Supplementary Information:
Quantification of atmospheric ammonia concentrations: A review of its measurement and modeling

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This document contains Table S1 and S2. Table S1 lists some of the in situ measurements of atmospheric ammonia concentrations reviewed in the main manuscript. Table S2 lists the equilibrium models used in the modeling studies listed in Table 3 of the main manuscript.

Table S1: In situ measurements of [NH_3].

Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Surface Observations					
Hoell et al. 1980	Hampton, VA	Mar 1979–Aug 1979	Remote Infrared Heterodyne Radiometer	10–1.3 ppbv	8.1
Cadle et al. 1982	(U) Commerce City, CO	11 Nov–21 Dec 1978	Oxalic acid filter pack / Technicon analyser or Modified Indophenol blue method	3.4 ppbv	3.4
	(U) Warren, MI	5 Sep–1 Oct 1979		1.2 ppbv	1.2
		22 Jan–18 Feb 1980		0.79 ppbv	0.8
		19 May–12 Jun 1980		1.3 ppbv	1.3
	(R) Abbeville, LA	6 Jun–25 Aug 1979		0.80 ppbv	0.8
	(R) Luray, VA	13 Jul–10 Aug 1980		1.9 ppbv	1.9
Alkezweeny et al. 1986	Lexington, KY	26 Jul–22 Aug 1983	Filter pack / Technicon analyser	0.04–5.6 $\mu g\,m^{-3}$	8.0
Erisman et al. 1988	(R) Cabauw, Netherlands–2 m	30 daytime and nighttime 12 hr periods	Two denuder tubes and a filterpack / Colorimetry	8.3 $\mu g\,m^{-3}$	12.0
	(R) Cabauw, Netherlands–25 m			6.2 $\mu g\,m^{-3}$	8.9
	(R) Cabauw, Netherlands–100 m			3.6 $\mu g\,m^{-3}$	5.2
	(R) Cabauw, Netherlands–200 m			2.1 $\mu g\,m^{-3}$	3.0
Harrison and Allen 1990	Essex University	21 Aug–13 Nov 1986	Filter pack / High Performance Liquid Chromatography (HPLC)	1.44±0.49 $\mu g\,m^{-3}$	2.1
		24 Feb–16 Apr 1987		0.98±0.34 $\mu g\,m^{-3}$	1.4
	Colchester	21 Aug–13 Nov 1986		1.68±0.47 $\mu g\,m^{-3}$	2.4
		24 Feb–16 Apr 1987		1.26±0.38 $\mu g\,m^{-3}$	1.8
	Dedham	21 Aug–13 Nov 1986		1.91±0.42 $\mu g\,m^{-3}$	2.8
		24 Feb–16 Apr 1987		2.29±1.96 $\mu g\,m^{-3}$	3.3
	Walton Pier	21 Aug–13 Nov 1986		0.98±0.39 $\mu g\,m^{-3}$	1.4
		24 Feb–16 Apr 1987		2.90±1.84 $\mu g\,m^{-3}$	4.2
Pio et al. 1991	Aveiro (Portugal) Urban	Aug 1988-May 1989	Filter pack with potassium hydrogen sulphate	4.56±2.51 ppbv	4.6

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Lee et al. 1993	Chicago,IL	Apr 1990–Mar 1991 Day	Annular denuder system (ADS)	0.15-5.60 μg m^{-3}	4.1
		Apr 1990–Mar 1991 Night		0.11-8.20 μg m^{-3}	6.0
Andersen et al. 1993	Denmark	24–31 May and 29 Aug–5 Sep 1991	Denuder, filter pack / indophenol blue	0–4.5 μg m^{-3}	3.2
Suh et al. 1995	Philadelphia,PA average	1992	Annular denuder	1.18–5.54 ppbv	20.1
		1993		2.04–5.68 ppbv	3.9
	Valley Forge,PA	1992		0.9 ±0.9 ppbv	0.9
		1993		1.4 ± 1.0 ppbv	1.4
	Roxborough,PA	1992		0.6 ±0.7 ppbv	0.6
		1993		Unreported	
	North Airport,PA	1992		0.9 ±0.7 ppbv	0.9
		1993		0.9 ±0.7 ppbv	0.9
	Camden, NJ	1992		2.2± 1.1 ppbv	2.2
		1993		1.9 ± 1.4 ppbv	1.9
	Laboratory,PA	1992		2.2± 1.1 ppbv	2.2
		1993		2.5 ±0.9 ppbv	2.5
	Presbyterian,PA	1992		2.6 ± 1.3 ppbv	2.6
		1993		3.0 ± 1.8 ppbv	3.0
	500 S. Broad,PA	1992		3.8 ± 1.9 ppbv	3.8
		1993		3.9± 1.1 ppbv	3.9
	Temple,PA	1992		2.6 ± 1.4 ppbv	2.6
		1993		2.4± 1.1 ppbv	2.4
Yamamoto et al. 1995	Yokohama (Japan) Urban	Jan 1987-Dec 1991	Boric acid bubbler with Teflon pre-filter	2.4-11.9 ppbv	2.4
Hoek et al. 1996	(R) Deurne,Netherlands	Oct 1987–Apr 1990	Annular denuder filter pack system (ADS)	0.7-11.6-57.6 μg m^{-3}	16.7
	(SR) Bilthoven, Netherlands			0.7-3.9-38.9 μg m^{-3}	5.6

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Brook et al. 1997	Egbert, Canada	1992–1994	Annular denuder filter pack system (ADS)	1.632 μg m^{-3}	2.4
	Kejimkujik, Canada			0.408 μg m^{-3}	0.6
	Sutton, Canada			0.833 μg m^{-3}	1.2
	Hamilton,Canada			4.284 μg m^{-3}	6.2
	Windsor,Canada			1.717 μg m^{-3}	2.5
Burkhardt et al. 1998	(R) Edinburgh, Scotland	Sep 1992-Dec 1992	Continuous rotating wet annular denuder with Sodium hydrogen sulphate	1.4 μg m^{-3}	2.0
Buijsman et al. 1998	8 sites in Netherlands Agricultural	Aug 1992-Jul 1995	Continuous-flow denuder with Sodium hydrogen sulphate	2-4–10-25 μg m^{-3}	15.8
Matsumoto and Okita 1998	Nara, Japan	Jun-94	Annular denuder system (ADS) with Oxalic acid	2.76 μg m^{-3}	4.0
		Jul-94		1.36 μg m^{-3}	2.0
		Aug-94		2.15 μg m^{-3}	3.1
		Sep-94		2.06 μg m^{-3}	3.0
		Oct-94		3.24 μg m^{-3}	4.7
		Nov-94		2.99 μg m^{-3}	4.3
		Dec-94		2.83 μg m^{-3}	4.1
		Jan-95		1.44 μg m^{-3}	2.1
		Feb-95		2.52 μg m^{-3}	3.6
		Mar-95		3.07 μg m^{-3}	4.4
		Apr-95		2.44 μg m^{-3}	3.5
		May-95		2.29 μg m^{-3}	3.3
		Annual Average		2.43 μg m^{-3}	3.5
McCulloch et al. 1998	Eastern North Carolina (USA) Agricultural	Sep-Dec 1997	Annular denuder system (ADS) with Citric acid	10.48 ± 14.75 μg m^{-3}	15.1
Wyers & Erisman 1998				5	5.0
Lee et al. 1999	Seoul,South Korea	Oct 1996–Sep 1997	Annular denuder	6.32	6.3

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
McCurdy et al. 1999	(SU) South Fayette, Pittsburgh, USA	13 Jul–9 Oct, 1993	Short-HEADS annular denuder with Acidic sulphate	22.85 ± 25.81 nmol m^{-3}	0.5
	(SU) Libertyboro, Pittsburgh, USA			86.33 ± 55.82 nmol m^{-3}	2.0
	(U) Flag Plaza, Pittsburgh, USA			87.75 ± 48.03 nmol m^{-3}	1.5
	(SU) Lawrenceville, Pittsburgh, USA			50.45 ± 21.43 nmol m^{-3}	0.9
Parmar et al. 2001	(U) Agra, India	Jul-Sep 1997	Mist chamber technique with Sodium hydrogen sulphate	16.4 ± 3.5 ppbv	16.4
		Nov–Feb 1998		11.8 ± 4.4 ppbv	11.8
Pryor et al. 2001	(F) Southern Indiana, USA	19 Apr–15 May 1998	Wet effluent diffusion denuders (WEDD) with Water	1.2 ± 1.3 µg m^{-3}	1.7
		20 Apr–5 May 1999		0.26 ± 0.10 µg m^{-3}	0.4
		08–19 Jan 1999		0.65 ± 0.60 µg m^{-3}	0.9
		26 Feb–03 Mar 2000		Unreported	
Perrino et al. 2002	(U+Traffic) Piazza Fermi, Rome, Italy	May 2001-Mar 2002	Annular diffusion denuders coated with Phosphorous acid	13.5–21.6 µg m^{-3}	25.3
	(R) Montelibretti, Italy	May 2001-Mar 2002		1.2–3.9 µg m^{-3}	3.7
	(U,Background) Villa Ada Park, Rome, Italy	May 2001-Mar 2002		2.9–4.9 µg m^{-3}	5.6
Robarge et al. 2002	(A) North Carolina, USA	Oct 1998-Sep 1999	Annular denuder system (ADS) with Citric acid	5.55 ± 5.35 µg m^{-3}	8.0
Yao et al. 2003	Beijing Urban	28 Jul–3 Aug 2001	Annular Denuder	16.8–42.2	29.5
Bari et al. 2003	Manhattan, USA	Jul-Sep 1999	Annular denuder system (ADS) with Citric acid	6.1 ± 1.3 µg m^{-3}	8.8
		Jul 1999-Jun 2000		5.0 ± 2.7 µg m^{-3}	7.2
		Jan-Mar 2000		4.1 ± 2.6 µg m^{-3}	5.9
		Apr-Jun 2000		5.9 ± 3.4 µg m^{-3}	8.5
	Bronx, USA	Jul 1999-Jun 2000		3.1 ± 2.6 µg m^{-3}	4.5
		Jan-Mar 2000		2.1 ± 2.1 µg m^{-3}	3.0

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
		Apr-Jun 2000		$4.2 \pm 2.6\ \mu g\ m^{-3}$	6.0
Carmichael et al. 2003	(R) Waliguan Mountain, China	Sep 1999-Jun 2001	IVL passive samplers	4 ppbv	4.0
	(R) Linan, China	1 month passive sampling		5 ppbv	5.0
	(R) Shang dian Zhi, China			3 ppbv	3.0
	(R) Cape D'Aequier, China			1 ppbv	1.0
	(R) Shui-Li, Taiwan			7 ppbv	7.0
	(R) Oki, Japan			<1 ppbv	<1
	(R) Tanah Rata, Malaysia			<1 ppbv	<1
	(R) Lawa Mandau, Malaysia			<1 ppbv	<1
	(R) Bukit Kototabang, Indonesia			3 ppbv	3.0
	(R) Kalimantan, Indonesia			6 ppbv	6.0
	(R) Chiang Mai, Thailand			2 ppbv	2.0
	(R) N. Sri Thammarat, Thailand			1 ppbv	1.0
	(R) Luang Prabang, Laos			3 ppbv	3.0
	(R) Savannaketh, Laos			1 ppbv	1.0
	(R) Mt. Sto. Thomas, Philippines			2 ppbv	2.0
	(R) Dhangadi, Nepal			22 ppbv	22.0
	(R) Nagarkot, Nepal			2 ppbv	2.0
	(R) Langtang, Nepal			1 ppbv	1.0
	(R) Berhampur, India			8 ppbv	8.0
	(R) Cochin, India			19 ppbv	19.0
	(R) Agra, India			>40 ppbv	>40
	(R) Bhubaneshwar, India			7 ppbv	7.0
	(R) Mt. Kenya, Kenya			1 ppbv	1.0
	(R) Elandsfontein, South Africa			2 ppbv	2.0
	(R) Cape Point, South Africa			1 ppbv	1.0
	(R) Tamanrasset, Algeria			4 ppbv	4.0

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
	(R) Banizoumbou			4 ppbv	4.0
	(R) Lamto			3 ppbv	3.0
	(R) Zoetele			2 ppbv	2.0
	(R) Petit Saut			<1 ppbv	<1
	(R) Isla Redonda, Argentina			<1 ppbv	<1
	(R) Ushuaia			<1 ppbv	<1
	(R) El Tololo			<1 ppbv	<1
	(R) Arembepe, Brazil			<1 ppbv	<1
	(R) Marcaomacocha			3 ppbv	3.0
	(R) Camkoru			<1 ppbv	<1
Cape et al. 2004	(U) Edinburgh, Scotland	Apr 2002	Passive samplers (CEH ALPHA) with Phosphorous acid	4.75 $\mu g\,m^{-3}$	6.8
van Pul 2004	(U+R) 155 sites in Netherlands	Sep 2000-Sep 2001	Passive samplers with Phosphorous acid (Duyzer and Weststrate,2002)	6.6 $\mu g\,m^{-3}$	9.5
Walker et al. 2004	(A) Clinton, North Carolina, USA	Winter 2000	Annular denuder system (ADS) with Citric acid	2.59 $\mu g\,m^{-3}$	3.7
		Spring 2000		4.62 $\mu g\,m^{-3}$	6.7
		Summer 2000		6.18 $\mu g\,m^{-3}$	8.9
		Fall 2000		2.85 $\mu g\,m^{-3}$	4.1
	(U) Kinston, North Carolina, USA	Winter 2000		0.49 $\mu g\,m^{-3}$	0.7
		Spring 2000		3.93 $\mu g\,m^{-3}$	5.7
		Summer 2000		2.72 $\mu g\,m^{-3}$	3.9
		Fall 2000		0.86 $\mu g\,m^{-3}$	1.2
	(U) Morehead city, North Carolina, USA	Winter 2000		0.33 $\mu g\,m^{-3}$	0.5
		Spring 2000		0.40 $\mu g\,m^{-3}$	0.6
		Summer 2000		0.72 $\mu g\,m^{-3}$	1.0
		Fall 2000		0.35 $\mu g\,m^{-3}$	0.5

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Vogt et al. 2005	(U+A) Munster, Germany	May-Jun 2004	Continuous-flow wet denuder (AMANDA) with NaHSO4	5.2 ppbv	5.2
Yao et al. 2006	(U) Hongkong	Autumn 2000	Autoanalyser	3 ppbv	3.0
Lin et al. 2006	(U) Taichung, Taiwan	Jan.-Dec. 2002	Filter,denuder / IC	12.2 ± 4.31 ppbv	12.2
Anatolaki and Tsitouridou 2007	(U) Thessaloniki, Greece	Apr 2002-Mar 2003	Annular denuder system (ADS) with Citric acid	2.33 ± 1.46 µg m^{-3}	2.3
Wilson and Serre 2007	(A) North Carolina, USA	Oct 2003–Dec 2003	Passive sampler with Phosphorous acid	10 ppbv	10.0
		Jan 2003–Mar 2004		8.1 ppbv	8.1
		Apr 2004–Jun 2004		10.9 ppbv	10.9
		Jul 2004–Sep 2004		16.7 ppbv	16.7
Alebic-Juretic 2008	(U+Industrial) Croatia	Winter seasons 2000-2002	Spectrophotometrically by Nesslerization (WHO, 1976)	16.3 µg m^{-3}	23.5
		Spring seasons 2000-2002		12.3 µg m^{-3}	17.7
		Summer seasons 2000-2002		9.3 µg m^{-3}	13.4
		Fall seasons 2000-2002		15.7 µg m^{-3}	22.6
	(U+Residential) Croatia	Winter seasons 2000-2002		20.3 µg m^{-3}	29.2
		Spring seasons 2000-2002		37.8 µg m^{-3}	54.4
		Summer seasons 2000-2002		44.9 µg m^{-3}	64.7
		Fall seasons 2000-2002		20.3 µg m^{-3}	29.2
		1983–2005 Annual average		6–14 µg m^{-3}	14.4
	(U) Rijeka, Croatia	1983–2005 Annual average		12–20 µg m^{-3}	23.0
Biswas et al. 2008	(U) Lahore, Pakistan	Dec 2005–Feb 2006	Annular denuder	30.3-116.9 ppbv	73.6
M. Hu et al. 2008	(R) Guangzhou, China	4 Oct–4 Nov 2004	Wet-rotating annular denuder with Sodium Carbonate	10.5 ppbv	10.5
Cao et al. 2009	(U) Xian, China	2006.04 to 2007.04	Passive sampler	18.6 ppbv	18.6
	(Suburban) Xian, China	2006.04–2007.05	Passive sampler	20.3	20.3 ppbv
Wu et al. 2009	(U) Beijing, China	Summer 2002–2003	Annular denuder	23.9 ppbv	23.9

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Fountoukis et al. 2009	(U) Mexico city, Mexico	21–30 Mar 2006	Quantum Laser (QCL) Spectrometer	17.73±11.02 $\mu g\,m^{-3}$	25.5
Behera and Sharma 2010	(U) Colonelganj, India	1 Dec, 2007–31 Jan, 2008	Chemiluminescence (Seres CV 2000 G online NOx-NH_3 analyzer)	26.4±5.8 $\mu g\,m^{-3}$	38.0
		8 Apr–30 Jun, 2007		28.7±7.3 $\mu g\,m^{-3}$	41.3
	(U) IIT Kanpur, India	1 Dec, 2007–31 Jan, 2008		16.3±5.0 $\mu g\,m^{-3}$	23.5
		8 Apr–30 Jun, 2007		18.0±3.9 $\mu g\,m^{-3}$	25.9
Ianniello et al. 2010	(U) Beijing, China	23 Jan–14 Feb 2007	Annular diffusion denuder with Phosphorous acid	5.47±3.75 $\mu g\,m^{-3}$	7.9
		2–31 Aug 2007		25.39±6.91 $\mu g\,m^{-3}$	36.6
Z.-Y. Meng et al. 2010	(R) Longfengshan, China	2007	Ogawa passive sampler	4.9±4.0 ppbv	4.9
		2008		6.6±5.4 ppbv	6.6
	(R) Shangdianzi, China	2007		2.2±2.3 ppbv	2.2
		2008		3.5±3.5 ppbv	3.5
	(R) Waliguan, China	2007		4.0±3.6 ppbv	4
		2008		4.1±2.2 ppbv	4.1
	(R) Houma, China	2007		13.9±7.7 ppbv	13.9
		2008		13.6±9.5 ppbv	13.6
	(R) Huai'an, China	2007		13.3±9.6 ppbv	13.3
		2008		14.1±8.6 ppbv	14.1
	(R) Linan, China	2007		2.3±2.3 ppbv	2.3
		2008		6.4±6.0 ppbv	6.4
	(R) Kaili, China	2007		6.4±4.4 ppbv	6.4
		2008		18.4±16.1 ppbv	18.4
	(R) Chenzhou, China	2007		4.1±4.8 ppbv	4.1
		2008		6.5±5.9 ppbv	6.5
	(R) Meixian, China	2007		6.2±1.9 ppbv	6.2
		2008		6.8±4.8 ppbv	6.8

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
	(R) Dianbai, China	2007		9.7±9.4 ppbv	9.7
		2008		11.9±8.5 ppbv	11.9
Ianniello et al. 2010	(U) Beijing, China	Winter and Summer 2007	Annular denuder	0.29–63.8 ppbv	32.0
L. Gong et al. 2011	(U) Houston, TX	12 Feb 2010–1 Mar 2010	External cavity quantum cascade laser (EC-QCL)	2.4±1.2 ppbv	2.4
		Aug 2010 yo 25 Sep 2010		3.1±2.9 ppbv	3.1
Z. Y. Meng et al. 2011	(U) Beijing, China	2007.1.23–2.14	Annular denuder	7.21 ± 4.94 ppbv	7.2
		2007.8.2–31		33.46 ± 9.11 ppbv	33.5
Schaap et al. 2011	(R) Netherlands	Aug. 2007 and 2008	MARGA	12.9 ppbv	12.9
Shen et al. 2011	North China Plain	Aug.2006-Jul.2007	Passive Sampler	21.1±10.5 ppbv	21.1
Z. Y. Meng et al. 2011	(U) Beijing, China	Feb 2008–Jul 2010	Ogawa passive sampler	22.8±16.3 ppbv	22.8
	(R) Beijing, China	Jan 2007–Jul 2010		10.2±10.8 ppbv	10.2
Makkonen et al. 2012	(U) Helsinki, Finland	Spring 2010		0.40±0.59 ppbv	0.4
Pandolfi et al. 2012	(U+T) Barcelona, Spain	May–Sep 2011	Online AiRRmonia	2.2±1.0 $\mu g\,m^{-3}$	3.2
	(U) City Center, Barcelona, Spain			5.6±2.1 $\mu g\,m^{-3}$	8.1
J.-S. Kim et al. 2012	(A,U) Gwangju, South Korea	Mar-07	Semi-continuous diffusion scrubber with fluorescent detection	∼3.1±1.2 $\mu g\,m^{-3}$	4.5
		Apr-07		∼2.5±1.5 $\mu g\,m^{-3}$	3.6
		Jul-07		∼2.4±0.7 $\mu g\,m^{-3}$	3.5
		Sep-07		∼1.4±1.0 $\mu g\,m^{-3}$	2.0
Zbieranowski and Aherne 2012	(A) Southern Ontario, Canada	Aug 2007–Apr 2009	Willems badge diffusive passive sampler with Tartaric acid	1.39 $\mu g\,m^{-3}$	2.0
Heald et al. 2012	US: 13 sites	2004, 2009	MAMN URG annular denuder/filter pack	up to 12 $\mu g\,m^{-3}$	4.5
Reche et al. 2012	(U+T) Barcelona, Spain	Jul 2010	Passive sampler (CEH ALPHA) with Phosphorous acid	7.6 $\mu g\,m^{-3}$	10.9
		Jan 2011		4.6 $\mu g\,m^{-3}$	6.6
	(U) Barcelona, Spain	Jul 2010		10.6 $\mu g\,m^{-3}$	15.3
		Jan 2011		3.9 $\mu g\,m^{-3}$	5.6

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
	(R) Barcelona, Spain	Jul 2010		1.9 μg m^{-3}	2.7
Behera et al. 2013	(U) Singapore	Sep.-Nov. 2011		3.6 ppbv	3.6
Longwen Gong et al. 2013	(U) Houston, TX	Aug-10		3.0±2.5	3.0
Hassan et al., 2013	(S) Cairo, Egypt	Summer 2009	Modified Indophenol blue method	18.2–67.2 μg m^{-3}	53.4
X. H. Yao and L. Zhang 2013	(L) Southern Ontario, Canada	Jun 2006–Mar 2007	Ogawa passive sampler and custom passive samplers	3.6–6.1 μg m^{-3}	7.0
	(A) Southern Ontario, Canada			1–3 μg m^{-3}	2.9
	(R) Southern Ontario, Canada			<0.4 μg m^{-3}	0.6
Q. Hu et al. 2014	(U) Toronto, Canada	Jul 2003–Sep 2011	Denuder, passive sampler / IC, Gas Particle IC	0–2.5–14.7 ppbv	2.5
		Summer		3.9 ± 1.6 ppbv	3.9
		Winter		1.1 ± 0.6 ppbv	1.1
Sharma et al. 2014	(U) National Capital Region, India	Jan 2010–Jun 2012 Daytime	Chemiluminescence NH_3-Analyzer (Model: CLD88CYp, M/s. ECO Physics AG, Switzerland)	19.3 ± 1.5 ppbv	19.3
		Jan 2010–Jun 2012 Night-time		21.9 ± 1.8 ppbv	21.9
Li et al. 2014	(R) Boulder, Wyoming	Dec.2006-Dec.2011	Denuder, filter / IC	0.24	0.2
Meng 2014	(R) Linan, China	1 Jan–31 Dec 2010	Ogawa passive sampler	16.5 ± 11.2 ppbv	16.5
Sudheer and Rengarajan 2015	(U) Ahmedabad, India	Jun 5–Jul 4, 2012	AIM–IC, URG 9000D.	10.5 ± 3.5 μg m^{-3}	10.5
		Dec 22, 2011–Jan 16, 2012		11.6 ± 5.0 μg m^{-3}	11.6
Wang et al. 2015	Shanghai, China Urban	Jul 2013 to Sep 2014	DOAS	6.2 ± 4.6 ppbv (1–54.5 ppbv)	6.2
	Shanghai, China Rural	Jul–Dec 2013, Mar–Jun 2014	MARGA	12.4 ± 9.1 ppbv (1-79.4 ppbv)	12.4
	Shanghai, China Industrial	Jan–Jun 2014	DOAS	17.6 ± 9.5 ppbv	17.6
Chang et al. 2016	Shanghai, China	3 Apr 2014–2 Apr 2015	MARGA	5.5 ± 3.9 μg m-3	7.9
		Spring		5.1 ± 3.8 μg m-3	7.3
		Summer		7.3 ± 4.9 μg m-3	10.5
		Autumn		4.5 ± 2.3 μg m-3	6.5

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
		Winter		5.0 ± 3.4 μg m-3	7.2
X. Yao and Leiming Zhang 2016	(R) North America	2006–2015 (Varying)	NAPS, CAPMoN and AMoN	0.3–0.5 ppbv	0.4
	(U) North America	2007–2015 (Varying)		1.6–2.6 ppbv	2.1
	(A) North America	2008–2015 (Varying)		0.8–4.9 ppbv	2.9
Li et al. 2017	14 Sites across Northern Colorado, USA	Summer 2010–2015	Radiello passive samplers + IASI + CMAQ	2.66–42.7 μg m-3	32.7
Zhaoyang Meng et al. 2017	(R) Gucheng, North China Plain	15 May–25 Sep 2013	Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS)	36.2±56.4 ppbv	36.2
		1 May–30 May 2013		∼37.8 ppbv	37.8
		1 Jun–30 Jun 2013		28.4 ppbv	28.4
		1 Jul–31 Jul 2013		73.9 ppbv	73.9
		1 Aug–31 Aug 2013		26.4 ppbv	26.4
		1 Sep–30 Sep 2013		13.5 ppbv	13.5
Teng et al. 2017	(U) Qingdao, China	Mid-Nov–Dec 2015	Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS)	0.3–2.4–10.8 ppbv	2.4
Zanten et al. 2017	Netherlands: 16 Sites	1998–2014	AMORs Continuous flow denuder AMANDA	2–20 $\mu g\,m^{-3}$	15.8
Tang et al. 2018	UK: 85 sites	1998–2014	Integrated Passive + Active	up to 22 $\mu g\,m^{-3}$	31.7
Nair et al. 2019	US: 90 sites	2007–2017	AMoN passive samplers	0–40 ppbv	5.0

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Aircraft Measurements					
Georgii and Müller 1974	Bavaria, Germany	Nov 1969–Sept 1972	Automated Wet Chemical Methods	Upto 20 μg m^{-3}	28.8
LeBel et al. 1985	Coastal Virginaia and Maryland, USA	Mar and Sep 1983	Tungsten Oxide Denuder System	0.1–1 ppbv	1.0
	North Atlantic ocean	Aug 1983		0.5–1.2 ppbv	1.2
Alkezweeny et al. 1986	Kentucky, USA	Summer 1983	Tungsten Oxide Denuder System	0.04–5.6 μg m^{-3}	4.1
Ziereis and Arnold 1986	Federal Republic of Germany	11, 14, and 15 May 1985	Modified Ion Mass Spectrometer	8x10-5–2 ppbv	2.0
Yokelson et al. 1999	North Carolina, USA	Apr 1997	Airborne Fourier Transform Infrared Spectrometer	0.023–0.088 ppm fire	50
Nowak et al. 2007	New York City and Georgia, USA	Jul–Aug 2004	CIMS		
Nowak et al. 2010	Houston, USA	16 Sep–13 Oct 2006	CIMS		
Nowak et al. 2012	California, USA	4 May–20 Jun 2010	CIMS		
Langridge et al. 2012	Los Angeles, USA		CIMS		
Leen et al. 2013	Washington, USA	24–25 May 2012	Mid-infrared off-axis ICOS spectrometer	1.6–103 ppbv	50.0
Schiferl et al. 2014	California, USA	May and Jun 2010	CIMS (CalNex) and GEOS-Chem	Upto 20 ppbv	20.0
Müller et al. 2014	Fresno, California, USA	Jan/Feb 2013	Proton Transfer Reaction Time-Of-Flight Mass Spectrometer	Upto 60 ppbv	60.0
Shephard et al. 2015	Canadian oil sands, Canada	3 and 5 Sep 2013	Dual Quantum Cascade Laser and high-resolution time-of-flight chemical ionization mass spectrometer	1.2±0.2 ppbv	1.2
Sun et al. 2015	California, USA	21, 28, and 30 Jan 2013	Cavity Ring Down Spectrometer And A Proton Transfer Reaction Time-Of-Flight Mass Spectrometer	5–80 ppbv	42.5

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Reference	Location	Period	Instrument	[NH_3]	∼ppbv
Ocean Transects					
Georgii and Gravenhorst 1977	North Sea, English Channel	Oct-73	Unspecified	42–180 nmol m^{-3}	26.7
	Azores			50–170 nmol m^{-3}	26.5
	Tropical Atlantic			11–60 nmol m^{-3}	8.5
	Caribbean			220 nmol m^{-3}	52.9
	Sargasso Sea			110–500 nmol m^{-3}	73.4
Ayers and Gras 1980	Cape Grim			3.5 nmol m^{-3}	0.8
Quinn et al. 1990	Central Pacific			0.67 nmol m^{-3}	0.2
Ottley and Harrison 1992	Southern North Sea			2–88 nmol m^{-3}	10.8
Gibb et al. 1999	Coastal Arabian Sea			3.8 nmol m^{-3}	0.9
	Remote Arabian Sea			1 nmol m^{-3}	0.2
Johnson et al. 2008	Northeast Atlantic	Autumn	Filter pack + FIGD-IC	1.4–8.0 (4.5) nmol m^{-3}	1.1
	Northern North Sea	Winter	Filter pack + OPA	1.4–5.5 (2.9) nmol m^{-3}	0.7
	Norwegian Sea/ Arctic Ocean	Spring–Summer	Filter pack + OPA	1.4–15.9 (7.5) nmol m^{-3}	1.8
	Irminger Basin	Winter	Filter pack + OPA	5.5–25.8 (n = 2) nmol m^{-3}	3.8
Wentworth et al. 2016	Baffin Bay/ Eastern Canadian Arctic Archipelago	13 Jul–7 Aug 2014	AIM-Ion Chromatograph	30–650 ng/m3	0.04–0.87

Table S2: Gas-Aerosol Equilibrium Models used in Chemical Transport Models.

Reference	Model	Species	Temperature Dependence
M. Bassett and Seinfeld 1983	EQUIL	Sulfate, nitrate, ammonium, water	Chemical potentials, solute activity, water activity
M. E. Bassett and Seinfeld 1984	KEQUIL	—"—	Chemical potentials, solute activity, water activity
Saxena et al. 1986	MARS	—"—	Equilibrium constants
Pilinis and Seinfeld 1987	SEQUILIB	—"— + sodium, chloride	Equilibrium constants
Wexler and Seinfeld 1991	AIM	—"—	Chemical potentials, DRHs
Y. P. Kim et al. 1993	SCAPE	—"—	Equilibrium constants, DRHs
Jacobson et al. 1996	EQUISOLV	—"— + bisulfate	Equilibrium constants, DRHs, activity coefficients
Kim and Seinfeld 1995 Zhaoyue Meng et al. 1995	SCAPE2	—"— + potassium, calcium, magnesium, carbonate	Equilibrium constants, DRHs
Binkowski and Shankar 1995	MARS-A	Sulfate, nitrate, ammonium, water	Equilibrium constants
Nenes et al. 1998	ISORROPIA	—"— + sodium, chloride	Equilibrium constants
Clegg et al. 1998	AIM2	—"—	Equilibrium constants, chemical potentials, DRHs, activities, solubilities, and freezing points
Jacobson 1999	EQUISOLV II	—"— + potassium, calcium, magnesium, carbonate	Equilibrium constants, DRHs, activity coefficients
Ansari 1999	GFEMN	—"—	Chemical potentials
Zaveri et al. 2005	MESA	Sulfate, nitrate, ammonium, sodium, chloride, calcium, bisulfate, water	Equilibrium constants
Topping et al. 2005	ADDEM	—"—	Chemical potentials, equilibrium constants, Kelvin effect
Amundson et al. 2006	UHAERO	Sulfate, nitrate, ammonium, sodium, chloride, water	Equilibrium constants
Fountoukis and Nenes 2007	ISORROPIA-II	—"— + potassium, calcium, magnesium	Equilibrium constants
Friese and Ebel 2010	eAIM	Sulfate, nitrate, ammonium, chloride, sodium, water	Equilibrium constants, chemical potentials, DRHs, activities, solubilities, and freezing points

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