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Tropospheric aerosol hygroscopicity in China

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Table S1. Single hygroscopicity parameters (κ) reported by H-TDMA measurements in the North China Plain (NCP). *d*: dry particle diameter; NH: nearly-hydrophilic; LH: less-hygroscopic; MH: more-hygroscopic.

location	time	*d* (nm)	NH (κ<0.1)	LH (0.1<κ<0.25)	MH (κ>0.25)	mean κ	notes	ref
PKU, Beijing	Jun-Jul 2004	30	0.000	0.036	0.175		urban	[1]
		50	0.020	0.110	0.245			
		80	0.022	0.116	0.253			
		150	0.028	0.141	0.297			
		250	0.027	0.154	0.345			
		350	0.022	0.176	0.375			
	Jan-Feb 2005	30	0.000	0.048	0.175			
		50	0.015	0.116	0.253			
		80	0.022	0.141	0.311			
		150	0.020	0.112	0.330			
		250	0.023	0.108	0.345			
		350	0.022	0.106	0.340			
PKU, Beijing	17-20 Jan 2005 (moderate polluted)	30	0.000	0.067	0.167	0.061	urban	[2]
		50	0.010	0.110	0.278	0.170		
		80	0.017	0.128	0.311	0.223		
		150	0.016	0.080	0.330	0.173		
		250	0.019	0.062	0.353	0.113		
		350	0.015	0.052	0.357	0.090		
	20-24 Jan 2005 (high polluted)	30	0.000	0.036	0.152	0.074		
		50	0.010	0.110	0.269	0.177		
		80	0.022	0.154	0.328	0.238		
		150	0.024	0.141	0.339	0.235		
		250	0.027	0.148	0.362	0.205		
		350	0.022	0.128	0.366	0.182		
	24-25 Jan 2005 (less polluted)	30	0.000	0.048	0.183	0.081		
		50	0.010	0.116	0.261	0.184		
		80	0.022	0.141	0.319	0.261		
		150	0.020	0.118	0.339	0.220		
		250	0.019	0.097	0.336	0.166		

		350	0.019	0.080	0.340	0.157		
PKU, Beijing	May-Jun 2014	50				0.160	urban	[3]
		100				0.190		
		150				0.220		
		250				0.260		
		350				0.280		
PKU, Beijing	June 2014	50				0.090	urban	[4]
		100				0.090		
		150				0.100		
		250				0.100		
PKU, Beijing	Mar-May 2014	50				0.200	urban	[5]
		75				-		
		100				0.210		
		150				0.210		
		250				0.230		
		350				0.220		
	Jun-Aug 2014	50				0.160		
		75				0.160		
		100				0.190		
		150				0.220		
		250				0.240		
		350				0.280		
	Sep-Nov 2014	50				0.120		
		75				0.150		
		100				0.160		
		150				0.190		
		250				0.190		
		350				0.230		
	Nov 2014-Feb 2015	50				0.120		
		75				0.190		
		100				0.180		
		150				0.180		
		250				0.160		
		350				0.140		
IAP,	Aug-Oct 2015	40				0.100	urban	[6]

Beijing	Clean 1 period	80			0.110		
		110			0.150		
		150			0.200		
		200			0.250		
	Aug-Oct 2015 Clean 2 period	40			0.140		
		80			0.170		
		110			0.200		
		150			0.240		
		200			0.280		
	Aug-Oct 2015 Pollution period	40			0.160		
		80			0.240		
		110			0.300		
		150			0.360		
		200			0.420		
IAP, Beijing	Nov-Dec 2016 clean period	40			0.164	urban	[7]
		80			0.245		
		110			0.246		
		150			0.241		
		200			0.230		
	Nov-Dec 2016 pollution period	40			0.155		
		80			0.263		
		110			0.289		
		150			0.293		
		200			0.290		
IAP, Beijing	Nov-Dec 2016	40			0.158	urban	[8]
		80			0.253		
		110			0.271		
		150			0.266		
		200			0.260		
	May-Jun 2017	40			0.211		
		80			0.227		
		110			0.240		
		150			0.256		
		200			0.267		
CAMS,	Dec 2016	50	0.010	0.286	0.214	urban	[9]

Beijing		100	0.008	0.318	0.223		
		150	0.012	0.330	0.220		
		200	0.015	0.358	0.222		
Yufa, Beijing	Aug-Sep 2006	50			-	rural	[10]
		150					
		250					
Huairou, Beijing	Jan-Mar 2016	50			0.162	rural	[11]
		100			0.195		
		150			0.205		
		200			0.208		
		300			0.191		
Wuqing, Tianjin	Jul-Aug 2009	50	0.054	0.310	0.250	suburban	[12,13]
		100	0.034	0.330	0.280		
		200	0.028	0.380	0.320		
		250	0.025	0.390	0.340		
NKU, Tianjin	13 Mar 2018	50			0.308	urban	[14]
		100			0.301		
		150			0.387		
		200			0.408		
		250			0.470		
		300			0.477		
	14 Mar 2018	50			-		
		100			0.203		
		150			0.305		
		200			0.306		
		250			0.356		
		300			0.386		
	15 Mar 2018	50			-		
		100			0.370		
		150			0.351		
		200			0.325		
		250			0.281		
		300			0.419		
Xinzhou, Shanxi	Jul-Aug 2014	25			0.420	suburban	[15]
		50			0.494		

		100				0.528		
		200				0.449		
Xingtai, Hebei	May-Jun 2016	40				0.378	urban	[16]
		80				0.364		
		110				0.368		
		150				0.378		
		200				0.390		
Xingtai, Hebei	21 May 2016 clean period	40				0.288	urban	[17]
		80				0.300		
		110				0.324		
		150				0.330		
		200				0.339		
	23 May 2016 polluted period	40				0.325		
		80				0.333		
		110				0.333		
		150				0.341		
		200				0.352		
Xianghe, Hebei	Jul-Aug 2013	50	0.056	0.211	0.378	0.291	rural	[18,19]
		100	0.039	0.185	0.365	0.299		
		150	0.038	0.183	0.380	0.312		
		200	0.031	0.174	0.412	0.329		
		250	0.034	0.170	0.420	0.348		
		350	0.020	0.173	0.455	0.373		
Wangdu, Hebei	Jun 2014	30				0.240	rural	[20]
		50				0.240		
		100				0.270		
		150				0.280		
		200				0.300		
		250				0.320		

Table S2. Single hygroscopicity parameters (κ) reported by H-TDMA measurements in the Yangtze River Delta (YRD). *d*: dry particle diameter; NH: nearly-hydrophilic; LH: less-hygroscopic; MH: more-hygroscopic.

location	time	*d* (nm)	NH (κ<0.1)	LH (0.1<κ<0.25)	MH (κ>0.25)	mean κ	notes	ref
FDU, Shanghai	Jan-Feb 2009	30	0.063		0.296	-	urban	[21]
		50	0.047		0.291			
		100	0.041		0.340			
		150	0.033		0.379			
		200	0.027		0.381			
FDU, Shanghai	18 Jan 2009	250	0.029		0.387		urban	[22]
	19 Jan 2009	250	0.029		0.387			
	10 Feb 2009	250	0.061		0.399			
FDU, Shanghai	Feb-Mar 2014	250	0.029		0.376		urban	[23]
FDU, Shanghai	Dec 2014-Jan 2015	40				0.161	urban	[24]
		100				0.239		
		220				0.317		
		300				0.338		
		350				0.334		
		400				0.345		
FDU, Shanghai	Jul 2017	120					urban	[25]
		240						
		360						
Pudong, Shanghai	Sep 2009	30	0.054		0.270	0.200	urban	[26]
		50	0.039		0.300	0.250		
		80	0.025	0.150	0.350	0.280		
		100	0.019	0.150	0.350	0.280		
		130	0.014	0.170	0.370	0.290		
		150	0.013	0.170	0.380	0.290		
		180	0.011	0.170	0.390	0.300		
		200	0.011	0.150	0.390	0.310		
ZJU, Hangzhou	Dec 2009-Jan 2010	30		0.121	0.303	-	urban	[27]
		50	0.079		0.324			

		80	0.065		0.343			
		100	0.063		0.349			
		130	0.062		0.355			
		150	0.061		0.352			
		180	0.060		0.349			
		200	0.060		0.360			
NUIST, Nanjing	May-Jul 2012	40	0.079		0.330	0.259	suburban	[28]
		80	0.066		0.294	0.238		
		110	0.058		0.306	0.250		
		150	0.051		0.330	0.265		
		200	0.040		0.349	0.275		
NUIST, Nanjing	Apr-May 2014	30	0.018	0.232		0.175	suburban	[29,30]
		70	0.004	0.228		0.178		
		110	0.000	0.213		0.146		
		150	0.000	0.199		0.147		
		190	0.000	0.189		0.138		
		230	0.000	0.186		0.131		
NATC, Nanjing	Aug 2013	32	0.017	0.178		0.081	urban	[31]
		50	0.019	0.188		0.096		
		80	0.019	0.189		0.102		
		110	0.024	0.189		0.102		
		162	0.023	0.193		0.105		
		238	0.031	0.210		0.115		
		350	0.019	0.229		0.126		
JEMC, Nanjing	Jan-Feb 2015	40	0.044		0.333	0.200	urban	[32]
		80	0.035		0.314	0.219		
		110	0.034		0.319	0.231		
		150	0.032		0.330	0.249		
		200	0.030		0.350	0.271		

Table S3. Single hygroscopicity parameters (κ) reported by H-TDMA measurements in the Pearl River Delta (PRD). *d*: dry particle diameter; NH: nearly-hydrophilic; LH: less-hygroscopic; MH: more-hygroscopic.

location	time	*d* (nm)	NH (κ<0.1)	LH (0.1<κ<0.25)	MH (κ>0.25)	mean κ	notes	ref
Xinken, Guangzhou	Oct-Nov 2004	80				0.244	rural	[33]
		140				0.283		
		250				0.324		
		380				0.288		
Wanqinsha, Guangzhou	Oct-Nov 2008	40				-	rural	[34]
		50				-		
		60				-		
		80				-		
Panyu, Guangzhou	Nov-Dec 2011	40	0.091		0.321	0.219	suburban	[35]
		80	0.066		0.294	0.208		
		110	0.058		0.290	0.213		
		150	0.051		0.297	0.220		
		200	0.045		0.323	0.230		
Panyu, Guangzhou	Dec 2012-Jan 2013	40	0.024	0.127	0.306	0.179	suburban	[36]
		80	0.017	0.115	0.292	0.185		
		110	0.014	0.110	0.298	0.195		
		150	0.011	0.111	0.309	0.207		
		200	0.009	0.104	0.326	0.223		
	Jul-Sep 2013	40	0.022	0.134	0.290	0.172		
		80	0.014	0.120	0.291	0.177		
		110	0.011	0.111	0.300	0.181		
		150	0.008	0.106	0.317	0.195		
		200	0.006	0.101	0.339	0.214		
Panyu, Guangzhou	Jan-Mar 2014	40				0.204	suburban	[37]
		80				0.250		
		110				0.266		
		150				0.288		
		200				0.312		
Panyu,	Feb-Mar 2014	80			0.382	0.261	suburban	[38]

Guangzhou		110		0.414	0.281		
		150		0.431	0.305		
		200		0.432	0.323		
Panyu, Guangzhou	Nov 2014	40			0.216	suburban	[39]
		80			0.250		
		110			0.267		
		150			0.283		
		200			0.313		
Panyu, Guangzhou	Nov-Dec 2014	40			0.213	suburban	[40]
		80			0.248		
		110			0.265		
		150			0.282		
		200			0.312		
Panyu, Guangzhou	Sep-Oct 2016	30				suburban	[41]
		60					
		100					
		145					
HKUST, Hong Kong	May 2011	75	0.020	0.390	0.360	suburban and coastal	[42,43]
		100	0.020	0.360	0.340		
		150	0.010	0.370	0.330		
		200	0.000	0.380	0.340		
	1-15 Sep 2011	75	0.040	0.400	0.380		
		100	0.040	0.390	0.370		
		150	0.020	0.380	0.370		
		200	0.020	0.400	0.390		
	16-30 Sep 2011	75	0.070	0.340	0.210		
		100	0.020	0.270	0.250		
		150	0.030	0.250	0.210		
		200	0.020	0.280	0.250		
	Nov 2011	75	0.030	0.340	0.320		
		100	0.030	0.330	0.300		
		150	0.020	0.320	0.290		
		200	0.020	0.330	0.300		

Table S4. Single hygroscopicity parameters (κ) reported by H-TDMA measurements in other regions (except NCP, YRD and PRD) in China. *d*: dry particle diameter; NH: nearly-hydrophilic; LH: less-hygroscopic; MH: more-hygroscopic.

location	time	*d* (nm)	NH (κ<0.1)	LH (0.1<κ<0.25)	MH (κ>0.25)	mean κ	notes	ref
Taipei, Taiwan	Oct-Dec 2001	53	0.056		0.274		urban	[44]
		82	0.050		0.301			
		95	0.049		0.337			
		202	0.068		0.422			
Mt. Huang, Anhui	Sep-Oct 2012 foot	40	0.081		0.290		mountain	[45]
		80	0.089		0.285			
		110	0.091		0.286			
		150	0.085		0.295			
		200	0.078		0.310			
	Sep-Oct 2012 top	40	0.059	0.248				
		80	0.075		0.271			
		110	0.083		0.280			
		150	0.061		0.290			
		200	0.071		0.313			
Mt. Huang, Anhui	Jul 2014	70				0.275	mountain	[46,47,48]
		150				0.266		
		230				0.290		
Shouxian, Anhui	Jun-Jul 2016	50	0.040	0.229		0.129	rural	[49]
		100	0.030	0.238		0.152		
		150	0.033		0.265	0.219		
		200	0.028		0.323	0.265		
		250	0.023		0.328	0.279		
East China Sea	May-Jun 2014						marine	[50]

	daytime	100	0.810
	nighttime	100	0.950

Table S5. Supersaturation (S), activation diameter (d_a and d_t), and single hygroscopicity parameters (κ_a and κ_t) reported by CCN activity measurements in China. Please refer to the main text for definitions of d_a, d_t, κ_a and κ_t.

location	time	S (%)	d_a (nm)	κ_a	d_t (nm)	κ_t	notes	ref
Yufa, Beijing	Aug-Sep 2006 entire campaign	0.86	44±5	0.23±0.08	45±6	0.22±0.08	rural	[51]
		0.66	53±7	0.24±0.08	54±8	0.23±0.08		
		0.46	63±8	0.28±0.08	64±9	0.27±0.01		
		0.26	85±8	0.34±0.09	89±12	0.31±0.10		
		0.07	191±10	0.46±0.07	204±25	0.40±0.11		
		average		0.31±0.08		0.28±0.09		
	Aug-Sep 2006 aged regional pollution	0.86	43±4	0.24±0.07	43±4	0.24±0.07		
		0.66	50±4	0.26±0.06	51±4	0.25±0.06		
		0.46	59±3	0.31±0.05	60±4	0.31±0.06		
		0.26	81±4	0.38±0.06	83±5	0.36±0.07		
		0.07	185±5	0.50±0.05	187±5	0.49±0.04		
		average		0.35±0.05		0.32±0.05		
	Aug-Sep 2006 fresh city pollution	0.86	51±8	0.16±0.07	52±9	0.16±0.07		
		0.66	60±9	0.16±0.07	62±10	0.16±0.07		
		0.46	74±10	0.18±0.08	76±11	0.17±0.08		
		0.26	95±9	0.25±0.07	106±15	0.19±0.09		
		0.07	206±12	0.36±0.06	242±33	0.24±0.09		
		all		0.22±0.07		0.18±0.08		
PKU, Beijing	Jun 2014	0.80	67±3	0.09±0.01			urban	[4]
		0.40	118±6	0.06±0.01				
		0.20	171±16	0.09±0.03				
IAP, Beijing	Nov-Dec 2014, Aug-Sep 2015		60	0.24±0.07			urban	[15]
			80	0.22±0.07				
			110	0.25±0.10				

			120	0.31±0.11				
			150	0.29±0.15				
Wuqing, Tianjin	Nov-Dec 2011	0.812	45±4	0.19±0.05	60±7 [a]	0.08±0.03 [a]	suburban	[52,53]
		0.424	61±4	0.31±0.06	76±7	0.17±0.05		
		0.200	93±5	0.39±0.07	106±7	0.26±0.06		
		0.083	175±12	0.35±0.07	194±13	0.26±0.06		
		0.061	215±12	0.35±0.06	238±17	0.26±0.06		
Xianghe, Hebei	Jun-Jul 2013 polluted case	0.80	45±3	0.24±0.03			rural	[54]
		0.42	63±4	0.30±0.04				
		0.23	94±8	0.31±0.05				
		0.11	162±15	0.26±0.05				
		0.08	190±6	0.32±0.03				
	Jun-Jul 2013 background case	0.80	46±1	0.22±0.02				
		0.42	64±1	0.29±0.01				
		0.23	92±2	0.34±0.02				
		0.11	151±3	0.33±0.02				
		0.08	179±4	0.38±0.02				
Xianghe, Hebei	Jul-Aug 2013	0.80	46±4	0.22±0.06			rural	[19,55]
		0.40	68±6	0.28±0.07				
		0.20	103±9	0.34±0.07				
		0.10	152±12	0.40±0.09				
		0.07	192±14	0.40±0.08				
Xinzhou, Shanxi	Jul-Aug 2014		37	0.42±0.07			suburban	[15]
			55	0.51±0.07				
			60	0.51±0.07				
			80	0.50±0.08				
			120	0.46±0.10				
			145	0.49±0.10				
			150	0.50±0.11				

Lin'an, Zhejiang	Jan-Oct 2013	0.70	48±5	0.26±0.07	49±5	0.25±0.07	rural	[56,57]
		0.45	62±6	0.30±0.07	63±6	0.28±0.07		
		0.28	80±6	0.35±0.08	81±6	0.33±0.08		
		0.20	96±7	0.40±0.09	98±8	0.38±0.09		
		0.10	149±9	0.42±0.08	152±10	0.40±0.08		
		average		0.34±0.09		0.33±0.09		
NBM, Nanjing	Aug 2013	0.56	55	0.30±0.08			suburban	[58]
		0.38	67	0.34±0.08				
		0.29	77	0.37±0.09				
		0.20	95	0.38±0.09				
		0.11	149	0.36±0.08				
		average		0.35±0.13				
Backgarden, Guangzhou	Jul 2006 entire campaign	1.27	32±4	0.29±0.09	32±4	0.28±0.08	rural	[59,60]
		0.87	41±4	0.28±0.08	41±5	0.28±0.09		
		0.67	49±6	0.28±0.09	50±7	0.27±0.09		
		0.47	59±7	0.32±0.09	61±8	0.30±0.09		
		0.27	81±9	0.37±0.10	85±11	0.33±0.11		
		0.068	190±11	0.44±0.08	213±22	0.33±0.10		
		average		0.34±0.11		0.30±0.10		
	Jul 2006 biomass mass burning event (BBE)	1.27	34±5	0.25±0.13	35±5	0.22±0.11		
		0.87	47±5	0.19±0.07	48±7	0.18±0.07		
		0.67	59±7	0.16±0.06	63±8	0.13±0.06		
		0.47	69±9	0.21±0.08	71±10	0.19±0.08		
		0.27	93±12	0.25±0.09	99±13	0.21±0.09		
		0.068	205±12	0.35±0.06	222±21	0.28±0.07		
		average		0.24±0.10		0.21±0.09		
	Jul 2006 entire campaign excluding BBE	1.27	31±3	0.30±0.07	31±3	0.29±0.07		
		0.87	40±4	0.29±0.08	40±4	0.29±0.08		
		0.67	48±5	0.29±0.08	49±5	0.28±0.08		

		0.47	58±6	0.33±0.08	59±7	0.32±0.09		
		0.27	80±7	0.39±0.09	83±10	0.35±0.11		
		0.068	187±9	0.46±0.07	212±22	0.33±0.10		
		average		0.35±0.10		0.31±0.09		
Panyu, Guangzhou	Nov-Dec 2014	0.70	58±11	0.21±0.05			suburban	[40]
		0.40	78±15	0.25±0.06				
		0.20	107±17	0.28±0.06				
		0.10	156±19	0.30±0.07				
HKUST, Hong Kong	May 2011	0.70	46	0.28±0.09			suburban and coastal	[61]
		0.50	56	0.31±0.10				
		0.35	67	0.36±0.09				
		0.15	116	0.39±0.06				
Hualin, Taiwan	Aug 2011 with anthropogenic emissions	0.91			53±5 [a]	0.11±0.04 [a]	rural	[62]
		0.73			59±5	0.12±0.04		
		0.46			70±6	0.19±0.05		
		0.28			88±5	0.26±0.05		
		0.19			105±5	0.34±0.05		
		0.089			164±6	0.35±0.05		
	Aug 2011 without anthropogenic emissions	0.91			71±8	0.042±0.02		
		0.73			76±8	0.056±0.02		
		0.46			88±8	0.095±0.03		
		0.28			106±7	0.15±0.03		
		0.19			125±8	0.20±0.04		
		0.089			176±6	0.28±0.03		
Taipei, Taiwan	Jun 2012	0.91			90±9 [a]	0.021±0.01 [a]	urban	[62,63]
		0.73			103±9	0.022±0.01		
		0.46			131±14	0.029±0.02		
		0.28			160±19	0.045±0.02		
		0.19			187±17	0.063±0.02		

		0.089			246±15	0.10±0.02		
remote South China Sea	Sep 2012	0.38 0.14	45-80 96-150	0.50±0.21 0.54±0.14			marine	[64]
north South China Sea	Aug 2018	0.59 0.34 0.18	47±3 67±5 105±8	0.38±0.09 0.40±0.09 0.38±0.09			marine	[65]

[a]: κ_{cut} were reported instead of κ_t. Please refer to the main text for definitions of κ_{cut} and κ_t.

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