The source, distribution, and environmental effects of suspended particulate matter in the Yangtze River system

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Table S1 Distribution of SPM concentration in dry season and flood season of rivers in the river system

	NO.	Location	Sampling time		Concentration(mg/L)		Reference
					Dry season	Flood season	
Upstream	YYR	Youyu River	January 2007	August 2006	0.94	1.52	[1]
	CCR	Caichong River			1.71	6.27	
	LNR	Lannigou River			14	27.4	
	SR	Sha River			3.29	78.03	
	XCR	Xiaoche River			3.42	3	
	YCR	Yangchang River			0.91	3.47	
	MXR	Maxian River			4.91	9.4	
	HLR	Houliu River			5.39	3.79	
	MBR	Maibao River			10.6	86	
	THYR	Taohuayuan River			4.4	315	
	WJR	Wujiang River	May 2013	August 2013	10	227	[2]
	ZZZ	Zhutuo zhan	January 2015	July 2015	3.4	226.8	[3]
	BBZ	Beibei zhan			0.1	47.87	
	WLZ	Wulong zhan			42.21	85.24	
	CTZ	Cuntan zhan			27.8	65.3	
	FLZ	Fuling zhan			10.17	9.42	
	WZZ	Wanzhou zhan			51.47	3.35	
	NT	Nantong	November–April 2008-2009	May-October 2008-2009	11.75	5.82	[4]
	LCJ	Lower changjiang	June 2003-July 2011	June 2003-July 2011	27.8	65.3	[5]
Downstream	CJE1	Changjiang Estuary 20	April 2014	August 2014	10.17	9.42	[6]
	CJE2	Changjiang Estuary 05			51.47	3.35	
	CJE3	Changjiang Estuary 06			11.75	5.82	

Table S2 Distribution of SPM concentration in dry season and flood season of lakes in the river system

	No	Location	Sampling time		Concentration(mg/L)		Reference
					Dry season	Flood season	
Upstream	AHL1	Aha Lake AHDB	January 2007	August 2006	1.19	2.27	[1]
	AHL2	Aha Lake AHLJK			0.86	3	
	HFL	Hongfeng Lake			2.59	3.37	
Midstream	PYN	Poyang Lake north	October 2008	July 2011	39.46	18.46	[7]
	PYS	Poyang Lake south	October 2009		31.02	17.89	
	CHL	Chaohu Lake	January 2018	July 2018	31.6	61.9	[8]
Downstream	THL1	Taihu Lake	January 2011	August 2011	22.66	39.11	[9]
	THL2	Taihu Lake	17 January 2005-14 January 2010	17 January 2005-14 January 2010	40.67	75.04	[10]

Table S3 Interannual variation of SPM concentration of the Yangtze River

Location	Sampling time	Concentration(mg/L)	Reference
Upstream	2007	198	[2]
	2008	79	
	2009	40	
	2010	135	
	2011	49	
	2012	24	
	2013	28	
Midstream	Apr. 1997	97.6	[11]
	Apr. 2003	93.9	
	Nov. 2006	19.3	
	Jan. 2008	21.6	
	Oct. 2009	33.7	
	Jun. 2010	30.8	
Downstream	2003	101.8	[5]
	2004	78.8	
	2005	103.1	
	2006	43.9	
	2007	39.5	
	2008	27.6	
	2009	35.3	
	2010	45.5	
	2011	43.9	

Table S4 Spatial distribution of SPM concentration in Yangtze River system

NO.	Location	Latitude and longitude	Sampling time	Concentration(mg/L)		Reference
				maximum	minimum	
U1	Beibei zhan	106°05′31.20″N,30°43′30.00″E	January 2015/July 2015	315.00	4.40	[3]
U2	Zhutuo zhan	106°13′22.80″N,28°05′49.20″E		86.00	10.60	
U3	Hongfeng Lake	106°23′24.00″N,26°29′45.60″E	January 2007 /August 2006	3.73	2.59	[1]
U4	Cuntan zhan	106°25′08.40″N,29°50′09.60″E	January 2015/July 2015	227.00	10.00	[3]
U5	Aha Lake	106°37′58.80″N,26°32′16.80″E	January 2007 /August 2006	2.27	1.19	[1]
U6	Fuling zhan	107°08′13.20″N,29°43′15.60″E	January 2015/July 2015	226.80	3.40	[3]
U7	Wulong zhan	107°24′50.40″N,29°42′46.80″E		4.20	2.00	
U8	Wujiang River	107°52′15.60″N,29°16′19.20″E	May 2013/August 2013	119.56	4.46	[2]
U9	Three Gorges Reservoir	110°41′42.00″N,30°59′38.40″E	June 2003 to July 2011	65.30	27.80	[5]
M1	Dongting Lake	112°42′00.00″N,29°03′36.00″E	October 19, 2017	139.13	12.00	[12]

M2	Honghu Lake	113°20′24.00″N,29°51′36.00″E	October 18, 2017	95.00	10.40	
M3	Hanjiang River	114°12′10.80″N,30°34′58.80″E	July 2005/December 2005	203.20	147.24	[**13**]
M4	Dongjing River	114°05′09.60″N,30°23′16.80″E		147.24	65.52	
M5	Yangtze River 7	114°10′19.20″N,30°24′43.20″E	July 2005/December 2005	115.64	71.67	[**13**]
M6	Xunsi River	114°08′24.00″N,30°14′49.20″E		40.00	0.00	
M7	Fuhe River	114°09′00.00″N,30°25′55.20″E		110.52	/	
M8	Donghu Lake	114°20′34.80″N,30°25′12.00″E		157.50	64.05	
M9	Liangzi Lake	114°31′12.00″N,30°13′48.00″E	October 17, 2017	29.14	19.00	[**12**]
M10	Poyang Lake	116°08′16.80″N,29°11′34.80″E	October 2008 /October 2009/ July 2011	39.46	18.46	[**7**]
M11	Longgan Lake	116°09′00.00″N,29°57′00.00″E	October 21, 2017	148.00	114.67	[**12**]
M12	Nangang	116°13′58.80″N,29°39′39.60″E	August 2004	296.10	270.30	[**14**]
L1	Pohu Lake	116°27′00.00″N,30°09′36.00″E	October 21, 2017	37.33	32.00	[**12**]
L2	Caizi Lake	117°05′24.00″N,30°49′48.00″E	October 10, 2017	50.67	10.67	
L3	Chaohu Lake	117°32′24.00″N,31°34′12.00″E	July 2018/ January 2018	61.90	31.60	[**8**]
L4	Datong zhan	117°36′00.00″N,30°48′00.00″E	May 2015 to May 2016	125.13	19.18	[**9**]
L5	Shijiu	118°52′48.00″N,31°28′12.00″E	October 23, 2017	24.00	12.00	[**12**]
L6	Nanyi Lake	118°57′36.00″N,31°06′36.00″E		38.67	17.33	
L7	Zhoutou	119°42′50.40″N,32°17′13.20″E	August 2004	303.30	279.10	[**14**]
L8	Taihu Lake	120°11′24.00″N,31°12′00.00″E	2011 to 2014	39.11	22.66	[**9**]
L9	Nantong	120°31′26.40″N,32°34′01.20″E	May-October,2008-2009 November–April,2008-2009	85.24	42.21	[**4**]
L10	Yangtze River Estuary A3	122°06′00.00″N,31°02′24.00″E	mid-August to early September 2018	155.40	/	[**15**]
L11	Yangtze River Estuary B1	122°13′12.00″N,31°30′36.00″E		92.00	/	

References

1. L. Liang, C.-Q. Liu, X. Zhu, B. T. Ngwenya, Z. Wang, L. Song and J. Li, Zinc isotope characteristics in the biogeochemical cycle as revealed by analysis of suspended particulate matter (spm) in aha lake and hongfeng lake, guizhou, china, Journal of Earth Science **31** (2019), no. 1, 126-140.
2. H. Ji, C. Li, H. Ding and Y. Gao, Source and flux of poc in a karstic area in the changjiang river watershed: Impacts of reservoirs and extreme drought, Biogeosciences **13** (2016), no. 12, 3687-3699.
3. C. Han, B. Zheng, Y. Qin, Y. Ma, C. Yang, Z. Liu, W. Cao and M. Chi, Impact of upstream river inputs and reservoir operation on phosphorus fractions in water-particulate phases in the three gorges reservoir, Science of The Total Environment **610-611** (2018), 1546-1556.
4. S. Panwar and S. Yang, Influence of three gorges dam and drought on particulate organic carbon flux and its source in the lower yangtze river, Biogeochemistry **158** (2022), no. 2, 269-284.
5. Y. Wu, H. Bao, H. Yu, J. Zhang and G. Kattner, Temporal variability of particulate organic carbon in the lower changjiang (yangtze river) in the post-three gorges dam period: Links to anthropogenic and climate impacts, Journal of Geophysical Research: Biogeosciences **120** (2015), no. 11, 2194-2211.

6. J. Hu, H. Zhang, L. Li, Y. Wang and M. Zhao, Seasonal changes of organic matter origins and anammox activity in the changjiang estuary deduced from multi-biomarkers in suspended particulates, Science China Earth Sciences **59** (2016), no. 7, 1339-1352.
7. J. Huang, X. Chen, T. Jiang, F. Yang, L. Chen and L. Yan, Variability of particle size distribution with respect to inherent optical properties in poyang lake, china, Applied Optics **55** (2016), no. 22, 5821.
8. P. Yang, C. Yang and H. Yin, Dynamics of phosphorus composition in suspended particulate matter from a turbid eutrophic shallow lake (lake chaohu, china): Implications for phosphorus cycling and management, Science of The Total Environment **741** (2020), 140203.
9. G. Jiang, W. Su, C. Zhang, W. Deng, X. Wang, Z. Yang, X. Lv, C. Lu, S. Li, R. Ma, X. Huang, L. Ye, M. Wang and W. Yu, Satellite determining dominant sources of particulate organic carbon across different eutrophic waters, Ecological Indicators **142** (2022), 109302.
10. F. G. Schmitt, Y. Zhang, K. Shi, X. Liu, Y. Zhou and B. Qin, Lake topography and wind waves determining seasonal-spatial dynamics of total suspended matter in turbid lake taihu, china: Assessment using long-term high-resolution meris data, PLoS ONE **9** (2014), no. 5, e98055.
11. Y. Wu, T. I. Eglinton, J. Zhang and D. B. Montlucon, Spatiotemporal variation of the quality, origin, and age of particulate organic matter transported by the yangtze river (changjiang), Journal of Geophysical Research: Biogeosciences **123** (2018), no. 9, 2908-2921.
12. K. Xue, R. Ma, M. Shen, Y. Li, H. Duan, Z. Cao, D. Wang and J. Xiong, Variations of suspended particulate concentration and composition in chinese lakes observed from sentinel-3a olci images, Science of The Total Environment **721** (2020), 137774.
13. Z. Tang, Z. Yang, Z. Shen, J. Niu and Y. Cai, Residues of organochlorine pesticides in water and suspended particulate matter from the yangtze river catchment of wuhan, china, Environmental Monitoring and Assessment **137** (2007), no. 1-3.
14. L. Hua, H. Ma and J. Ji, Concentration and distribution characteristic of main toxic metals in suspended particle material in nanjing reach, changjiang river, Environmental Monitoring and Assessment **173** (2010), no. 1-4, 361-370.
15. Z. Zhang, H. Yao, B. Wu, B. Wang and J. Chen, Limited capacity of suspended particulate matter in the yangtze river estuary and hangzhou bay to carry phosphorus into coastal seas, Estuarine, Coastal and Shelf Science **258** (2021), 107417.