583	0.976	1.000	0.409	0.371	N/A	0.664	0.873	0.943	0.305	0.558	0.832	0.949	N/A	0.185	0.871	0.361	-0.231	-0.144	0.546	0.008	0.495	0.501	-0.032	-0.243	0.793	0.549	0.227	0.533	-0.480	0.452	0.389	0.333	0.697	0.461	-0.018	-0.484
P	0.215	0.019	0.341	-0.117	0.396	0.409	1.000	-0.183	N/A	0.204	0.259	0.196	0.148	-0.353	0.337	0.319	N/A	-0.117	0.113	0.006	-0.064	0.097	0.162	0.738	0.073	0.553	0.507	-0.055	0.464	0.304	0.376	0.324	-0.234	0.195	0.511	0.385	0.365	0.650	-0.043	-0.230
S	0.865	0.945	0.772	0.808	0.426	0.371	-0.183	1.000	N/A	0.264	0.542	0.419	-0.139	0.718	0.723	0.599	N/A	0.958	0.660	0.713	0.239	0.154	0.917	-0.332	0.957	0.291	-0.368	0.166	0.609	0.846	0.422	0.829	-0.269	0.905	0.534	0.671	0.682	0.106	0.466	0.022
Cl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
K	0.477	0.305	0.514	0.505	0.607	0.664	0.204	0.264	N/A	1.000	0.818	0.689	0.749	0.608	0.406	0.651	N/A	0.157	0.493	0.530	-0.184	-0.281	0.376	0.201	0.345	0.779	0.349	-0.177	0.694	0.418	0.352	0.426	-0.025	0.243	0.325	0.287	0.700	0.737	-0.091	-0.542
Ca	0.668	0.529	0.786	0.689	0.877	0.873	0.259	0.542	N/A	0.818	1.000	0.897	0.420	0.750	0.749	0.916	N/A	0.408	0.765	0.610	-0.120	-0.186	0.656	0.086	0.612	0.615	-0.005	-0.289	0.829	0.602	0.302	0.590	-0.398	0.523	0.344	0.373	0.730	0.589	-0.016	-0.575
Ti	0.579	0.424	0.696	0.550	0.899	0.943	0.196	0.419	N/A	0.689	0.897	1.000	0.413	0.732	0.741	0.889	N/A	0.220	0.804	0.341	-0.125	-0.052	0.476	-0.134	0.455	0.359	-0.101	-0.159	0.658	0.450	0.204	0.438	-0.552	0.366	0.281	0.291	0.604	0.315	0.074	-0.430
V	0.078	-0.063	0.138	0.084	0.141	0.305	0.148	-0.139	N/A	0.749	0.420	0.413	1.000	0.255	-0.022	0.148	N/A	-0.215	-0.013	0.199	-0.107	-0.162	-0.133	0.158	-0.124	0.522	0.523	0.159	0.154	-0.026	0.211	0.000	-0.185	-0.218	0.139	0.072	0.303	0.406	-0.037	-0.251
Cr	0.571	0.571	0.532	0.653	0.560	0.558	-0.353	0.718	N/A	0.608	0.750	0.732	0.255	1.000	0.513	0.669	N/A	0.590	0.646	0.584	-0.022	-0.051	0.588	-0.436	0.613	0.207	-0.378	-0.126	0.503	0.476	0.148	0.456	-0.189	0.476	0.137	0.294	0.509	0.120	0.158	-0.340
Mn	0.902	0.805	0.959	0.784	0.858	0.832	0.337	0.723	N/A	0.406	0.749	0.741	-0.022	0.513	1.000	0.909	N/A	0.587	0.924	0.515	0.037	0.045	0.853	-0.063	0.834	0.477	-0.150	0.002	0.847	0.848	0.424	0.831	-0.547	0.822	0.641	0.621	0.820	0.346	0.288	-0.171
Fe	0.778	0.625	0.859	0.737	0.976	0.949	0.319	0.599	N/A	0.651	0.916	0.889	0.148	0.669	0.909	1.000	N/A	0.444	0.937	0.535	-0.151	-0.130	0.757	-0.007	0.710	0.544	-0.130	-0.273	0.901	0.722	0.304	0.701	-0.388	0.664	0.456	0.449	0.790	0.504	0.045	-0.477
Ni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cu	0.787	0.896	0.665	0.665	0.256	0.185	-0.117	0.958	N/A	0.157	0.408	0.220	-0.215	0.590	0.587	0.444	N/A	1.000	0.466	0.709	0.292	0.228	0.888	-0.201	0.923	0.292	-0.314	0.191	0.537	0.828	0.461	0.816	-0.145	0.904	0.554	0.720	0.607	0.144	0.477	0.059
Zn	0.804	0.695	0.836	0.808	0.903	0.871	0.113	0.660	N/A	0.493	0.765	0.804	-0.013	0.646	0.924	0.937	N/A	0.466	1.000	0.459	-0.102	-0.105	0.756	-0.228	0.738	0.387	-0.252	-0.159	0.813	0.719	0.259	0.693	-0.360	0.686	0.442	0.415	0.755	0.286	0.143	-0.276
Pb	0.675	0.621	0.616	0.799	0.373	0.361	0.006	0.713	N/A	0.530	0.610	0.341	0.199	0.584	0.515	0.535	N/A	0.709	0.459	1.000	-0.333	-0.447	0.777	-0.164	0.747	0.649	-0.270	-0.255	0.654	0.693	0.097	0.650	-0.047	0.707	0.307	0.376	0.640	0.412	-0.141	-0.519
Cl^-	0.153	0.355	0.148	-0.138	-0.193	-0.231	-0.064	0.239	N/A	-0.184	-0.120	-0.125	-0.107	-0.022	0.037	-0.151	N/A	0.292	-0.102	-0.333	1.000	0.867	0.072	0.260	0.168	-0.177	0.393	0.736	-0.097	0.156	0.719	0.227	-0.222	0.147	0.426	0.501	0.084	-0.069	0.871	0.785
NO_3^-	0.125	0.270	0.074	-0.338	-0.142	-0.144	0.097	0.154	N/A	-0.281	-0.186	-0.052	-0.162	-0.051	0.045	-0.130	N/A	0.228	-0.105	-0.447	0.867	1.000	0.016	0.175	0.102	-0.279	0.279	0.752	-0.138	0.140	0.660	0.206	-0.247	0.133	0.478	0.571	0.038	-0.159	0.883	0.747
SO_4^{2-}	0.935	0.921	0.884	0.837	0.616	0.546	0.162	0.917	N/A	0.376	0.656	0.476	-0.133	0.588	0.853	0.757	N/A	0.888	0.756	0.777	0.072	0.016	1.000	-0.072	0.989	0.545	-0.232	-0.018	0.839	0.959	0.462	0.938	-0.234	0.981	0.651	0.720	0.828	0.400	0.294	-0.187
Na^+	-0.083	-0.159	0.043	-0.311	0.058	0.008	0.738	-0.332	N/A	0.201	0.086	-0.134	0.158	-0.436	-0.063	-0.007	N/A	-0.201	-0.228	-0.164	0.260	0.175	-0.072	1.000	-0.137	0.466	0.786	-0.037	0.247	0.047	0.475	0.099	0.123	-0.066	0.306	0.216	0.146	0.729	-0.012	-0.073
NH_4^+	0.948	0.964	0.877	0.836	0.555	0.495	0.073	0.957	N/A	0.345	0.612	0.455	-0.124	0.613	0.834	0.710	N/A	0.923	0.738	0.747	0.168	0.102	0.989	-0.137	1.000	0.489	-0.230	0.102	0.783	0.957	0.509	0.941	-0.254	0.981	0.676	0.756	0.821	0.321	0.405	-0.069
K^+	0.610	0.430	0.615	0.518	0.473	0.501	0.553	0.291	N/A	0.779	0.615	0.359	0.522	0.207	0.477	0.544	N/A	0.292	0.387	0.649	-0.177	-0.279	0.545	0.466	0.489	1.000	0.483	-0.082	0.799	0.649	0.499	0.656	0.033	0.490	0.619	0.516	0.816	0.897	-0.063	-0.427
Mg^{2+}	-0.045	-0.115	0.009	-0.285	-0.088	-0.032	0.507	-0.368	N/A	0.349	-0.005	-0.101	0.523	-0.378	-0.150	-0.130	N/A	-0.314	-0.252	-0.270	0.393	0.279	-0.232	0.786	-0.230	0.483	1.000	0.389	0.109	-0.013	0.624	0.060	0.096	-0.214	0.422	0.273	0.231	0.598	0.246	0.231
Ca^{2+}	0.217	0.345	0.113	-0.121	-0.338	-0.243	-0.055	0.166	N/A	-0.177	-0.289	-0.159	0.159	-0.126	0.002	-0.273	N/A	0.191	-0.159	-0.255	0.736	0.752	-0.018	-0.037	0.102	-0.082	0.389	1.000	-0.207	0.166	0.629	0.226	-0.283	0.106	0.555	0.551	0.153	-0.229	0.881	0.868
BC	0.843	0.693	0.868	0.737	0.838	0.793	0.464	0.609	N/A	0.694	0.829	0.658	0.154	0.503	0.847	0.901	N/A	0.537	0.813	0.654	-0.097	-0.138	0.839	0.247	0.783	0.799	0.109	-0.207	1.000	0.860	0.500	0.851	-0.150	0.773	0.652	0.615	0.920	0.756	0.069	-0.438
OC	0.973	0.932	0.899	0.758	0.587	0.549	0.304	0.846	N/A	0.418	0.602	0.450	-0.026	0.476	0.848	0.722	N/A	0.828	0.719	0.693	0.156	0.140	0.959	0.047	0.957	0.649	-0.013	0.166	0.860	1.000	0.638	0.996	-0.221	0.969	0.833	0.856	0.917	0.492	0.421	-0.064
EC	0.609	0.635	0.564	0.195	0.227	0.227	0.376	0.422	N/A	0.352	0.302	0.204	0.211	0.148	0.424	0.304	N/A	0.461	0.259	0.097	0.719	0.660	0.462	0.475	0.509	0.499	0.624	0.629	0.500	0.638	1.000	0.704	-0.154	0.513	0.885	0.879	0.682	0.523	0.782	0.417
TC	0.967	0.933	0.894	0.721	0.567	0.533	0.324	0.829	N/A	0.426	0.590	0.438	0.000	0.456	0.831	0.701	N/A	0.816	0.693	0.650	0.227	0.206	0.938	0.099	0.941	0.656	0.060	0.226	0.851	0.996	0.704	1.000	-0.222	0.953	0.871	0.891	0.925	0.514	0.479	-0.010
OC1	-0.351	-0.330	-0.546	-0.263	-0.412	-0.480	-0.234	-0.269	N/A	-0.025	-0.398	-0.552	-0.185	-0.189	-0.547	-0.388	N/A	-0.145	-0.360	-0.047	-0.222	-0.247	-0.234	0.123	-0.254	0.033	0.096	-0.283	-0.150	-0.221	-0.154	-0.222	1.000	-0.230	-0.244	-0.248	-0.202	0.170	-0.338	-0.124
OC2	0.929	0.934	0.849	0.758	0.519	0.452	0.195	0.905	N/A	0.243	0.523	0.366	-0.218	0.476	0.822	0.664	N/A	0.904	0.686	0.707	0.147	0.133	0.981	-0.066	0.981	0.490	-0.214	0.106	0.773	0.969	0.513	0.953	-0.230	1.000	0.723	0.789	0.797	0.333	0.394	-0.046
OC3	0.804	0.759	0.728	0.381	0.366	0.389	0.511	0.534	N/A	0.325	0.344	0.281	0.139	0.137	0.641	0.456	N/A	0.554	0.442	0.307	0.426	0.478	0.651	0.306	0.676	0.619	0.422	0.555	0.652	0.833	0.885	0.871	-0.244	0.723	1.000	0.956	0.829	0.505	0.671	0.282
OC4	0.816	0.824	0.717	0.380	0.328	0.333	0.385	0.671	N/A	0.287	0.373	0.291	0.072	0.294	0.621	0.449	N/A	0.720	0.415	0.376	0.501	0.571	0.720	0.216	0.756	0.516	0.273	0.551	0.615	0.856	0.879	0.891	-0.248	0.789	0.956	1.000	0.785	0.422	0.740	0.279
OC_{pyro}	0.934	0.819	0.894	0.751	0.686	0.697	0.365	0.682	N/A	0.700	0.730	0.604	0.303	0.509	0.820	0.790	N/A	0.607	0.755	0.640	0.084	0.038	0.828	0.146	0.821	0.816	0.231	0.153	0.920	0.917	0.682	0.925	-0.202	0.797	0.829	0.785	1.000	0.666	0.341	-0.164
$EC1_{corrected}$	0.407	0.235	0.459	0.270	0.487	0.461	0.650	0.106	N/A	0.737	0.589	0.315	0.406	0.120	0.346	0.504	N/A	0.144	0.286	0.412	-0.069	-0.159	0.400	0.729	0.321	0.897	0.598	-0.229	0.756	0.492	0.523	0.514	0.170	0.333	0.505	0.422	0.666	1.000	-0.116	-0.469
EC2	0.455	0.606	0.366	0.071	-0.038	-0.018	-0.043	0.466	N/A	-0.091	-0.016	0.074	-0.037	0.158	0.288	0.045	N/A	0.477	0.143	-0.141	0.871	0.883	0.294	-0.012	0.405	-0.063	0.246	0.881	0.069	0.421	0.782	0.479	-0.338	0.394	0.671	0.740	0.341	-0.116	1.000	0.787
EC3	-0.040	0.162	-0.132	-0.276	-0.502	-0.484	-0.230	0.022	N/A	-0.542	-0.575	-0.430	-0.251	-0.340	-0.171	-0.477	N/A	0.059	-0.276	-0.519	0.785	0.747	-0.187	-0.073	-0.069	-0.427	0.231	0.868	-0.438	-0.064	0.417	-0.010	-0.124	-0.046	0.282	0.279	-0.164	-0.469	0.787	1.000