Scientific needs for high quality, inter-calibrated datasets of $C_nH_oX_pY_q$ or: Why bother?

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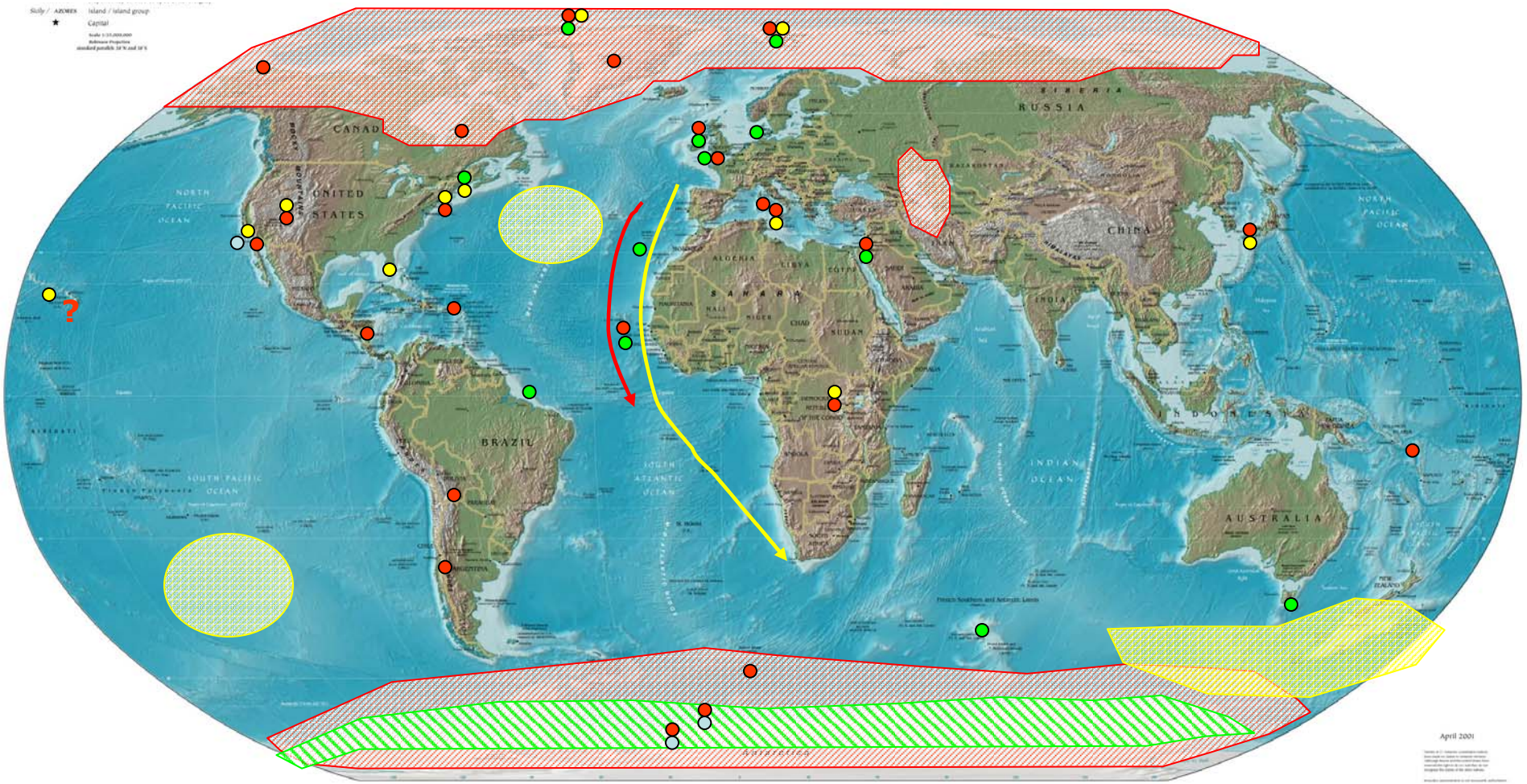
Tropospheric chemistry

Inorganic gas phase halogens in BL

(incl. volcanic plumes, salt lakes)



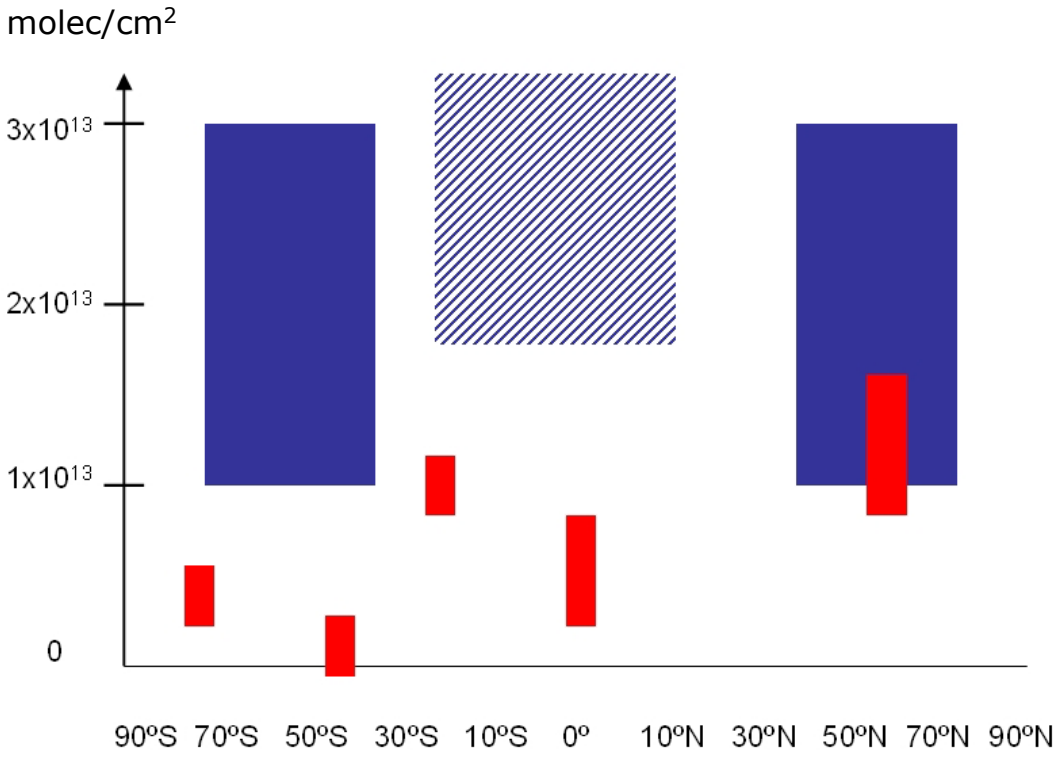
BrO(, Br_2, BrCl) I_x Cl_x

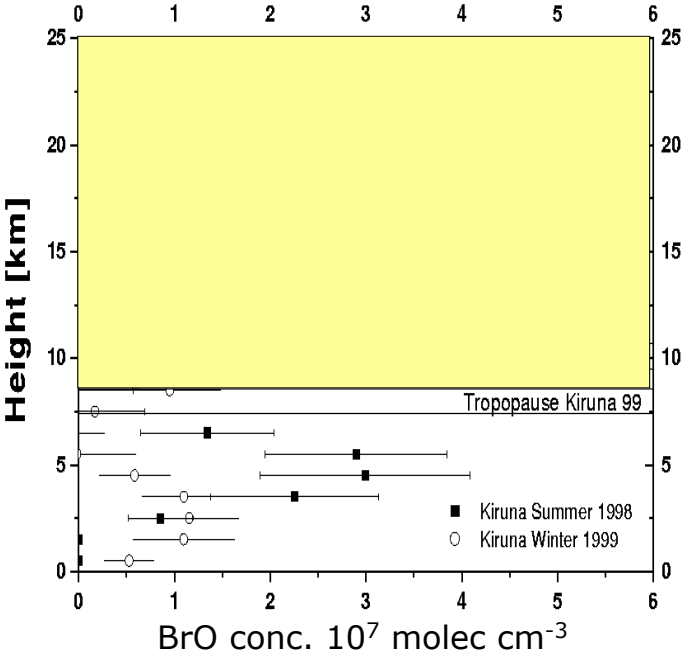
Halogens in the free troposphere

comparison balloon-borne DOAS vs. ground and satellite derived vertical column vs. stratospheric model:

tropospheric BrO column of 1-3 x 10^{13} molec cm^{-2} ≈ 0.5 – 2ppt

(Harder et al. 1998, McElroy et al. 1999, Frieß et al. 1999, Pundt et al. 2000, Wagner et al. 2001, Richter et al. 2002, van Roozendael et al. 2002, Fietkau et al. 2007, Hendrick et al. 2007)





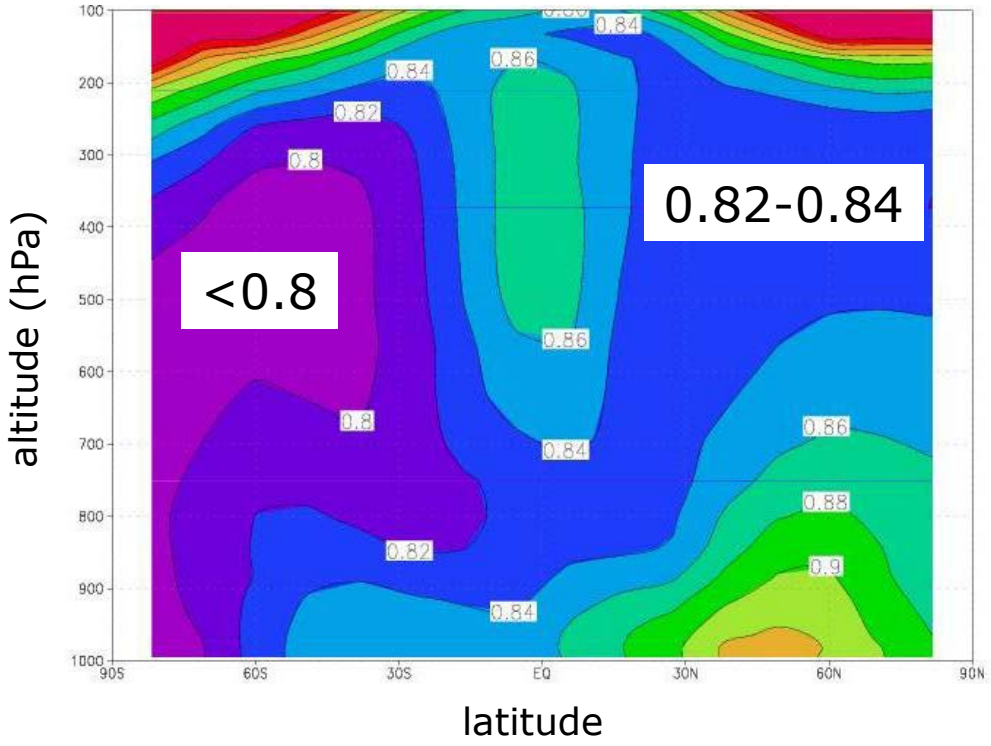
Fitzenberger et al., 2000:

0.5 – 2.5 pmol mol^{-1}

satellite (GOME) - balloon

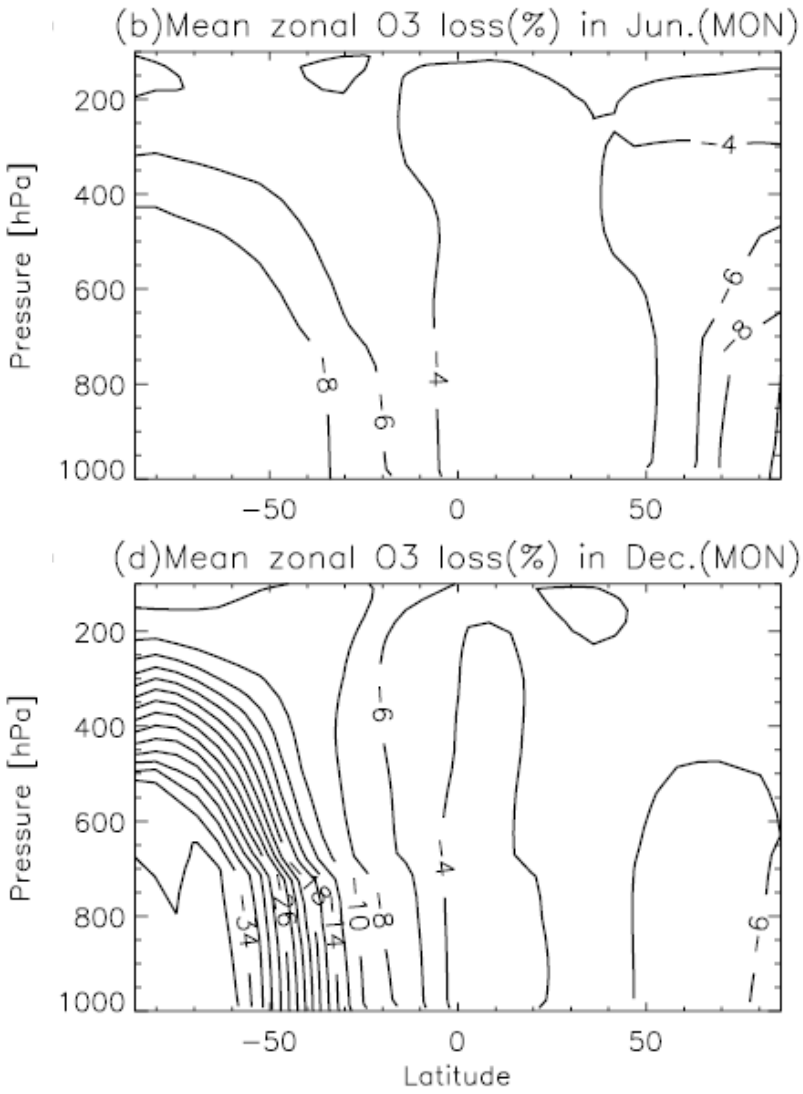
ground-based MAX-DOAS

O_3 reduction due to bromine chemistry



annual average

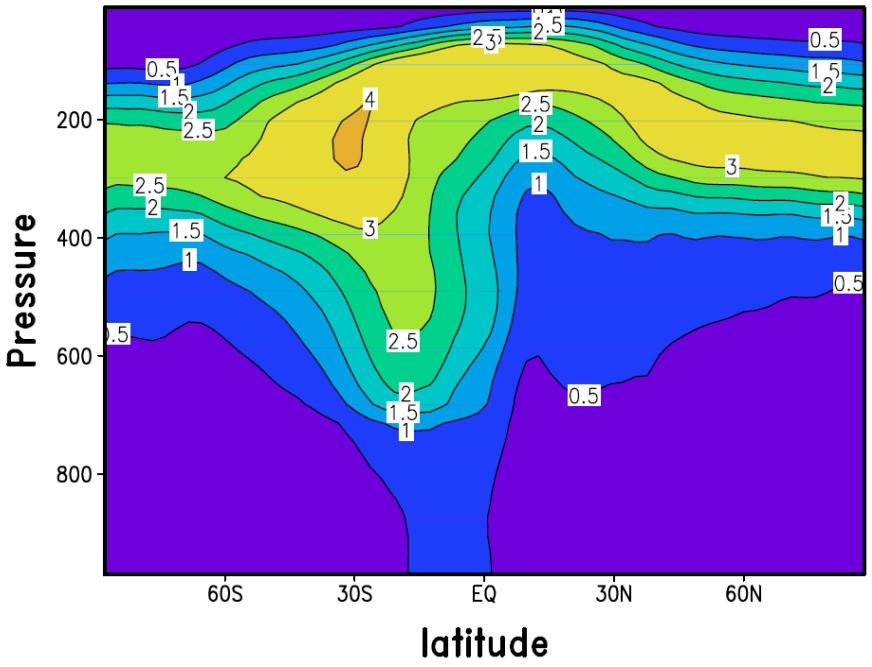
von Glasow et al., ACP, 2004

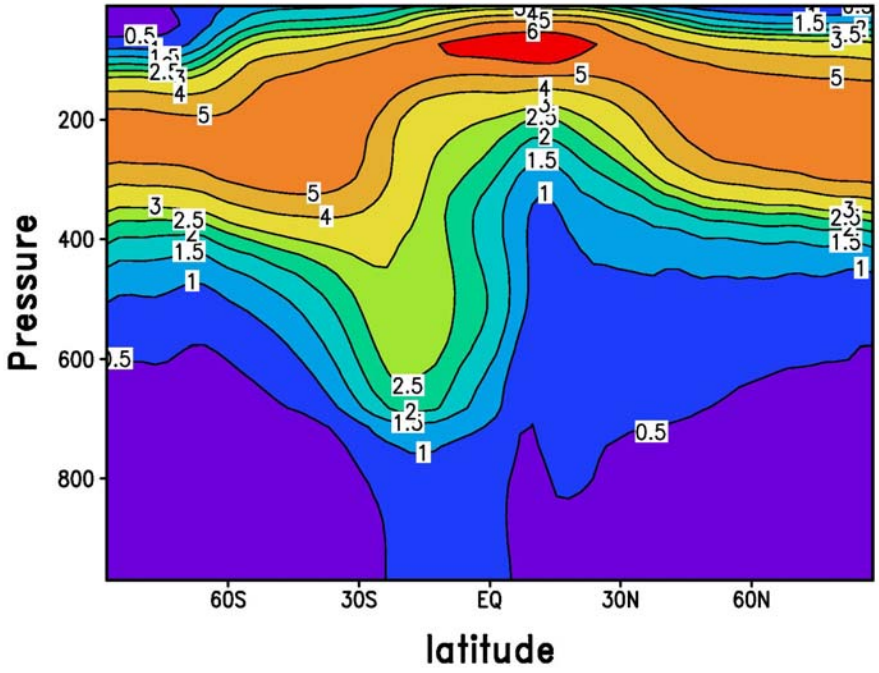


Yang et al., JGR, 2005

Biogenic Br precursors

Increase in inorg-Br due to VSLS (in pmol/mol):





~600 GgCHBr$_3$/yr

additionally:

CH_2Br_2	113 Gg/yr
CH_2BrCl	7 Gg/yr
$CHBr_2Cl$	23 Gg/yr
$CHBrCl_2$	16 Gg/yr

Nicola Warwick, Cambridge, SOLAS Newsletter, Winter 2007

Appledore Island

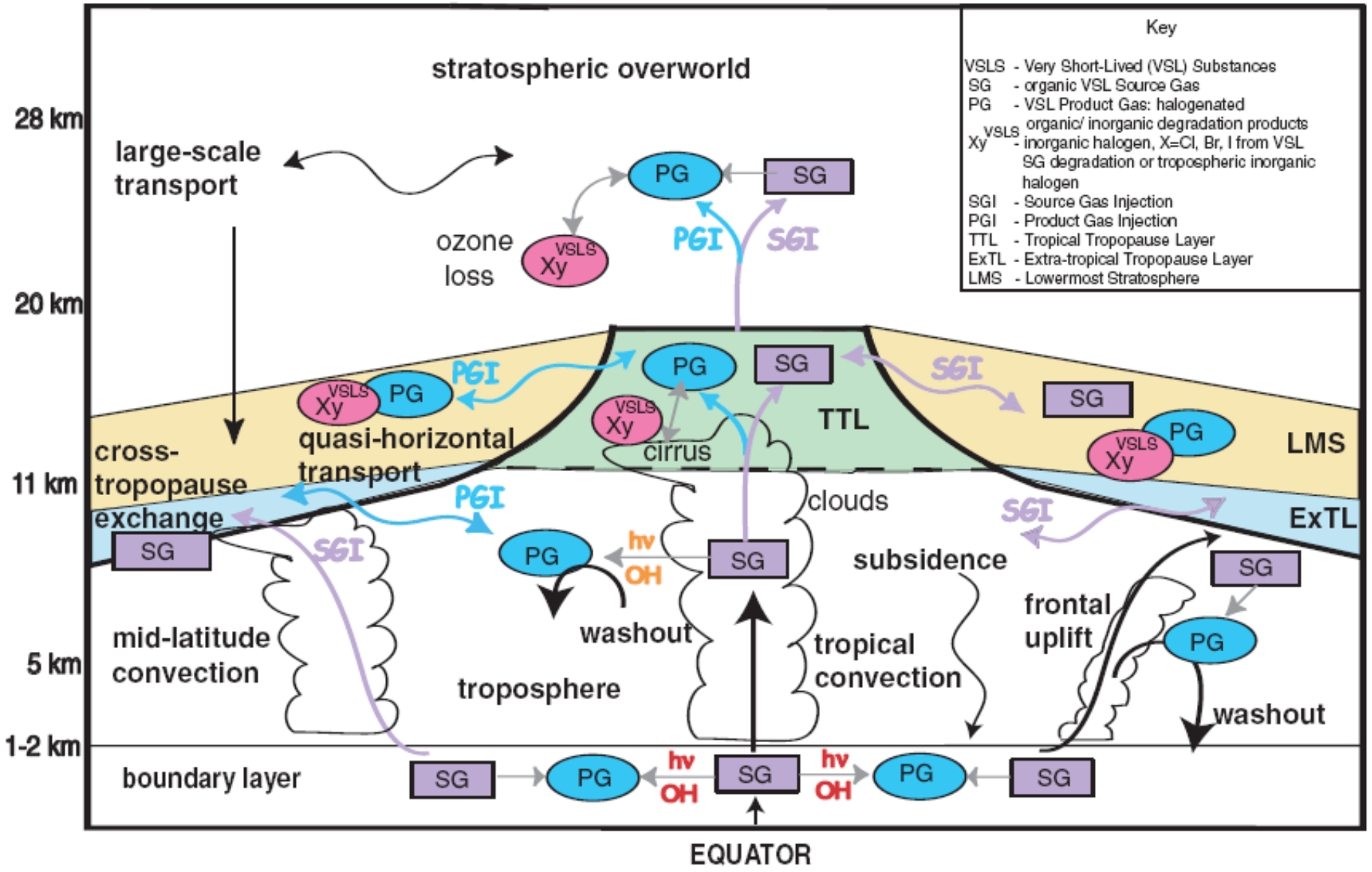
Mace Head

Tropospheric chemistry

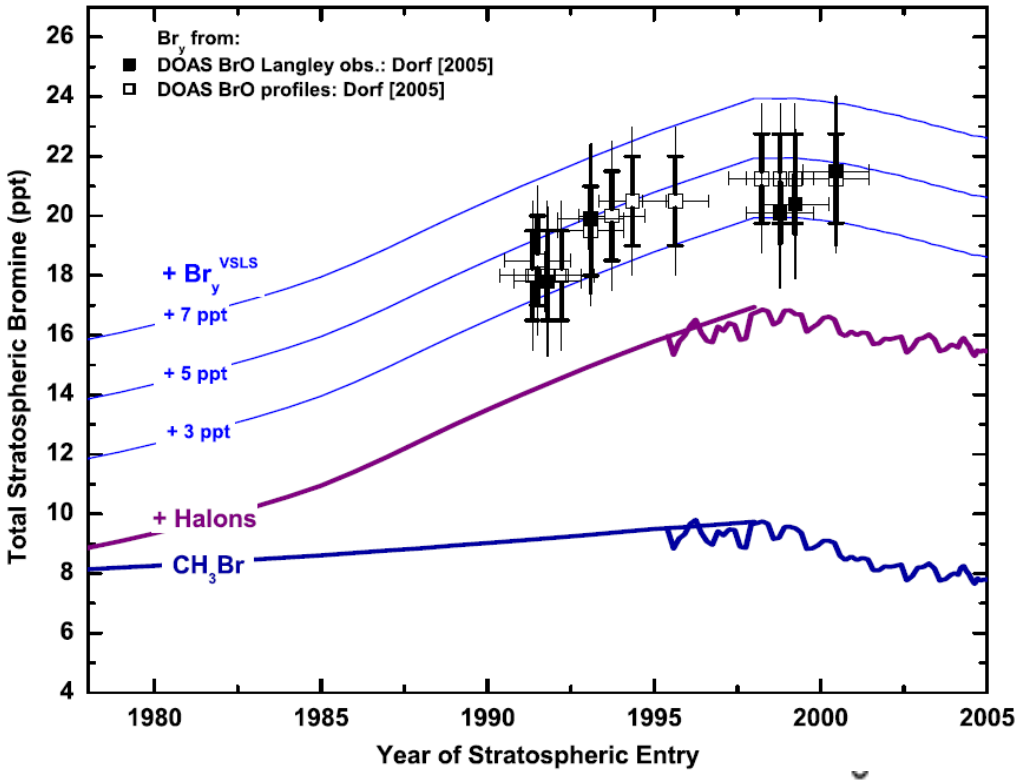
- Bromine
  - MBL BrO: largely sea salt
  - FT BrO: could be very important for oxidation capacity
    - sea salt key precursor in MBL and partly in FT
    - org-Br: lifetime order of weeks ➔ effect *NOT* close to source but regional to hemispheric
- Iodine
  - MBL, coastal regions: I_2 key precursor
  - MBL, open ocean (gas phase IO, aerosol enrichment): likely org-I key precursor, lifetime of minutes (CH_2I_2) to minutes/hours ➔ effect fairly close to source
  - free troposphere, UT/LS??? no positive identification of inorganic gaseous iodine so far

Stratospheric chemistry

Chemical and Dynamical Processes Affecting VSLS

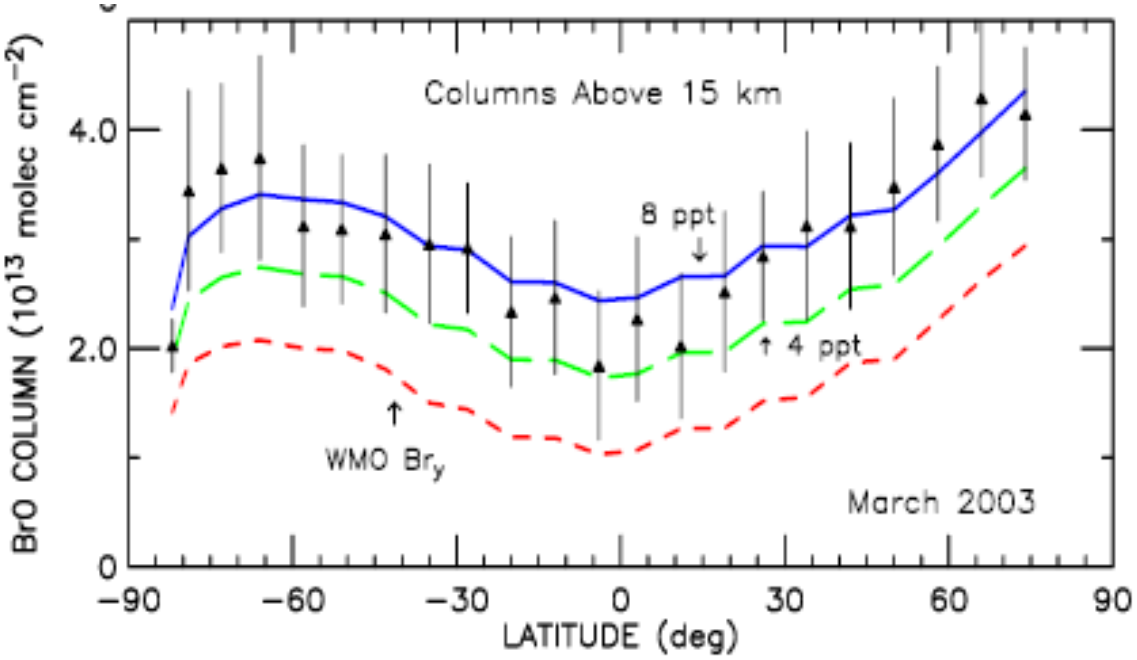


WMO, 2007

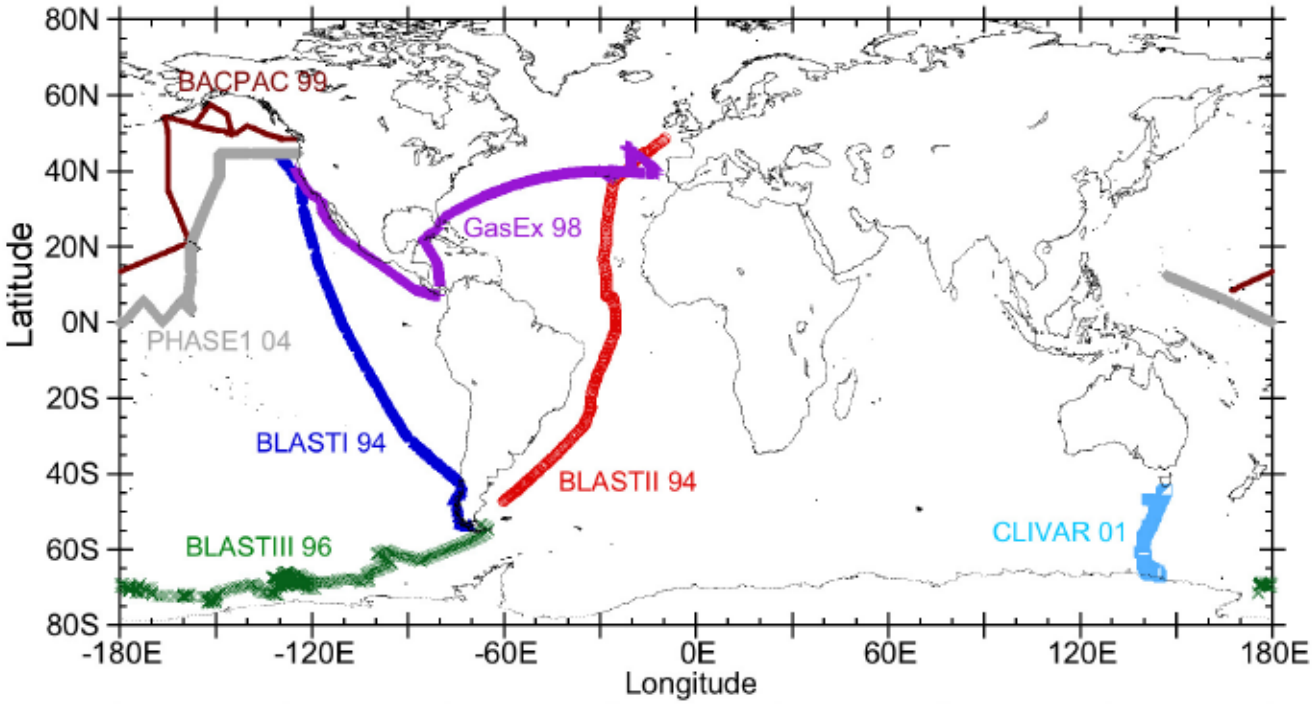


Br_y calculated from balloon DOAS BrO

total column BrO above 15 km from SCIAMACHY with BrO partial columns from the AER 2-D model,

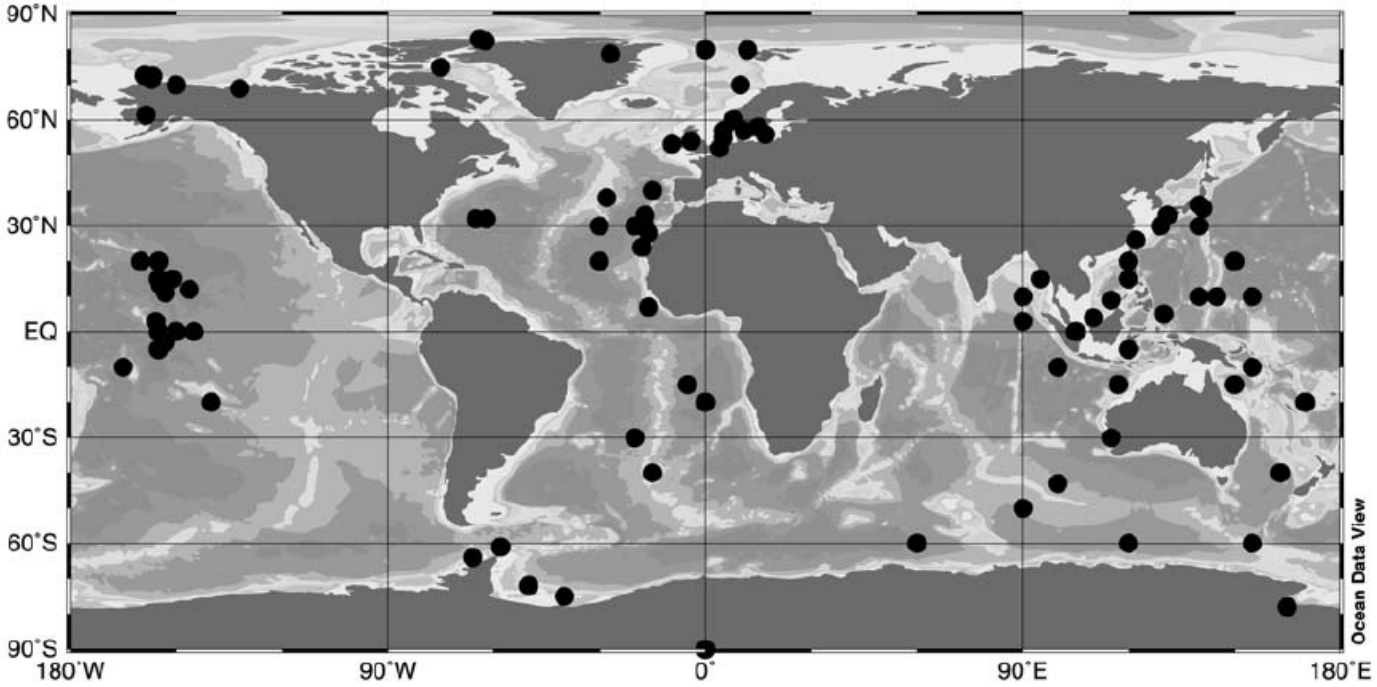


WMO, 2007



$CHBr_3$

Butler et al., 2007



Quack and Wallace, 2003

Stratospheric iodine???

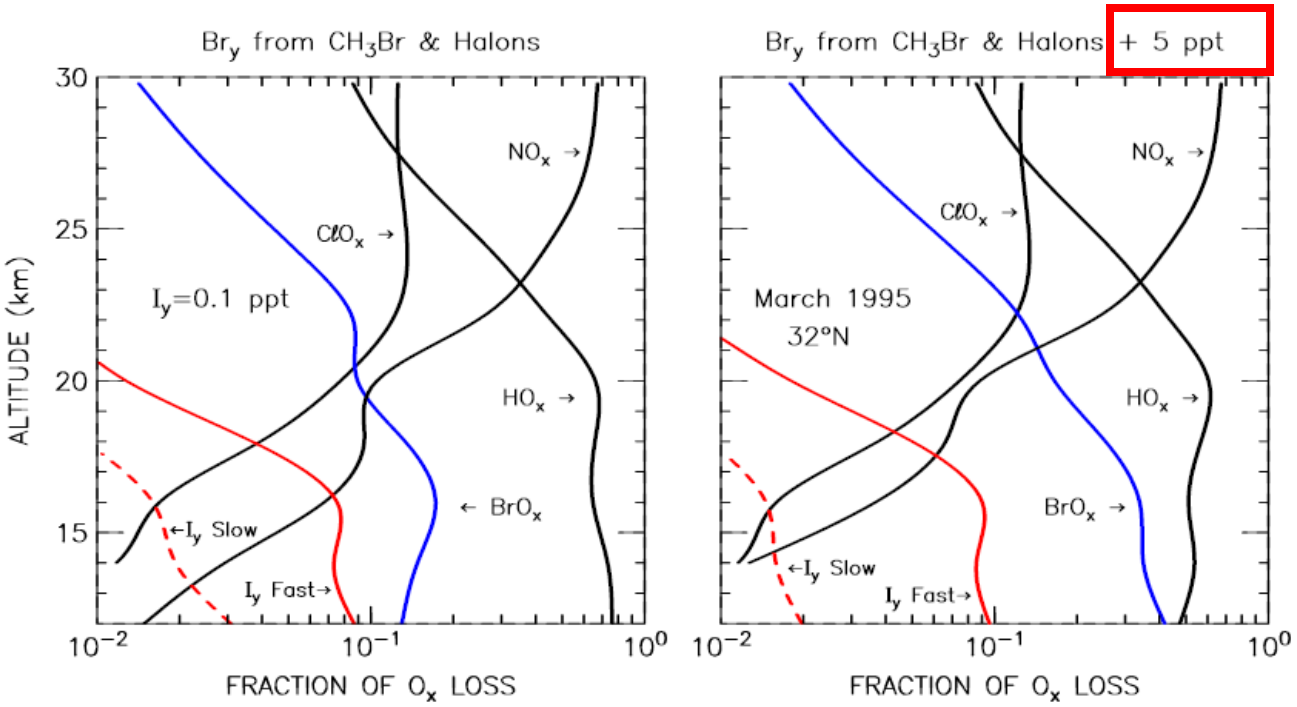
- How much is there?
- Is it increasing due to human activity?
- Tropical (vertical) iodine mass balance is not understand

Summary

- Troposphere
  - FT Br might be dominated by org-Br
  - open ocean I might be dominated by org-I
  - lifetime: τ(org-Br) > τ(org-I)
- Stratosphere
  - VSL-Br prob. contributes 3-5 ppt to Br_y
  - VSL-I not understood yet
- for quantitative understanding and input for (global) models we need:
  - global fields of org-Br and org-I as a function of:
    - space
    - time: past (for trend analyses)
    - time: present (for "current" atmosphere)
  - comparable numbers → intercalibration!
  - IUPAC/JPL–style assessment of "good" data

Uncertainty for possible future questions and needs

- Troposphere:
  - DL < 1ppt "X", better if DL < 0.2 ppt [several 0.1ppt of XO in background MBL/FT have large effect already → O_3, DMS!]
  - org-I: detection of "super" short-lived compounds like CH_2I_2 might be key
  - overall required uncertainty: better than 50%
- Stratosphere:
  - WMO 2006: VSL-Br
    - "central value": 5 (3-8) ppt
    - range: 0-10 ppt
  - required: +/- 1ppt
- overall: uncertainty should be good enough to detect trends



WMO, 2007 (Russ Dickerson)