Supplement of Atmos. Chem. Phys., 22, 14075–14094, 2022
https://doi.org/10.5194/acp-22-14075-2022-supplement

Atmospheric Chemistry and Physics
Open Access

Supplement of

Fluorescence characteristics, absorption properties, and radiative effects of water-soluble organic carbon in seasonal snow across northeastern China

Xiaoying Niu et al.

Correspondence to: Xin Wang (wxin@lzu.edu.cn)

Table of Contents

Table S1. The WSOC concentrations, the BC concentrations, the value of TFV, NFV, $a_{WSOC}(280)$, MAC_{280}, and AAE for 34 snow samples across northeastern China.

Table S2. Descriptions of three fluorescent components identified by PARAFAC analysis.

Table S3. The statistical results about the fitted light absorption coefficient based on the F_{max} data of three fluorescent components.

Figure S1. Residual analysis of 2- to 7-component PARAFAC models.

Figure S2. Split half analysis of 3-component PARAFAC model with the split style of S4C6T3.

Figure S3. Linear relationships between absorption intensities and fluorescence signal data.

Table. S1 The WSOC concentrations, the BC concentrations, the value of TFV and NFV, the value of $a_{WSOC}(280)$ and MAC_{280} and AAE for 34 snow samples across northeastern China.

Sample number	WSOC (mg L^{-1})	BC (μg L^{-1})	TFV (RU nm^2)	NFV (RU nm^2) (mg L^{-1})$^{-1}$	$a_{WSOC}(280)$ (m^{-1})	MAC_{280} (m^2 g^{-1})	$AAE_{280-400}$
Q494	4.36	404.24	8785.50	2015.02	8.04	1.84	6.52
Q495	3.62	636.74	9733.38	2688.04	8.30	2.29	6.47
Q497	1.77	180.61	5077.88	2864.01	4.91	2.77	6.97
Q498	1.58	291.29	3752.35	2377.92	3.36	2.13	7.08
Q499	5.43	1782.96	10923.03	2010.87	9.87	1.82	6.78
Q470	7.08	1358.29	18623.05	2631.86	16.98	2.40	6.94
Q471	3.84	847.24	9201.03	2397.35	8.18	2.13	6.48
Q473	6.33	2102.80	17147.50	2707.64	15.10	2.38	6.15
Q474	5.23	776.19	16043.30	3067.55	14.15	2.71	6.36
Q484	17.99	837.24	13992.48	778.01	16.06	0.89	6.31
Q486	1.28	185.03	3309.11	2579.19	2.71	2.11	6.70
Q487	3.55	951.41	8562.05	2409.81	7.52	2.12	6.30
Q488	4.83	604.51	12298.11	2544.61	12.34	2.55	6.60
Q489	3.14	233.53	6927.21	2208.93	6.39	2.04	6.53
Q491	5.76	710.03	10425.86	1809.73	10.24	1.78	7.14
Q492	4.92	869.08	13136.19	2669.41	12.13	2.47	7.09
Q493	4.80	664.75	11799.23	2457.66	10.69	2.23	6.93
Q501	5.52	954.80	13548.19	2453.49	13.07	2.37	6.91
Q477	6.02	1826.99	18501.02	3074.79	15.10	2.51	7.01
Q480	2.03	238.67	8092.00	3980.33	6.20	3.05	7.40
Q481	1.87	486.07	7029.69	3763.22	6.06	3.25	7.00
Q482	3.44	849.85	8195.67	2383.85	7.96	2.32	7.18
Q483	3.46	401.94	7849.15	2267.23	7.83	2.26	7.90

Table. S1 Continue.

Sample number	**WSOC ($mg\ L^{-1}$)**	**BC ($\mu g\ L^{-1}$)**	**TFV ($RU\ nm^2$)**	**NFV ($RU\ nm^2$) ($mg\ L^{-1})^{-1}$**	**$a_{WSOC}(280)$ (m^{-1})**	**MAC_{280} ($m^2\ g^{-1}$)**	**$AAE_{280-400}$**
CM1	4.22	991.73	8080.44	1915.25	7.78	1.84	6.77
CM2	2.01	396.75	3983.06	1980.64	4.40	2.19	6.66
CM5	2.88	522.41	6050.44	2100.12	6.42	2.23	6.48
CM11	1.29	280.42	2470.98	1918.46	2.49	1.94	5.13
CM13	0.63	69.23	1182.85	1868.64	1.11	1.75	5.42
CM14	0.65	87.76	1628.69	2494.17	1.65	2.53	5.28
Q440	0.32	59.09	690.27	2137.06	0.42	1.29	8.77
Q443	0.29	66.87	702.11	2396.27	0.78	2.66	4.41
Q447	0.54	39.57	1431.25	2650.47	0.97	1.80	7.47
Q449	0.52	91.07	1235.28	2389.32	1.08	2.09	5.55
Q454	0.83	42.33	802.03	968.05	0.87	1.05	7.13

Table. S2 Descriptions of fluorescent components identified by PARAFAC analysis. The secondary peaks are shown in parentheses.

Component number	**Excitation maximum wavelength (nm)**	**Emission maximum wavelength (nm)**	**Descriptions**	**References**
C1 (HULIS-1)	240(308)	448	Terrestrial humic-like substances	Stedmon et al., 2003
C2 (HULIS-2)	240(293)	398	Anthropogenic, terrestrial, or microbial humic-like substances	(Murphy et al., 2011); (Yamashita et al., 2008); Stedmon et al., 2003
C3 (PRILS)	240(296)	302	Tyrosine-like fluorophore	Stedmon and Markager, 2005

Table. S3 The statistical results about the fitted light absorption coefficient based on the Fmax data of three fluorescent components.

Wavelength (nm)	R^2	*P*
280	0.98	7.94E-24
281	0.99	1.13E-29
284	0.99	9.24E-29
287	0.99	5.34E-28
290	0.99	1.92E-27
293	0.99	3.20E-27
296	0.99	2.91E-27
299	0.99	1.76E-27
302	0.99	1.02E-27
305	0.99	1.49E-27
308	0.99	4.61E-27
311	0.98	2.39E-26
314	0.98	1.36E-25
317	0.98	6.96E-25
320	0.98	2.51E-24
323	0.98	5.48E-24
326	0.98	9.38E-24
329	0.98	1.36E-23
332	0.97	2.32E-23
335	0.98	2.17E-23
338	0.97	2.72E-23
341	0.97	2.50E-23
344	0.98	2.17E-23
347	0.98	1.67E-23
350	0.98	1.67E-23
353	0.98	1.79E-23
356	0.97	2.40E-23
359	0.97	2.86E-23
362	0.97	3.76E-23
365	0.97	4.40E-23
368	0.97	7.03E-23
371	0.97	1.26E-22
374	0.97	3.27E-22
377	0.97	6.53E-22
380	0.97	2.30E-21
383	0.96	7.95E-21
386	0.96	2.97E-20
389	0.95	1.31E-19
392	0.95	3.07E-19
395	0.95	6.64E-19
398	0.94	2.74E-18
401	0.94	5.68E-18

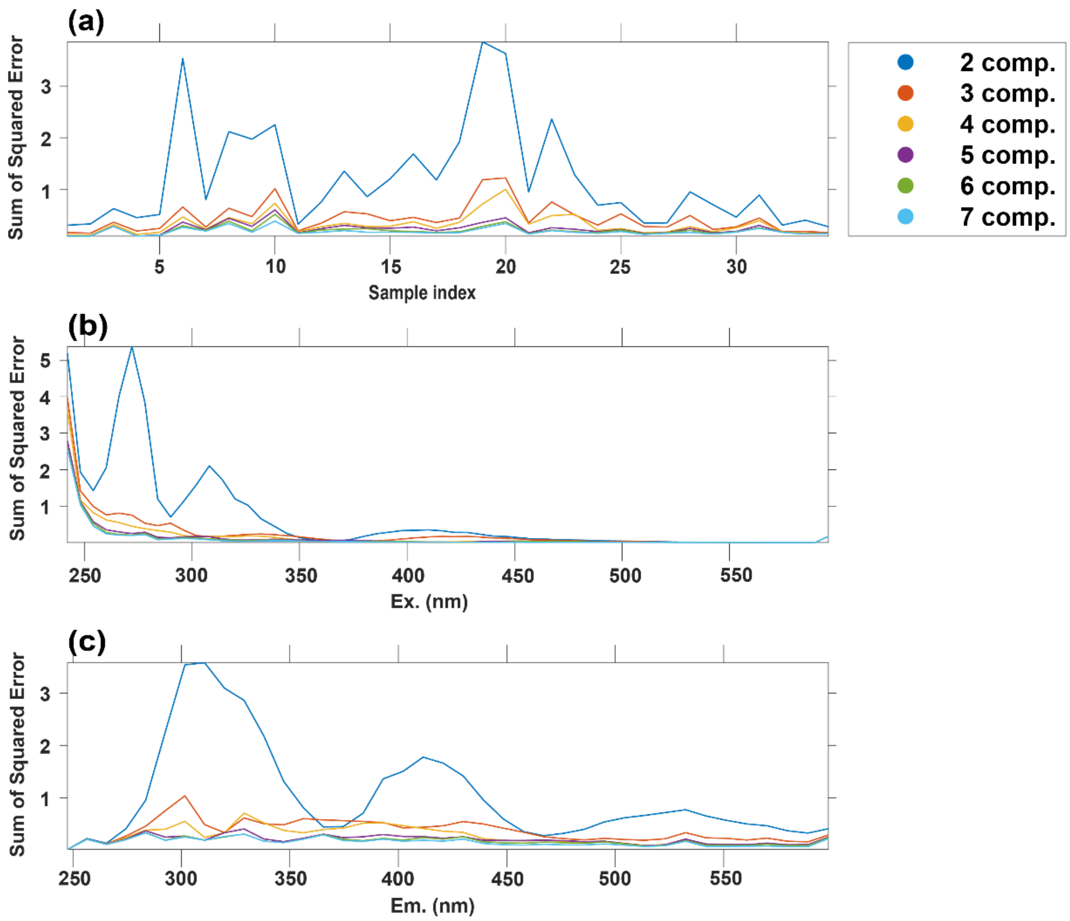

Figure S1: Residual analysis of 2- to 7-component PARAFAC models for (a) sample index, (b) excitation wavelength and (c) emission wavelength.

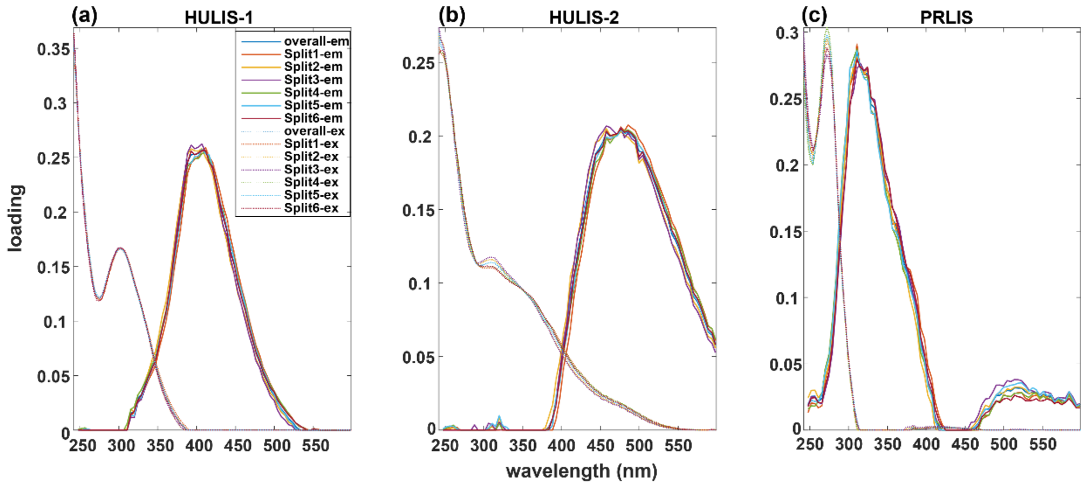

Figure S2: Split half analysis of 3-component PARAFAC model with the split style of S4C6T3. The dashed lines indicate the excitation loadings and the solid lines indicate the emission loadings. The results of different splits and the overall dataset are in different colors as shown in the legend.

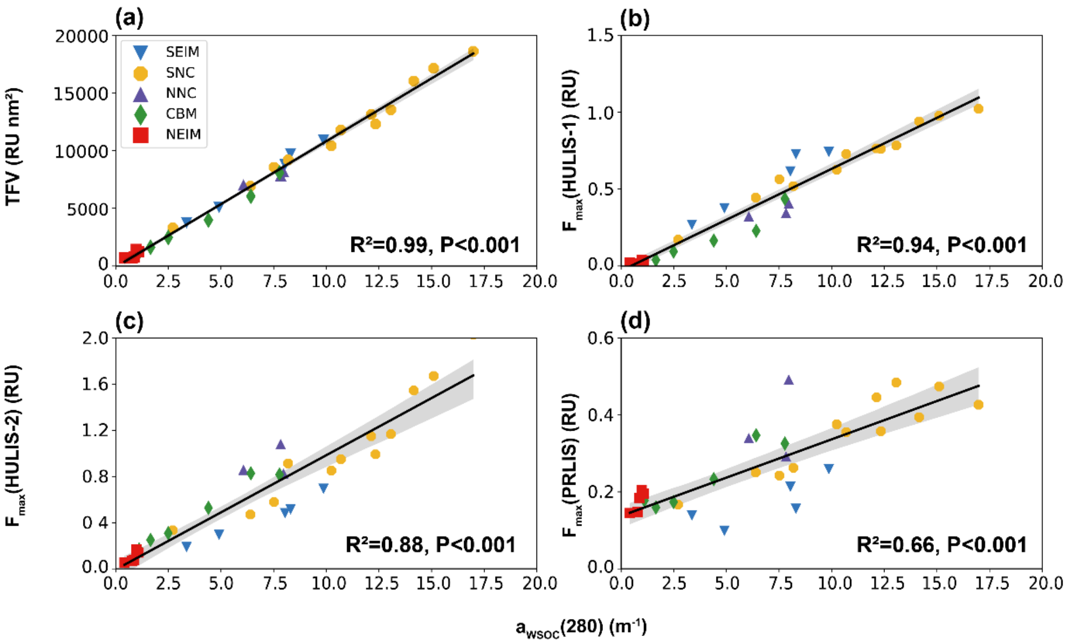

Figure S3: Linear relationships between absorption intensities and (a) TFV, (b) F_{max}(HULIS-1), (c) F_{max}(HULIS-2), (d)F_{max}(PRLIS). Data in different groups are distinguished by different colors and shapes, and the gray shadows are confidence intervals.

References

Murphy, K. R., Hambly, A., Singh, S., Henderson, R. K., Baker, A., Stuetz, R., and Khan, S. J.: Organic Matter Fluorescence in Municipal Water Recycling Schemes: Toward a Unified PARAFAC Model, Environ. Sci. Technol., 45, 2909–2916, https://doi.org/10.1021/es103015e, 2011.

Osburn, C. L., Handsel, L. T., Peierls, B. L., and Paerl, H. W.: Predicting Sources of Dissolved Organic Nitrogen to an Estuary from an Agro-Urban Coastal Watershed, Environ. Sci. Technol., 50, 8473–8484, https://doi.org/10.1021/acs.est.6b00053, 2016.

Stedmon, C. A. and Markager, S.: Resolving the variability in dissolved organic matter fluorescence in a temperate estuary and its catchment using PARAFAC analysis, Limnol. Oceanogr., 50, 686–697, https://doi.org/10.4319/lo.2005.50.2.0686, 2005.

Stedmon, C. A., Markager, S., and Bro, R.: Tracing dissolved organic matter in aquatic environments using a new approach to fluorescence spectroscopy, Marine Chemistry, 82, 239–254, https://doi.org/10.1016/S0304-4203(03)00072-0, 2003.

Yamashita, Y., Jaffé, R., Maie, N., and Tanoue, E.: Assessing the dynamics of dissolved organic matter (DOM) in coastal environments by excitation emission matrix fluorescence and parallel factor analysis (EEM-PARAFAC), 53, 1900–1908, https://doi.org/10.4319/lo.2008.53.5.1900, 2008.