Very Short-Lived Halocarbons into CAM-Chem

Don Wuebbles

Department of Atmospheric Sciences
University of Illinois
Urbana, Illinois 61801

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Halogens and Tropospheric Chemistry

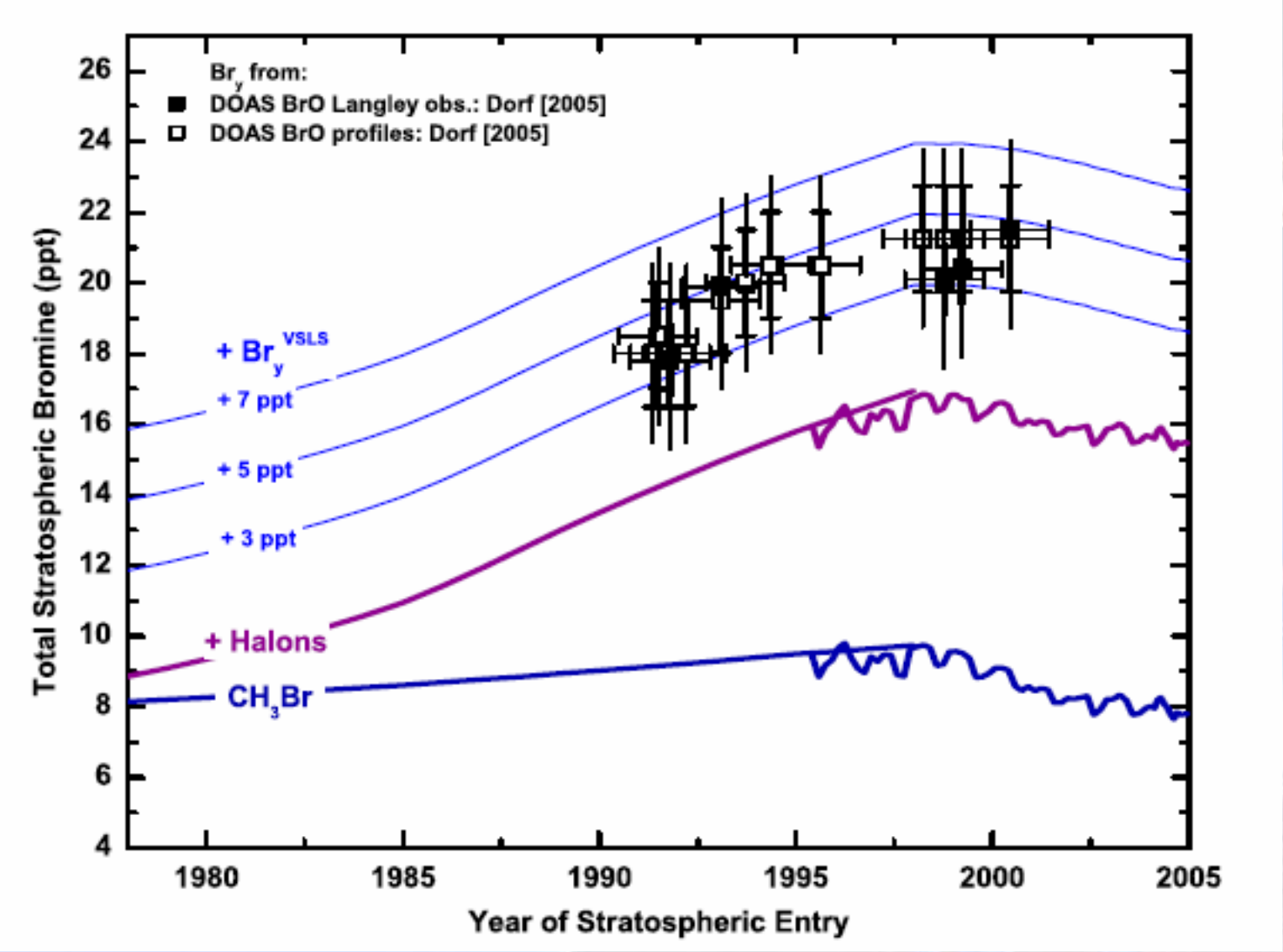
Boundary Layer

- Effects on ozone (above snow, over salt lakes)
- Br, Cl interactions over marine areas
- Effects on DMS chemistry (von Glasow, 2004)

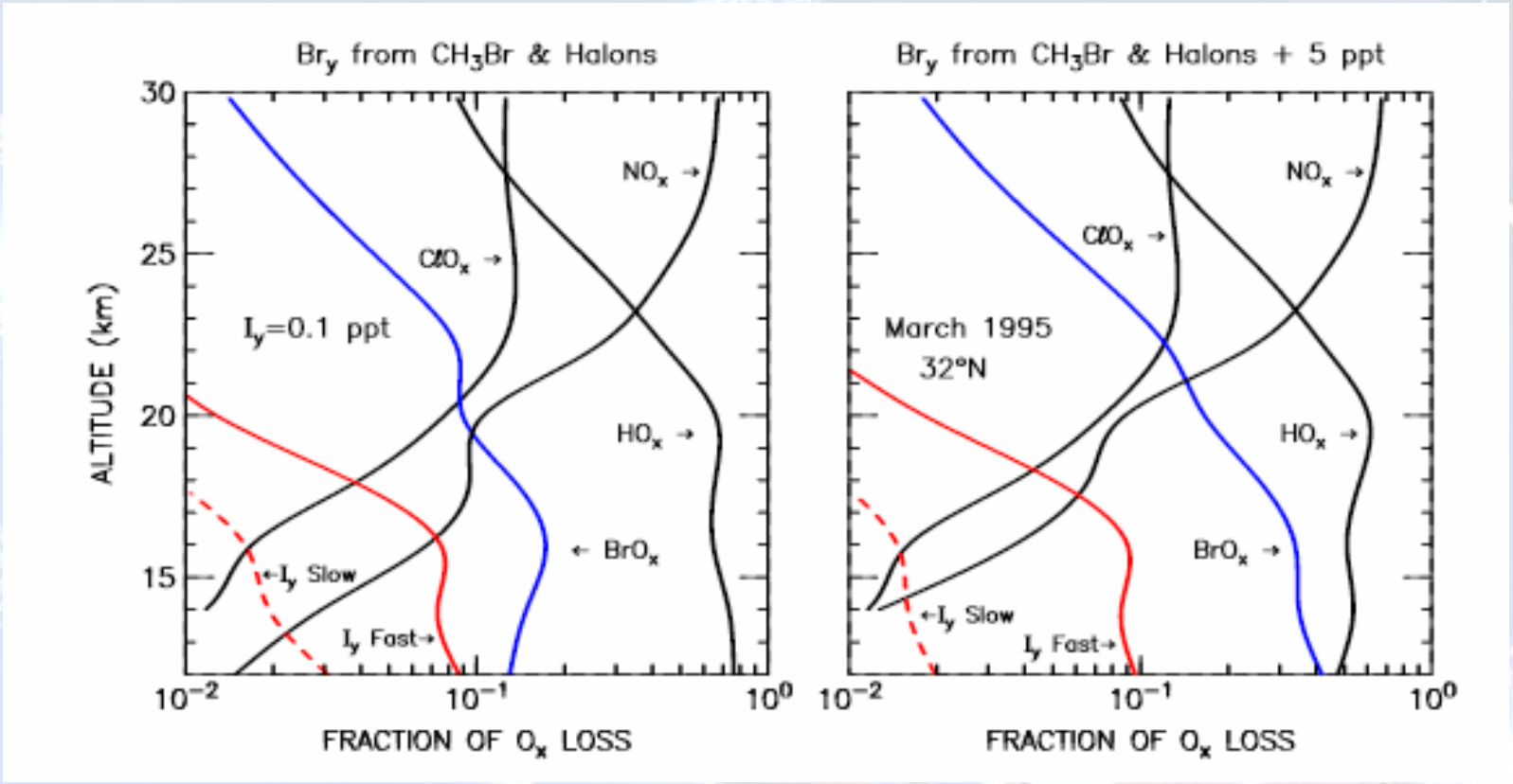
Free Troposphere

- Cl is ~10% initiation of methane oxidation
- BrONO2 important to HNO3 production in lower troposphere (as much as 30%)
- Partitioning of OH and Ho2
- Partitioning of NO and NO2

VSL Halocarbons & Stratospheric Br_y



VSL Halocarbons Affect Stratospheric O_x



VSL Halocarbons Affect Troposphere and Stratospheric Chemistry

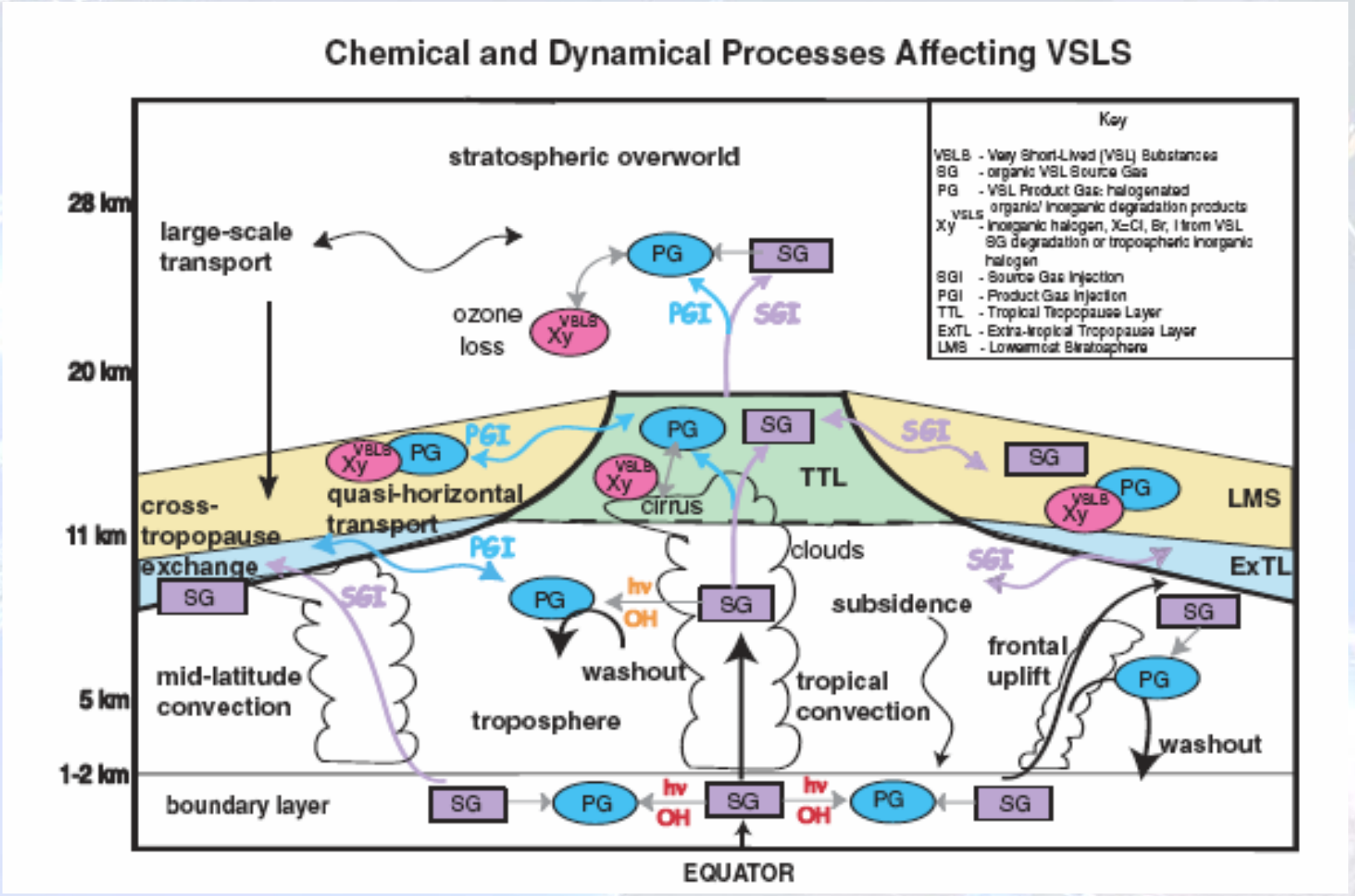


Table 2-3. Estimated local lifetimes, burdens, removal rates, and sources for some halogenated VSLS. New information since WMO (2003) is indicated in boldface.

Compound	Local Lifetime (days)	Estimated Burden (Gg)	Estimated Removal Rate (Gg yr^{-1})	Estimated Source from Inventory or Estimate of Biogeochemical Cycle (Gg yr^{-1})
CH_2BrCl	150[a]	1.2 (Br), 0.5 (Cl)[l]	2.9 (Br), 1.3 (Cl)[c]	
CH_2Br_2	120[a]	18-22 (Br)[b]	55-67 (Br)[c]	
		19 (Br)[l]	58 (Br)[f]	
$CHBrCl_2$	78[a]	1.3-1.5 (Br)[b]	6.1-7.0 (Br)[f]	**17 (Cl) open ocean[15,h]**
		1.2-1.3 (Cl)	5.4-6.2 (Cl)	**19 (Br) open ocean[15,h]**
		1.2 (Br), 1.1 (Cl)[l]	5.5 (Br), 4.9 (Cl)[c]	
$CHBr_2Cl$	69[a]	0.8-2.2 (Br), 0.2-0.5 (Cl)[b]	4.2-12 (Br), 0.9-2.7 (Cl)[f]	**5 (Cl) open ocean[15,h]** **23 (Br) open ocean[15,h]**
		2.3 (Br), 0.5 (Cl)[l]	12 (Br), 2.7 (Cl)[f]	
$CHBr_3$	26[a]	11-18 (Br)[b]	150-250 (Br)[c]	209 (47-370) (Br)[3]
		14 (Br)[l]	200 (Br)[c]	**800 (240-1760) (Br)[9]**
			285[2, d]	**28 (20-112) (Br) industry[9]**
CH_3I	5[e]	1.7-2.2 (I)[b]	120-160 (I)[f]	90-450 (I)[4]
	6[f]	4.8 (I)[f]	214 (I)[f]	**272 (I) total[10]**
				191 (I) net ocean (incl. 66 anthropogenic)[10]
				180 (I) open ocean[15,h]
C_2H_5I	4[a]	0.5 (I)	46 (I)[c]	
CH_2ClI	**0.1[a]**			**95 (I) open ocean[15,h]**
				27 (Cl) open ocean[15,h]
CH_2Cl_2	140[a]	83-250 (Cl)[b]	220-650 (Cl)[f]	487 (Cl) industrial[5]
	180[6, e]	250 (Cl)[6]	650 (Cl)[f]	160 (Cl) ocean
			500 (Cl)[6,d]	49 (Cl) biomass burning[16,i]
$CHCl_3$	150[a]	66-130 (Cl)[b]	160-320 (Cl)[f]	564 (Cl)[6]
	183[7,e]	210 (Cl)[7]	511 (Cl)[c]	**588 (392-784) (Cl)[11]**
			470 (350-600)[7,e]	**320 (240-400) (Cl) seawater[11]**
			412 (Cl)[6,d]	**196 (107-285) (Cl) soil[11]**
C_2HCl_3	4.6[a]	3.1 (Cl)[b]	260 (Cl)[c]	95 (Cl) industry[5]
	5.5[6,e]	5.30 (Cl)[6]	440 (Cl)[f]	20 (Cl) ocean[6]
			350 (Cl)[6,e]	3 (Cl) fossil fuel[6]
C_2Cl_4	99[a]	17-85 (Cl)[b]	63-310 (Cl)[c]	313 (Cl) industry[5]
	133[6,e]	160 (Cl)[6]	590 (Cl)[f]	16 (Cl) ocean[6]
			440 (Cl)[6,e]	2 (Cl) fossil fuel[6]
				222 (210-235) (Cl)[12,g]
C_2H_5Cl	**~30[13]**	**14 (Cl)[13]**	**165 (Cl)[c]**	
	~24[14]	**4.6-7.3 (Cl)[14]**	**70-110 (Cl)[c]**	
CH_2ClCH_2Cl	70[a]	5-26 (Cl)[b]	26-130 (Cl)[c]	700[8]

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Table 2-2. Reported mixing ratios of VSL source gases in the troposphere (global and hemispheric values), at 10 km in the tropics, and best estimates from this Assessment of median mixing ratios in the tropical marine boundary layer [MBL] (<1 km), and tropical upper troposphere [UT]. All mixing ratio values are in parts per trillion (ppt). New information since WMO (2003) is indicated in boldface.

Species	Reported Tropospheric Mixing Ratio [a]	Reported 10-km Tropical Mixing Ratio [a]	Estimated Tropical [MBL] Mixing Ratio and Range	Estimated Tropical [UT] Mixing Ratio and Range	Estimated Ratio of Tropical [UT]/[MBL]
CH_2BrCl			**0.47 (0.38-0.59)[c]**	**0.32 (0.26-0.35)[c]**	**0.7**
CH_2Br_2	0.8-3.4	0.6-0.9	**1.1 (0.7-1.5)[b,c,f]**	**0.9 (0.7-1.0)[b,c,e]**	**0.8**
$CHBr_2Cl$	0.1-0.5	0.04-0.11	**0.30 (0.06-0.76)[b,g,i]**	**0.08 (0.03-0.12)[b,c]**	**0.3**
$CHBrCl_2$	0.12-0.6	0.04-0.11	**0.33 (0.14-0.91)[b,c,g,i]**	**0.12 (0.05-0.15)[b,c]**	**0.4**
$CHBr_3$	0.6-3.0	0.4-0.6	**1.6 (0.5-2.4)[b,c,f,g]**	**0.37 (0.13-0.7)[b,c,e]**	**0.2**
CH_3I	0.1-2.0	0.05-0.2	**0.8 (0.3-1.9)[b,c,f]**	**0.08 (0.02-0.18)[b,c]**	**0.1**
CH_2ClI			**0.35[g]**		
CH_2Cl_2			**17.5 (9-39)[b,c,f]**	**13.2 (9-19)[b,c,e]**	**0.75**
$CHCl_3$	NH, 10-15 **12.4 (9.8-14.5)[k]** SH, 5-7 **8.0 (6.5-9.1)[k]**	3.1 ±0.7	**7.8 (5.2-13.3)[b,c,f,k]**	**6.0 (4.8-7.5)[b,c,e]**	**0.78**
C_2HCl_3	NH, 1-5 SH, 0.01-0.1	0-0.1	**0.5 (0.05-2)[b,c,d]**	**0.14 (0.02-0.3)[b,c,d,e]**	**0.3**
C_2Cl_4	NH, 5-15 **5.3 (3.3-7.3)[k]** SH, 0.7-1.5 **1.5 (1.1-1.6)[k]**	1-3	**1.8 (1.2-3.8)[b,c,f,k]**	**1.3 (0.9-1.6)[b,c,e]**	**0.7**
C_2H_5Cl	**NH, 2.6[l]** **SH, 1.6[l]**		**5.0 (2.7-5.9)[d]**	**1.5 (1.0-1.8)[d]**	**0.3**
CH_2ClCH_2Cl	NH, 20-40 SH, 5-7	14.9 ±1.1	**3.7 (0.7-14.5)[b,c,h]**	**1.8 (0.7-3.3)[b,c,e,h]**	**0.5**
$COCl_2$				**22.5 (20-25)[m]**	
Total Cl			**81 (75-99)[n]**	**55 (52-60)[n,o]**	
Total Br			**8.4 (6.9-9.6)[n]**	**3.5 (3.1-4.0)[n]**	
Total I			**1.2 (0.7-2.3)[n]**	**0.08 (0.02-0.18)[n]**	