

**Table S1: Geographical coordinates of transect sampling sites.**

site	latitude	longitude	elevation (m)	distance to Dalton Highway (m)
transect 1	68.7605° N	148.8659° W	501	730
transect 2	69.0350° N	148.8258° W	400	230
transect 3	69.4212° N	148.6691° W	333	210
transect 4	69.5692° N	148.6049° W	145	560
transect 5	69.6741° N	148.7003° W	118	240
transect 6	69.8324° N	148.7555° W	84	140
transect 7	70.0031° N	148.6804° W	46	250
transect 8	70.1323° N	148.4896° W	21	250

**Table S2: Summary total ( $Hg_{tot}$ ) and dissolved  $Hg$  ( $Hg_{diss}$ ) concentrations in snowpack and surface snow layers on the tundra and lake at Toolik Field Station.**

date	location	height (cm)	$Hg_{tot}$ (ng L <sup>-1</sup> )		$Hg_{diss}$ (ng L <sup>-1</sup> )	
			mean	SD <sup>a</sup>	mean	SD <sup>a</sup>
Oct. 14 <sup>th</sup> 2014	tundra	36	0.22	0.04	0.18	0.00
		25	0.24	0.04	0.14	0.08
		13	0.17	0.18	0.09	0.08
Dec. 7 <sup>th</sup> 2014	tundra	surface	0.21	0.03	<DL <sup>b</sup>	–
		21	0.43	0.55	0.12	0.03
		11	1.06	1.30	0.16	0.06
Dec. 31 <sup>st</sup> 2014	tundra	surface	0.36	0.28	0.17	0.06
		surface	0.27	0.16	0.12	0.05
		50	0.36	–	0.26	–
Jan. 26 <sup>th</sup> 2015	tundra	37	6.23	–	<DL <sup>b</sup>	–
		25	0.46	0.16	0.11	0.11
		10	0.28	0.17	0.08	0.06
	lake	8	0.31	0.06	0.21	0.05
Feb. 20 <sup>th</sup> 2015	tundra	surface	0.18	0.03	0.13	0.02
		48	0.66	0.10	0.15	0.02
		37	0.59	0.36	0.11	0.10
Mar. 8 <sup>th</sup> 2015	tundra	25	0.19	0.03	0.08	0.05
		13	0.29	0.05	<DL <sup>b</sup>	–
	lake	11	0.74	0.02	<DL <sup>b</sup>	–
Apr. 3 <sup>rd</sup> 2015	tundra	surface	–	–	0.24	0.06
		surface	0.87	0.25	0.21	0.04
Apr. 17 <sup>th</sup> 2015	tundra	35	1.03	0.45	0.28	0.01
		25	0.61	0.05	0.31	0.08
		15	1.24	0.41	0.29	0.15
		5	0.91	0.62	0.33	0.22
	lake	11	1.43	0.23	0.09	0.07

<sup>a</sup> standard deviation (n = 2 for snowpack and n = 3 for surface snow)

<sup>b</sup> below detection limit

“–” no data

Table S2: Continued.

date	location	height (cm)	Hg <sub>tot</sub> (ng L <sup>-1</sup> )		Hg <sub>diss</sub> (ng L <sup>-1</sup> )	
			mean	SD <sup>a</sup>	mean	SD <sup>a</sup>
Oct. 19 <sup>th</sup> 2015	tundra	surface	0.32	0.03	0.12	0.07
Nov. 15 <sup>th</sup> 2015	tundra	surface	0.46	0.17	0.26	0.13
Dec. 5 <sup>th</sup> 2015	tundra	surface	0.19	0.01	0.10	0.09
		34	0.32	–	0.12	–
		26	0.78	–	0.23	–
		16	0.43	0.12	0.20	0.04
		8	0.37	0.08	0.27	0.13
Jan. 13 <sup>th</sup> 2016	tundra	surface	0.82	0.54	0.13	0.08
Jan. 29 <sup>th</sup> 2016	tundra	surface	0.38	0.15	0.29	0.02
		35	1.00	–	0.18	–
		25	0.69	0.75	0.16	0.05
		15	0.56	0.18	0.19	0.05
		5	0.64	–	0.17	–
	lake	5	1.63	0.63	0.24	0.06
Feb. 20 <sup>th</sup> 2016	tundra	surface	0.60	0.15	0.24	0.08
Mar. 3 <sup>rd</sup> 2016	tundra	surface	0.41	0.04	0.33	0.05
Mar. 25 <sup>th</sup> 2016	tundra	surface	1.01	0.07	0.49	0.03
		50	0.58	–	0.13	–
		40	0.85	–	0.14	–
		30	0.54	–	0.10	–
		20	0.31	0.06	<DL <sup>b</sup>	–
		10	0.46	0.13	0.19	0.09
	lake	13	0.41	0.16	0.17	0.02
Apr. 2 <sup>nd</sup> 2016	tundra	surface	1.46	0.16	1.15	0.15
Apr. 13 <sup>th</sup> 2016	tundra	surface	0.21	0.03	0.13	0.01
May 1 <sup>st</sup> 2016	tundra	surface	0.66	0.23	0.23	0.08
		33	0.21	0.12	0.12	0.11
		23	1.07	1.20	0.13	0.06
		15	0.43	–	0.13	–
	lake	13	0.24	0.07	0.12	0.11

<sup>a</sup> standard deviation (n = 2 for snowpack and n = 3 for surface snow)

<sup>b</sup> below detection limit

“–” no data

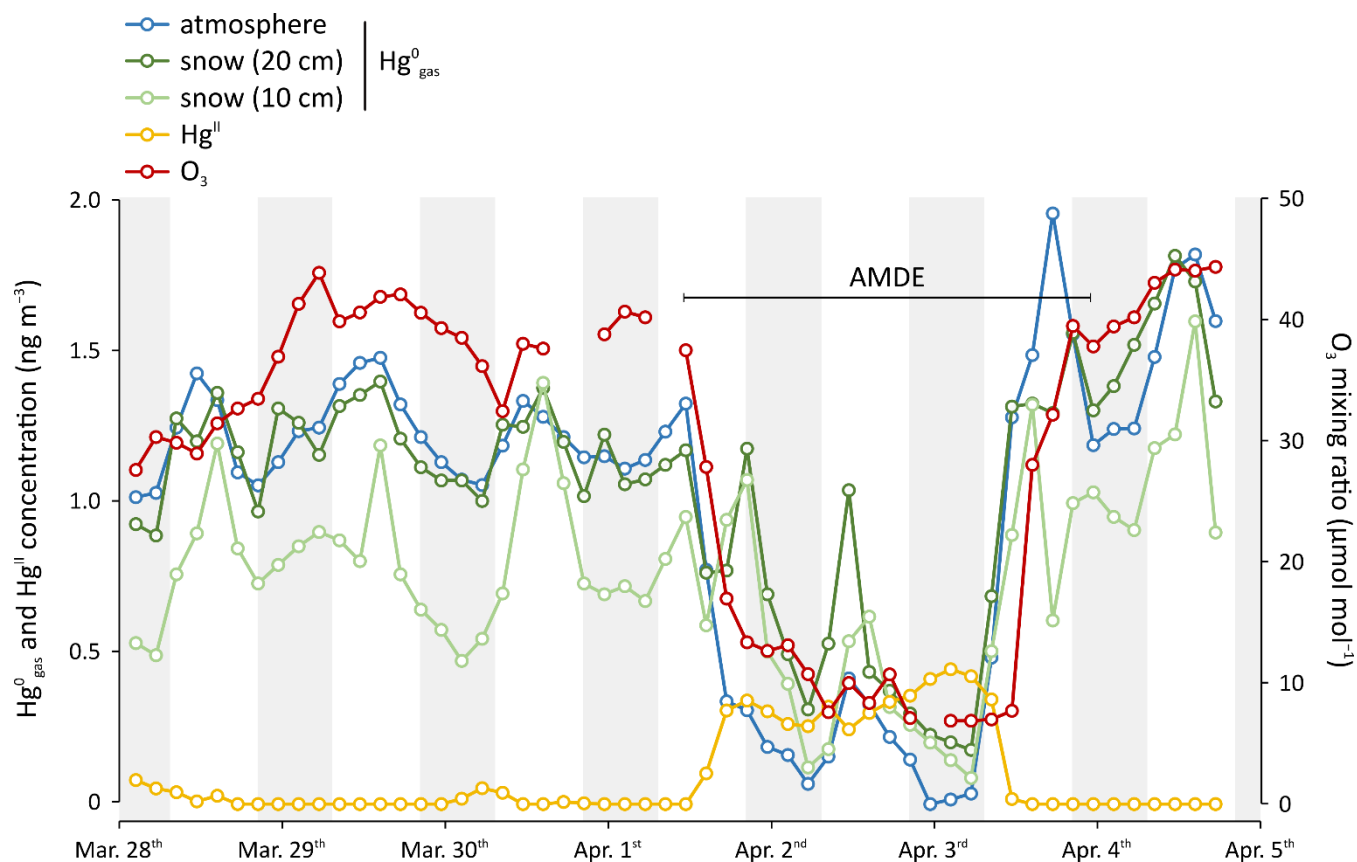
**Table S3: Summary total ( $\text{Hg}_{\text{tot}}$ ) and dissolved Hg ( $\text{Hg}_{\text{diss}}$ ) concentrations in snowpack on the tundra of transect sampling sites.**

site	height (cm)	$\text{Hg}_{\text{tot}}$ (ng L <sup>-1</sup> )	$\text{Hg}_{\text{diss}}$ (ng L <sup>-1</sup> )
transect 1	40	0.22	0.13
	30	0.22	0.11
	20	1.32	0.17
transect 2	33	0.27	0.13
	23	0.15	<DL <sup>a</sup>
	13	1.79	0.28
transect 3	45	0.25	0.13
	35	0.10	<DL <sup>a</sup>
	25	0.18	<DL <sup>a</sup>
	15	0.18	<DL <sup>a</sup>
transect 4	32	0.57	0.38
	22	0.38	0.13
	12	0.34	0.24
transect 5	40	0.60	0.34
	30	0.32	0.23
	20	0.36	0.14
	10	0.92	0.23
transect 6	61	0.86	0.46
	51	1.47	0.86
	41	0.54	0.19
transect 7	29	0.42	0.29
	19	0.78	0.26
transect 8	25	3.79	0.74
	15	0.73	0.20

<sup>a</sup> below detection limit



**Figure S1: Snow tower installation over the arctic tundra at Toolik Field Station.**



**Figure S2:  $\text{Hg}^0_{\text{gas}}$  concentrations (3-hours averages) in the atmosphere and snowpack interstitial air (10 and 20 cm above the ground surface), as well as  $\text{Hg}^{\text{II}}$  and  $\text{O}_3$  atmospheric measurements during a week in spring 2016, including an AMDE, measured at Toolik Field Station. The snow height was between 25 and 28 cm and surface snow  $\text{Hg}_{\text{tot}}$  concentrations between  $1.00 \pm 0.07$  (March 25<sup>th</sup>) and  $1.46 \pm 0.16$   $\text{ng L}^{-1}$  (April 2<sup>nd</sup>). The gray bars indicate nighttime periods.**