

Table S1. Basic Aerosol characteristics for various regions of the troposphere. Unless otherwise specified, results are from the *Hal* simulations.

		SFC			PBL			FT		
		Med.	Min	Max	Med.	Min	Max	Med.	Min	Max
GMD nm; Dry	Fine	48.2	20.3	52.8	47.6	21.5	52.8	32.1	25.1	40.9
	Accum	1.1x10 ²	78.8	3.7x10 ²	1.1x10 ²	82.5	3.3x10 ²	1.1x10 ²	89.1	2.0x10 ²
	Coarse	1.0x10 ³	1.0x10 ³	3.8x10 ³	1.0x10 ³	1.0x10 ³	3.4x10 ³	1.1x10 ³	1.0x10 ³	1.4x10 ³
GMD nm; Wet	Fine	70.9	23.7	92.4	74.2	25.0	95.6	38.3	27.8	55.3
	Accum	1.6x10 ²	83.3	4.4x10 ²	1.6x10 ²	90.7	4.2x10 ²	1.3x10 ²	9.7x10 ¹	2.7x10 ²
	Coarse	1.8x10 ³	1.3x10 ³	4.0x10 ³	2.0x10 ³	1.3x10 ³	3.5x10 ³	1.4x10 ³	1.1x10 ³	1.6x10 ³
pH	Fine	1.10	-0.79	3.07	1.00	-0.70	3.08	-0.36	-0.79	0.00
	Accum	1.34	-0.55	4.26	1.17	-0.53	4.14	-0.20	-0.46	0.22
	Coarse	2.81	0.19	5.28	2.69	0.19	5.58	0.26	-0.21	0.83
Na+ nmol m ⁻³	Fine	1.0x10 ⁻⁴	0.0	2.7x10 ⁻³	1.0x10 ⁻⁴	0.0	1.9x10 ⁻³	0.0	0.0	1.0x10 ⁻⁴
	Accum	2.9	0.2	19.7	2.3	0.2	14.2	0.3	0.1	1.0
	Coarse	90.3	2.4	7.0x10 ²	67.1	2.5	4.8x10 ²	6.6	1.2	21.1
Log(EFBr)	Bulk	93.2	2.6	7.2x10 ²	69.5	2.7	4.9x10 ²	6.9	1.3	22.1
	Fine	5.2	3.6	7.5	5.3	3.8	7.6	6.2	5.6	7.4
	Accum	1.1	-0.8	2.4	1.1	-0.5	2.3	1.7	1.5	2.0
Log(EFCI)	Coarse	-0.8	-2.1	0.0	-0.7	-2.1	0.0	-0.4	-0.7	0.0
	Fine	4.6	3.0	7.0	4.6	3.3	7.0	5.1	4.5	6.3
	Accum	1.4	-0.2	1.6	1.4	0.3	1.6	1.4	1.2	1.5
NSS-SO ₄ nmol m ⁻³	Coarse	-0.6	-2.4	-0.1	-0.6	-2.3	-0.2	-0.5	-0.8	-0.4
	Fine	0.47	0.04	31.2	0.55	0.05	20.9	0.19	0.08	1.7
	Accum	4.7	0.44	120	4.1	0.49	91.3	1.4	0.44	8.8
NoHal NSS-SO ₄ nmol m ⁻³	Coarse	0.23	0.02	17.8	0.20	0.02	13.2	0.04	0.01	0.43
	Bulk	5.5	0.51	134	4.9	0.57	104	1.8	0.53	10.3
	Fine	0.48	0.070	29.3	0.53	0.073	19.8	0.20	0.084	1.8
NoHal NSS-SO ₄ nmol m ⁻³	Accum	5.3	0.60	134	4.7	0.68	101	1.5	0.52	9.7
	Coarse	0.22	0.010	16.3	0.20	0.011	10.3	0.037	0.0056	0.43
	Bulk	6.1	0.68	149	5.5	0.78	109	1.8	0.62	11.5

Table S2. Aerosol composition for various regions of the atmosphere. Unless otherwise specified, results are from the *Hal* simulations. Double dashes indicate a value is undefined.

		NH CBL			SH CBL			NH MBL			SH MBL		
		Med.	Min	Max	Med.	Min	Max	Med.	Min	Max	Med.	Min	Max
GMD nm; Dry	Fine	35.3	26.0	43.2	38.6	0.1	52.7	46.2	0.1	52.7	44.8	0.0	52.8
	Accum.	1.1x10 ²	88.7	2.1x10 ²	1.0x10 ²	0.1	3.7x10 ²	94.9	0.1	2.3x10 ²	1.1x10 ²	0.0	2.2x10 ²
	Coarse	1.1x10 ³	1.0x10 ³	1.8x10 ³	1.0x10 ³	1.1	3.82x10 ³	1.0x10 ³	1.1	3.2x10 ³	1.0x10 ³	0.0	1.8x10 ³
GMD nm; Wet	Fine	45.7	29.2	61.3	53.2	0.1	79.9	58.1	0.1	81.2	62.9	0.0	91.3
	Accum.	1.3x10 ²	98.8	3.0x10 ²	1.3x10 ²	0.2	3.8x10 ²	1.2x10 ²	0.2	2.4x10 ²	1.4x10 ²	0.0	2.9x10 ²
	Coarse	1.5x10 ³	1.2x10 ³	1.9x10 ³	1.7x10 ³	2.6	4.0x10 ³	1.6x10 ³	2.1	3.4x10 ³	1.6x10 ³	0.0	2.3x10 ³
pH	Fine	-0.08	-0.71	0.54	0.09	-0.79	2.35	0.04	-0.61	2.27	0.77	-0.44	2.34
	Accum.	0.08	-0.40	1.03	0.26	-0.55	2.23	0.51	-0.08	2.25	1.09	0.0	2.79
	Coarse	0.80	-0.11	1.70	1.21	0.0	4.44	1.55	0.0	4.43	2.01	0.0	4.33
Na+ nmol m ⁻³	Fine	0.0	0.0	5.0x10 ⁻⁴	1.x10 ⁻⁴	0.0	1.4x10 ⁻³	0.0	0.0	1.1x10 ⁻³	0	0.0	2.6x10 ⁻³
	Accum.	0.8	0.1	3.7	0.67	0.0	4.9	1.0	0.0	7.1	2.8	0.0	11.56
	Coarse	19.3	1.5	1.2x10 ²	13.5	0.03	1.5x10 ²	22.7	0.1	1.9x10 ²	91	0.0	4.7x10 ²
Log(EFBr)	Bulk	20.1	1.6	1.2x10 ²	14.1	0.03	1.6x10 ²	23.8	0.1	2.0x10 ²	94	0.0	4.8x10 ²
	Fine	6.1	5.5	7.4	5.2	1.4	7.5	4.6	1.5	7.3	4.7	-1.0	7.3
	Accum.	1.6	1.4	2.1	1.2	-2.9	2.2	1.6	-2.0	2.4	0.1	--	1.7
Log(EFCl)	Coarse	-0.5	-0.8	-0.1	-0.8	--	-0.1	-0.6	-3.7	0.0	-1.6	--	-0.2
	Fine	5.1	4.4	6.5	4.5	1.2	6.8	3.8	0.9	6.5	4.7	-1.7	6.9
	Accum.	1.4	1.2	1.5	1.1	-1.9	1.6	1.5	-1.5	1.6	1.2	--	1.6
NSS-SO ₄ nmol m ⁻³	Coarse	-0.5	-0.9	-0.4	-0.8	-3.5	-0.3	-0.7	-3.5	-0.3	-0.6	--	-0.1
	Fine	0.29	0.08	5.30	1.36	0.0	15.41	0.09	0.0	21.43	0.76	0.0	31.19
	Accum.	2.0	0.46	24.3	8.2	0.0	120.2	0.65	0.0	60.9	6.5	0.0	75.7
NoHal NSS-SO ₄ nmol m ⁻³	Coarse	0.07	0.01	3.12	0.39	0.0	14.3	0.02	0.0	2.5	0.35	0.0	16.5
	Bulk	2.4	0.55	28.0	10.0	0.0	133.7	0.77	0.0	65.5	7.8	0.0	104.9
	Fine	0.31	0.084	5.6	1.2	4x10 ⁻³	15.2	0.14	3x10 ⁻³	22.6	0.72	0.0	29.3
NSS-SO ₄ nmol m ⁻³	Accum.	2.1	0.56	27.2	7.7	1.2x10 ⁻²	134	0.79	1.5x10 ⁻²	69.0	6.6	0.0	80.1
	Coarse	0.07	7x10 ⁻²	2.3	0.34	0	12.3	0.015	0	2.8	0.32	0.0	16.3
	Bulk	2.5	0.66	29.3	9.5	1.6x10 ⁻²	149	0.95	1.8x10 ⁻²	76.0	7.8	0.0	90.6

Table S3. Simulated mixing ratios for various gases across specified regions of the atmosphere from the *Hal* simulation. Units are in pmol mol⁻¹ unless specified otherwise.

	Surface			PBL			FT		
	Median	Min	Max	Median	Min	Max	Median	Min	Max
O ₃ (nmol mol ⁻¹)	11.0	0.99	52.0	13.0	0.99	59.0	46.0	1.9	6.0x10 ²
OH	6.5x10 ⁻³	2.0x10 ⁻⁴	0.094	0.0071	2.0x10 ⁻⁴	0.11	0.027	4.0x10 ⁻⁴	0.14
HO ₂	2.0	0.17	10.0	2.3	0.17	12.0	2.9	0.53	13
CH ₃ O ₂	1.2	0.08	8.3	1.5	0.08	8.3	0.57	0.049	5.7
NO	3.0	0.11	1.1x10 ⁴	2.5	0.079	1.1x10 ⁴	10.0	0.29	1.1x10 ²
NO ₂	23.0	0.20	1.4x10 ⁴	18.0	0.2	1.4x10 ⁴	20.0	0.22	4.6x10 ²
PAN	22.0	0.13	5.8x10 ²	22.0	0.065	5.8x10 ²	1.5x10 ²	2.1	5.7x10 ²
Br	0.2	2.0x10 ⁻⁴	2.6	0.23	2.0x10 ⁻⁴	3.1	0.033	2.0x10 ⁻⁴	1.9
Br ₂	3.3	0.059	10.0	3.3	0.026	10.0	0.2	0.0	7.2
BrO	1.4	0.0026	6.1	1.6	0.0026	6.3	0.23	8.0x10 ⁻⁴	4.3
BrCl	3.2	0.004	16.0	3.6	0.004	16.0	0.046	0.0	10
BrNO ₂	0.02	1.0x10 ⁻⁴	3.3	0.019	0.0	3.3	0.0058	0.0	1.2
BrNO ₃	0.89	0.018	9.1	0.74	0.018	9.1	0.23	6.0x10 ⁻⁴	5.7
HBr	1.6	0.091	13.0	1.6.0	0.085	13.0	0.71	0.022	11.0
HOBr	0.54	0.011	3.8	0.68	0.011	3.8	0.29	0.0021	2.9
Br _t	18.0	0.98	43.0	19.0	0.98	44.0	2.5	0.038	32.0
Cl (cm ⁻³)	6.4x10 ³	22	8.4x10 ⁴	7.3x10 ³	22	8.6x10 ⁴	170	0.7	4.5x10 ⁴
Cl ₂	1.5	0.0001	35.0	1.8	1.00x10 ⁻⁴	60.0	0.045	0.0	28.0
ClO	0.14	0.0011	6.0	0.27	0.0011	7.2	0.025	0.0	10.0
ClNO ₂	0.38	1.0x10 ⁻⁴	3.7x10 ²	0.29	1.0x10 ⁻⁴	3.7x10 ²	0.024	0.0	67.0
ClNO ₃	0.16	1.0x10 ⁻⁴	7.8	0.18	1.0x10 ⁻⁴	7.8	0.16	1.0x10 ⁻⁴	5.3
HCl	2.0x10 ²	0.47	2.5x10 ³	1.8x10 ²	0.47	2.6x10 ³	5.4	3.6x10 ⁻²	1.7x10 ³
HOCl	0.4	6.0x10 ⁻⁴	37.0	0.63	5.0x10 ⁻⁴	37.0	0.05	1.0x10 ⁻⁴	19.0
Cl*	22.0	0.029	4.1x10 ²	21.0	0.029	4.1x10 ²	0.56	4.0x10 ⁻⁴	1.0x10 ²
SO ₂	29.0	0.32	1.3x10 ⁵	26	0.09	1.3x10 ⁵	3.3	0.38	1.0x10 ⁴
DMS	32	3.1x10 ⁻³	6.8x10 ²	14	2.0x10 ⁻³	6.8x10 ²	0.13	1.3x10 ⁻⁷	59

Table S4. Simulated mixing ratios for various gases across specified regions of the atmosphere from the *Hal* simulation. Units are in pmol mol⁻¹ unless specified otherwise.

	NH CBL			SH CBL			NH MBL			SH MBL		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
O ₃ (nmol mol ⁻¹)	15.0	0.011	48.0	3.8	0.0063	35.0	14.0	0.0	47.0	4.0	0.0	36
OH	0.01	0.0	0.09	8.0x10 ⁻⁴	0.0	0.052	0.011	0.0	0.077	0.0022	0.0	0.048
HO ₂	2.1	0.0011	9.7	0.73	0.0014	10.0	2.2	0.0	8.9	1.1	0.0	8.3
CH ₃ O ₂	0.75	0.0007	7.0	0.17	0.0004	6.9	2.2	0.0	8.3	1.3	0.0	7.2
NO	35.0	0.0053	1.0x10 ⁴	1.2	0.0024	1.2x10 ³	3.0	0.0	3.6x10 ³	0.74	0.0	2.9x10 ²
NO ₂	2.9x10 ²	0.031	1.4x10 ⁴	0.47	0.0013	5.3x10 ³	33.0	0.0	7.8x10 ³	3.4	0.0	1.4x10 ³
PAN	1.3x10 ²	0.025	5.8x10 ²	22.0	0.013	3.7x10 ²	15.0	1.0x10 ⁻⁴	3.7x10 ²	8.0	0.0	2.1x10 ²
Br	0.036	1.0x10 ⁻⁴	0.8	0.075	1.0x10 ⁻⁴	1.0	0.083	0.0	0.78	0.4	0.0	2.6
Br ₂	1.6	0.002	8.1	3.0	0.0032	5.1	2.0	0.0	10.0	3.4	0.0	8.0
BrO	0.18	8.0x10 ⁻⁴	3.4	0.61	0.0011	2.4	0.91	0.0	4.7	2.3	0.0	6.1
BrCl	2.9	0.0049	11.0	0.017	1.0x10 ⁻⁴	6.7	5.5	0.0	16	1.3	0.0	11.0
BrNO ₂	0.28	0.0	3.2	0.0032	0.0	2.6	0.026	0.0	3.2	0.0026	0.0	1.3
BrNO ₃	3.0	0.0016	7.9	0.034	1.0x10 ⁻⁴	4.1	1.2	0.0	9.1	0.36	0.0	5.0
HBr	1.6	5.0x10 ⁻⁴	13.0	0.24	3.0x10 ⁻⁴	4.9	1.4	0.0	6.7	1.7	0.0	5.2
HOBr	0.27	4.0x10 ⁻⁴	2.3	0.18	3.0x10 ⁻⁴	1.0	0.75	0.0	3.8	0.91	0.0	3.7
Br _t	13	0.021	35.0	7.9	0.016	19.0	17.0	0.0	43.0	18.0	0.0	34
Cl (cm ⁻³)	6.1x10 ³	3.7	3.4x10 ⁴	120	0.43	1.6x10 ⁴	1.3x10 ⁴	0.0029	8.4x10 ⁴	5.1x10 ³	0.0	5.5x10 ⁴
Cl ₂	2.7	0.002	19.0	0.002	0.0	17.0	3.9	0.0	35.0	0.23	0.0	35.0
ClO	0.086	2.0x10 ⁻⁴	1.9	0.0059	0.0	1.0	0.44	0.0	6.0	0.11	0.0	4.2
ClNO ₂	27.0	6.0x10 ⁻⁴	3.0x10 ²	0.051	1.0x10 ⁻⁴	2.5x10 ²	2.7	0.0	2.9x10 ²	0.024	0.0	79.0
ClNO ₃	0.9	4.0x10 ⁻⁴	6.1	0.0027	0.0	2.1	0.27	0.0	7.8	0.019	0.0	1.2
HCl	140	0.018	1.8x10 ³	5.6	0.014	1.3x10 ³	430	0.0	2.5x10 ³	1.5x10 ²	0.0	1.8x10 ³
HOCl	0.58	1.0x10 ⁻⁴	17.0	0.0065	0.0	8.0	0.73	0.0	37.0	0.18	0.0	33.0
Cl*	39.0	0.055	3.3x10 ²	0.085	2.0x10 ⁻⁴	2.7x10 ²	27.0	0.0	3.4x10 ²	2.8	0.0	1.1x10 ²
SO ₂	1.3x10 ²	0.047	4.6x10 ⁴	3.4	5.2x10 ⁻³	1.3x10 ⁵	28	0.0	3.6x10 ⁴	12	0.0	6.5x10 ⁴
DMS	1.2	1.8x10 ⁻⁴	71	16	1.6x10 ⁻²	2.2x10 ²	18	0.0	3.0x10 ²	69	0.0	5.1x10 ²

Table S5. Simulated mixing ratios for various gases across specified regions of the atmosphere from the *NoHal* simulation. Units are in pmol mol⁻¹ unless specified otherwise.

	Surface			PBL			FT		
	Median	Min	Max	Median	Min	Max	Median	Min	Max
O ₃ (nmol mol ⁻¹)	34.0	18.0	64.0	37.0	18.0	69.0	67.0	27.0	5.9x10 ²
OH	0.01	0.001	0.10	0.012	0.001	0.11	0.034	0.002	0.16
HO ₂	2.3	0.19	11.0	2.8	0.19	12.0	2.7	0.44	13.0
CH ₃ O ₂	2.0	0.14	9.2	2.0	0.14	9.2	0.53	0.043	6.5
NO	3.8	0.42	6.0x10 ³	3.8	0.39	6.0x10 ³	12.0	0.72	92.0
NO ₂	30.0	0.98	1.7x10 ⁴	25.0	0.98	1.7x10 ⁴	24.0	1.4	4.0x10 ²
PAN	45.0	0.21	6.7x10 ²	45.0	0.16	6.7x10 ²	1.8x10 ²	2.3	6.5x10 ²
SO ₂	31	0.35	1.3x10 ⁵	28	0.12	1.3x10 ⁵	3.6	0.31	9.6x10 ³
DMS	1.1x10 ²	6.1x10 ⁻²	1.1x10 ³	55	2.9x10 ⁻³	1.1x10 ³	1.2	0.0	1.1x10 ³

Table S6. Simulated mixing ratios for various gases across specified regions of the atmosphere from the *NoHal* simulation. Units are in pmol mol⁻¹ unless specified otherwise

	NH CBL			SH CBL			NH MBL			SH MBL		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
O ₃ (nmol mol ⁻¹)	37	0.43	64	30	0.35	41	36	0.0	59	28	0	48
OH	0.98	0.0	0.94	0.22	0.0	0.51	0.17	0.0	0.83	0.8	0.0	0.56
HO ₂	2.1	0.14	9.8	1.0	0.21	11	2.0	0.0	8.9	2.3	0.0	8.3
CH ₃ O ₂	0.83	6.x10 ⁻⁴	8.0	0.41	0.11	8.4	2.3	0.0	9.2	2.9	0.0	8.4
NO	22	0.42	6.x10 ³	0.96	0.18	540	4.2	0.0	1.7x10 ³	1.5	0.0	140
NO ₂	2.6x10 ²	0.35	1.6x10 ⁴	1.6	0.39	5.2x10 ³	53	0.0	8.x10 ³	14	0.0	1.4x10 ³
PAN	2.0x10 ²	0.55	6.7x10 ²	45	0.26	3.9x10 ²	30	2.x10 ⁻⁴	4.5x10 ²	20	0.0	2.3x10 ²
SO ₂	1.4x10 ²	0.046	4.6x10 ⁴	3.8	5.2x10 ⁻²	1.3x10 ⁵	28	0.0	3.8x10 ⁴	13	0.0	6.2x10 ⁴
DMS	2.2	3.0x10 ⁻⁴	1.0x10 ²	1.7x10 ²	0.02	5.2x10 ²	28	0.0	3.5x10 ²	2.0x10 ²	0.0	9.3x10 ²

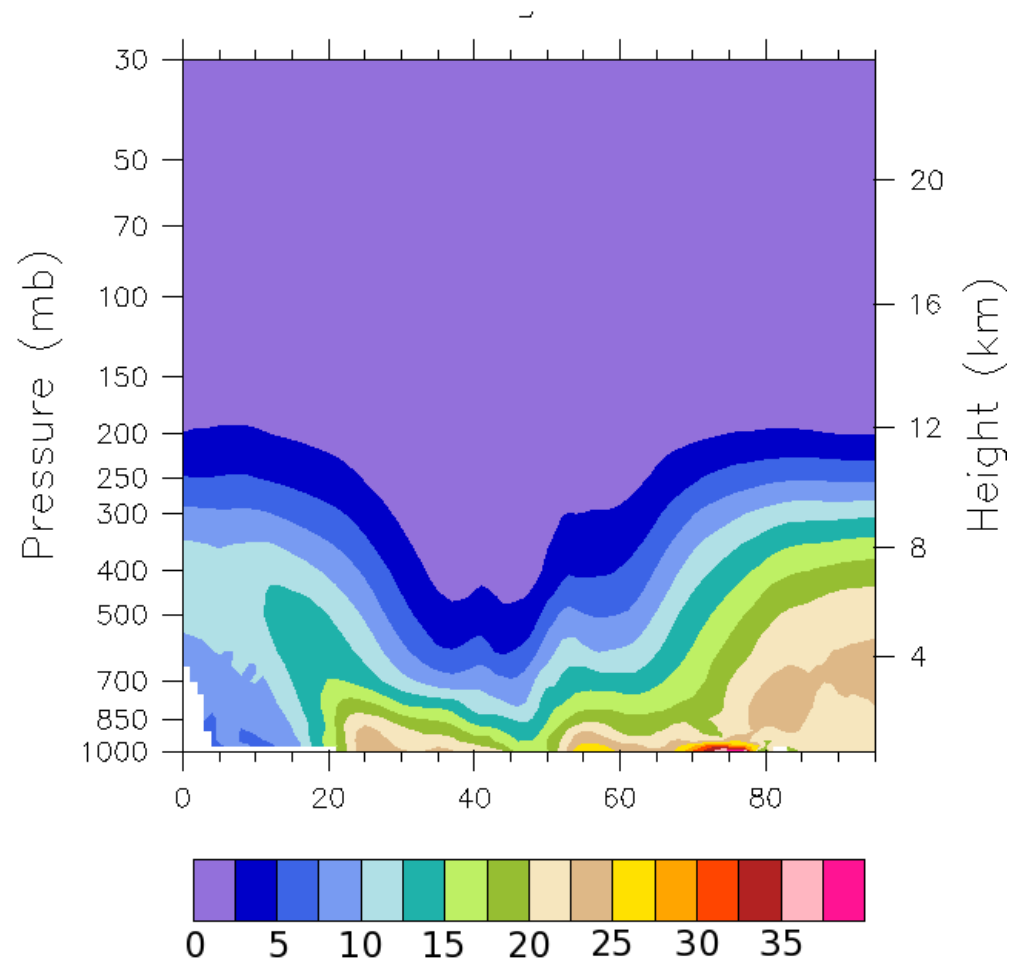


Figure S1. ANN zonal-median Br_t (pmol mol⁻¹).

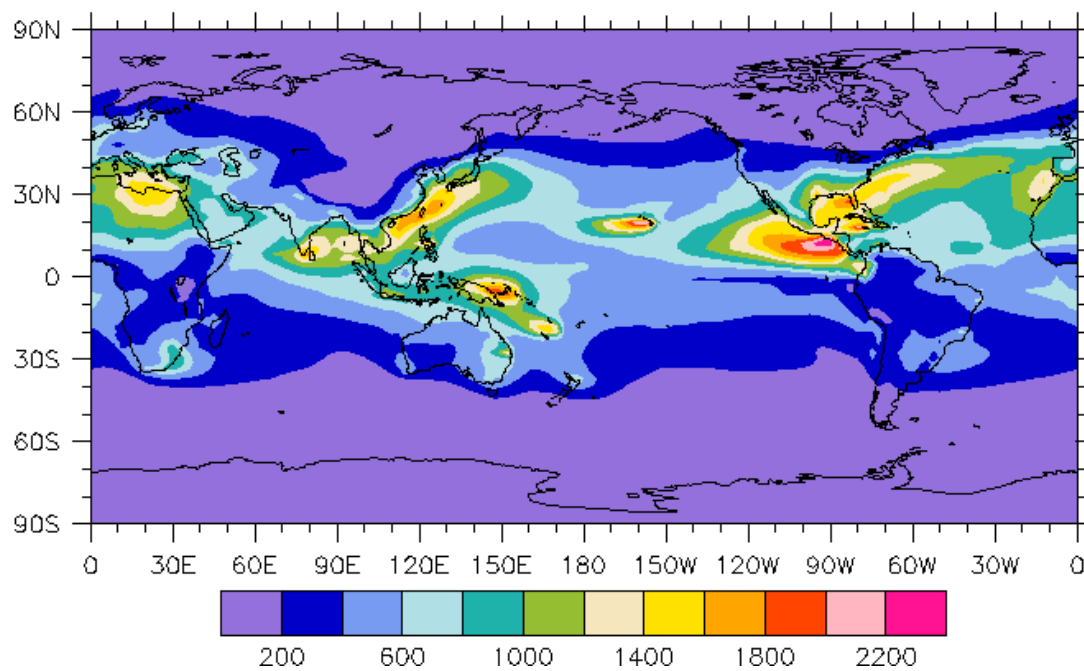


Figure S2. ANN HCl (pmol mol^{-1}) for the PBL.

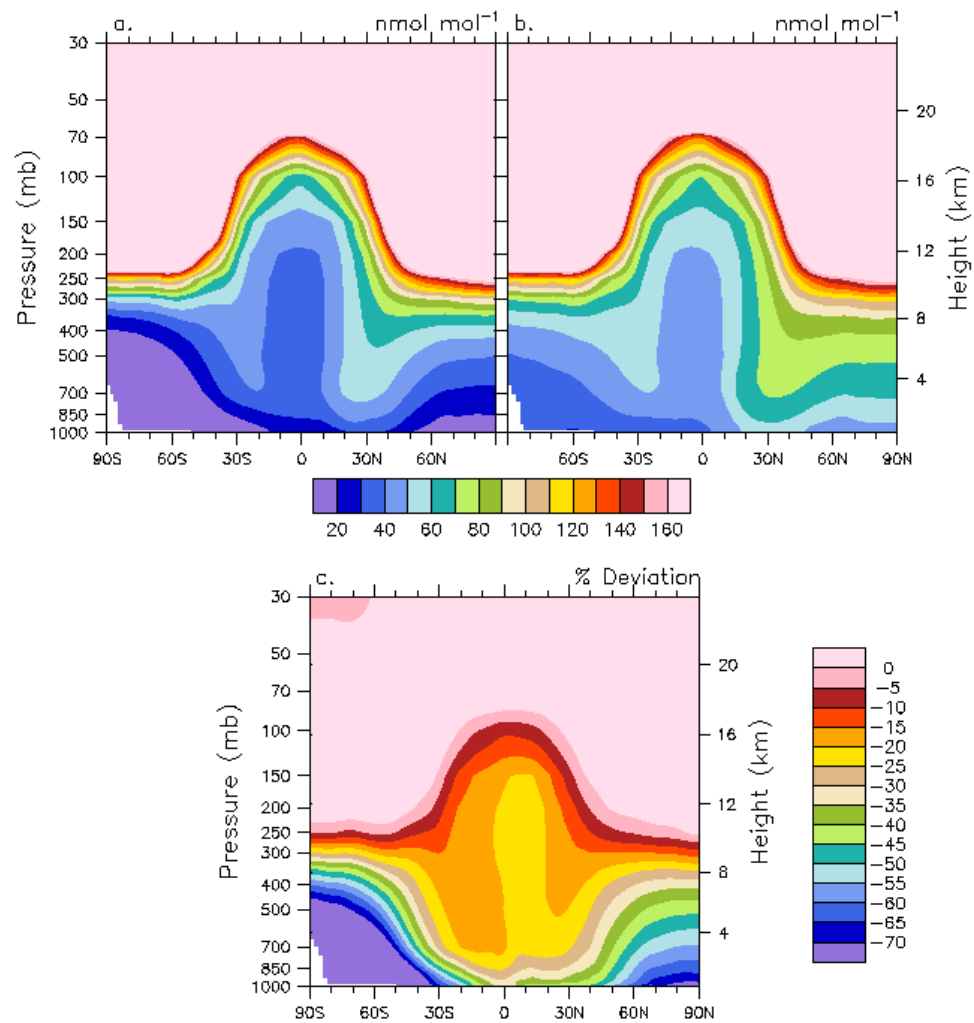


Figure S3. Zonal-median ANN O₃ (nmol mol⁻¹) for (a) *Hal*, (b) *NoHal*, and (c) *Hal* versus *NoHal* percent deviation. .