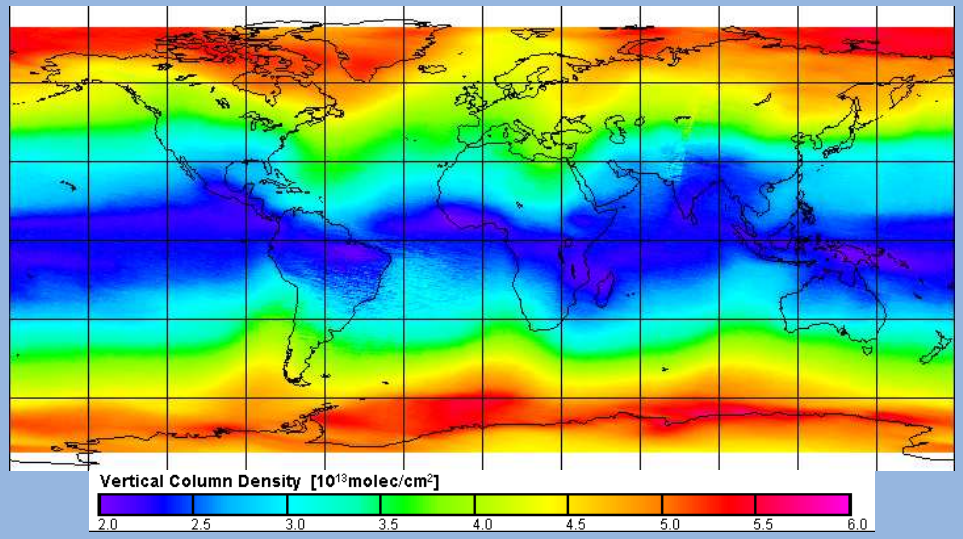
BrO as seen by GOME

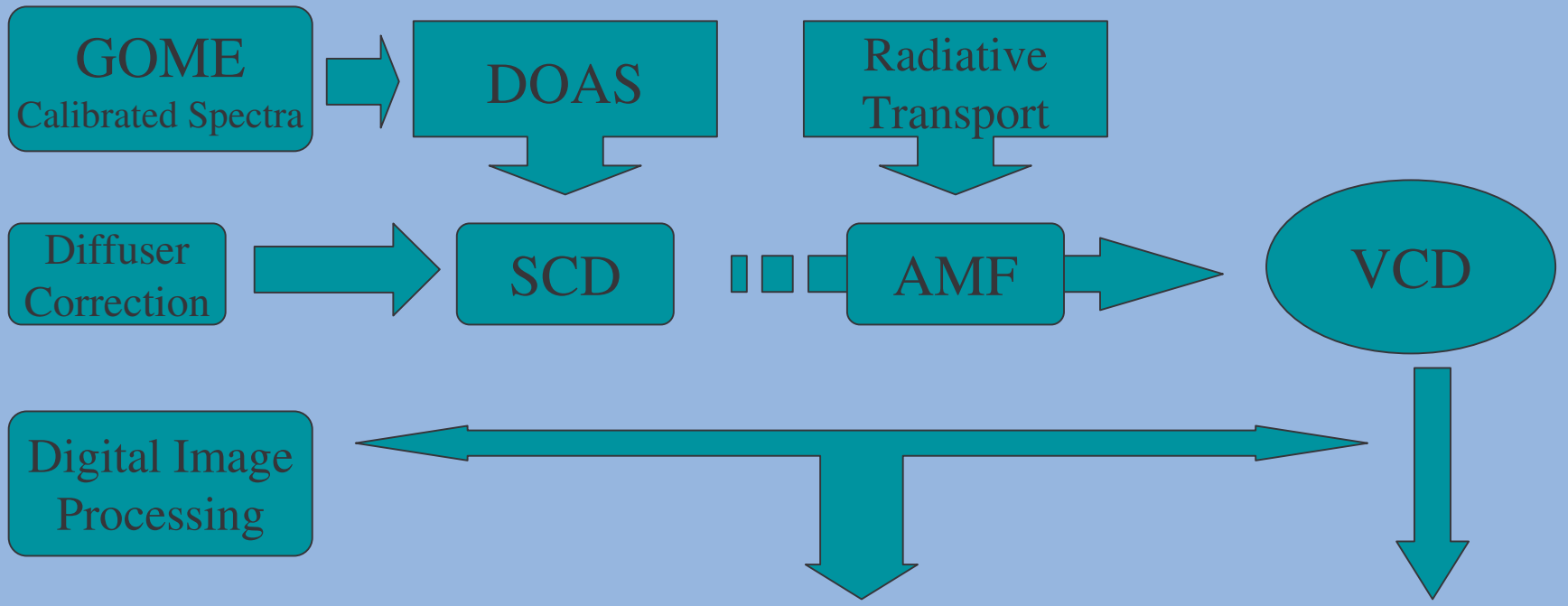
1996 - 2000

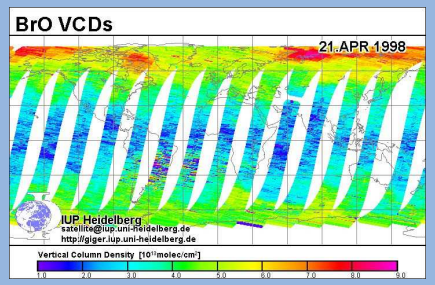
First German GOME / SCIAMACHY workshop;
IUP Heidelberg / IUP Bremen
Bremen, 25./26. November 2002



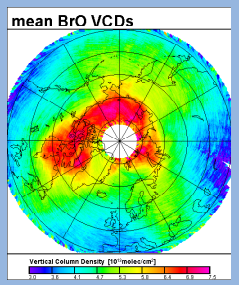
Jens Hollwedel, IUP Heidelberg

Overview of Data Evaluation

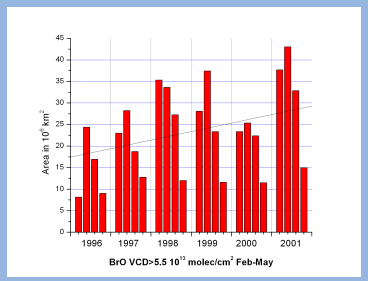




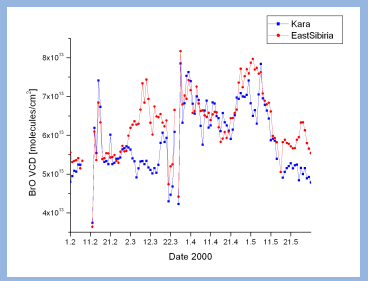
Daily Maps



Mean Maps

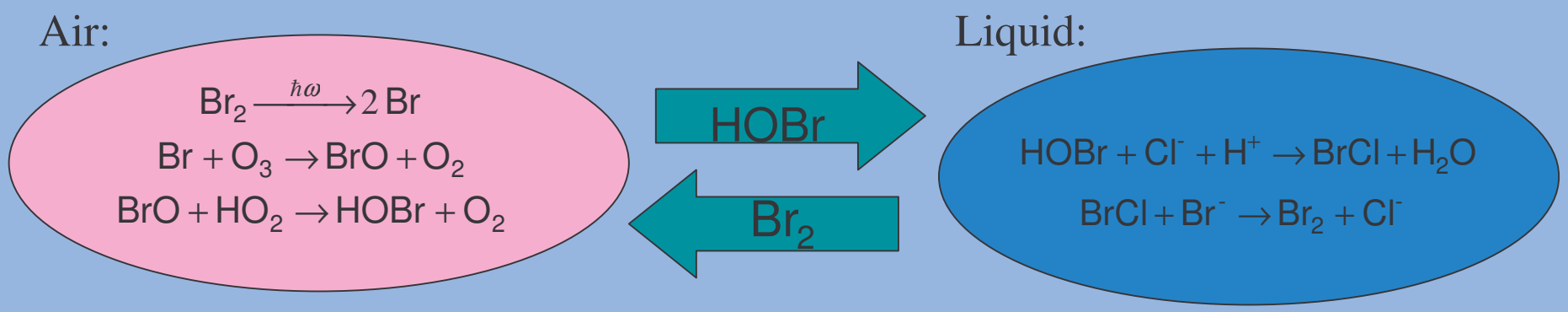


Areas



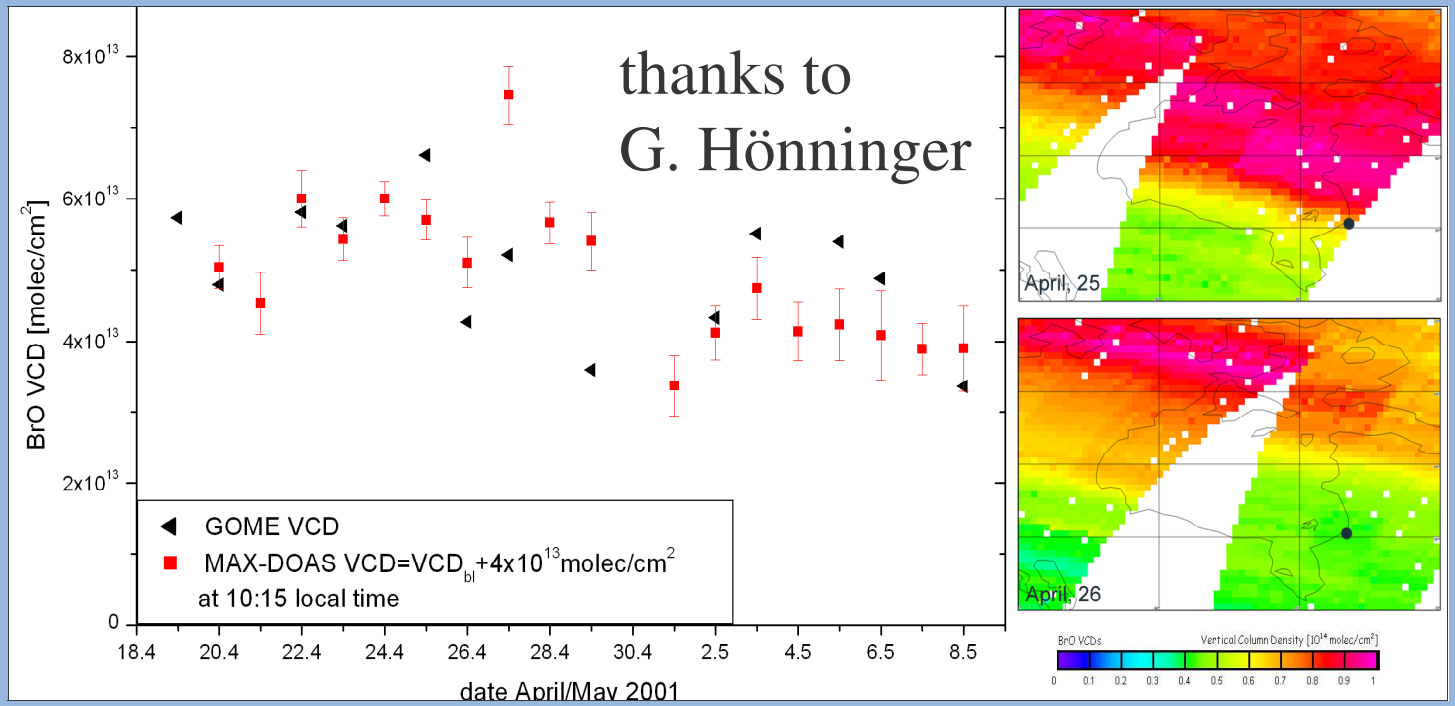
Time Series

Bromine Explosion in Polar Regions – the Tropospheric Ozone Hole in Polar Spring



Net:
$$HOBr + 2HO_2 + H^+ + 2O_3 + Br^- \xrightarrow{\hbar\omega} 2HOBr + 4O_2 + H_2O$$

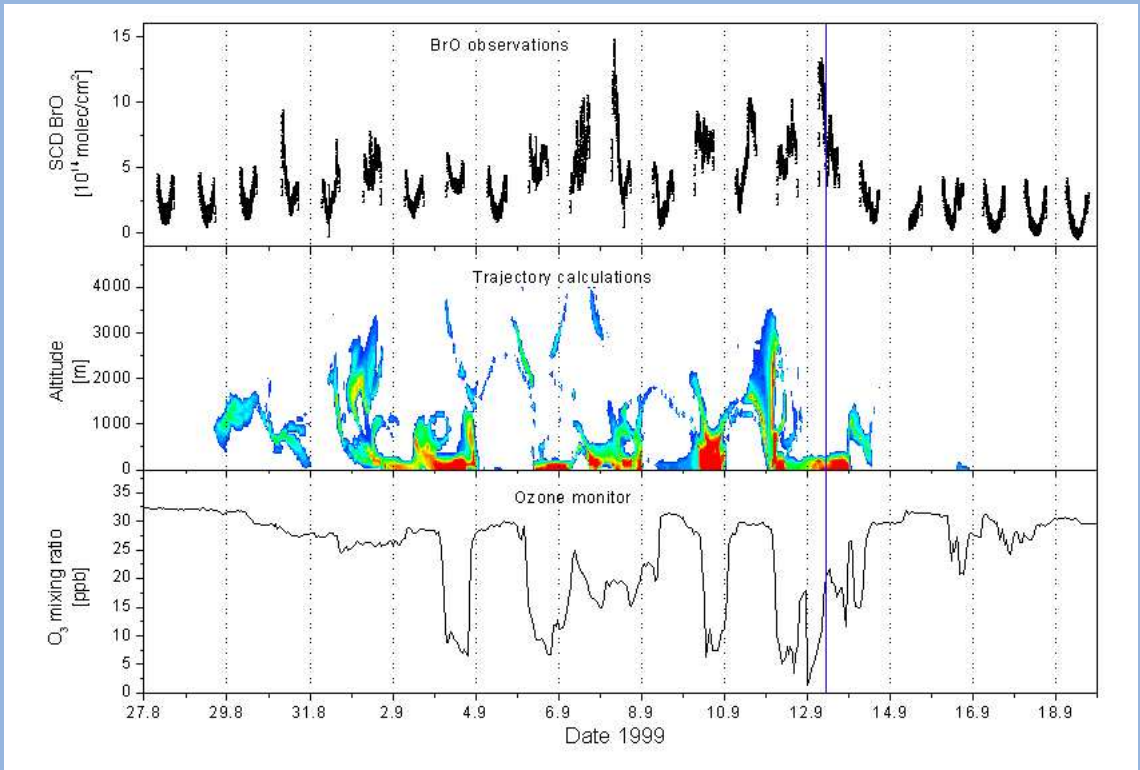
BrO @ Hudson Bay; Comparison with MAX-DOAS

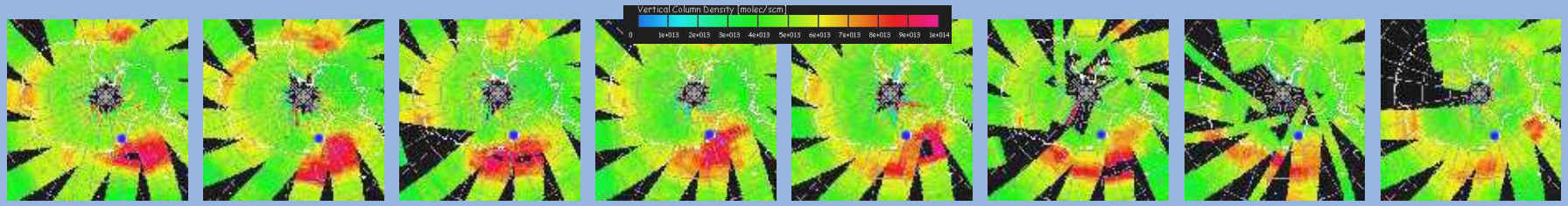


With MAX-DOAS it is possible to distinguish between a free troposphere/stratosphere background (VCD_{bg}) and a boundary layer column, with the assumption of an 1 km thick homogenous mixed BrO layer at the surface (VCD_{bl}). In the comparison with GOME data the seasonal background $VCD_{bg} \approx 4 \cdot 10^{13}$ molec/cm^2 is added to the boundary layer BrO VCDs to give total BrO VCDs. Note that on April, 27 and 29 the measurement site was covered by clouds.

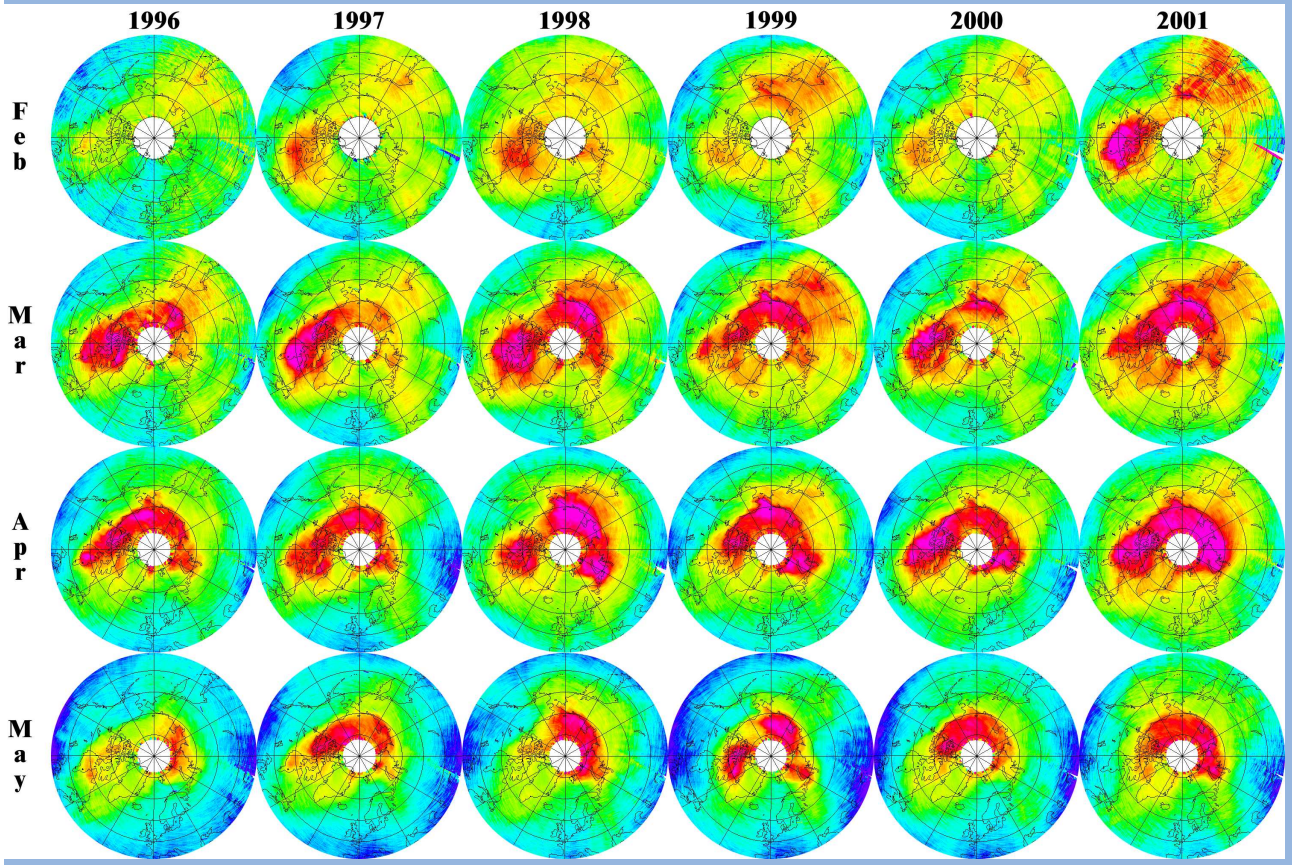
BrO @ Neumayer (Sept, 9 – 16 , 1999)

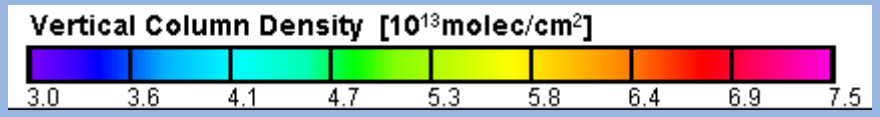
thanks to
U. Frieß

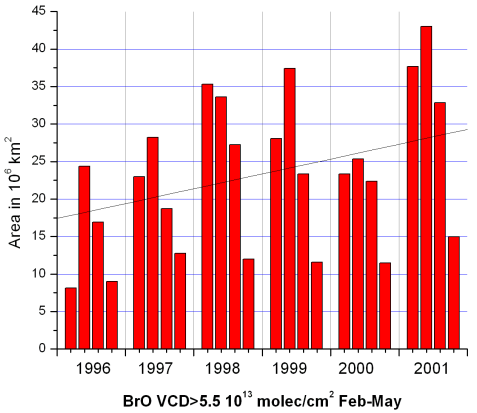


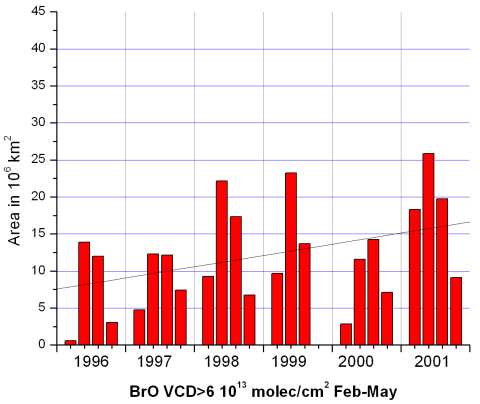


Monthly Mean BrO VCDs in Arctic Spring

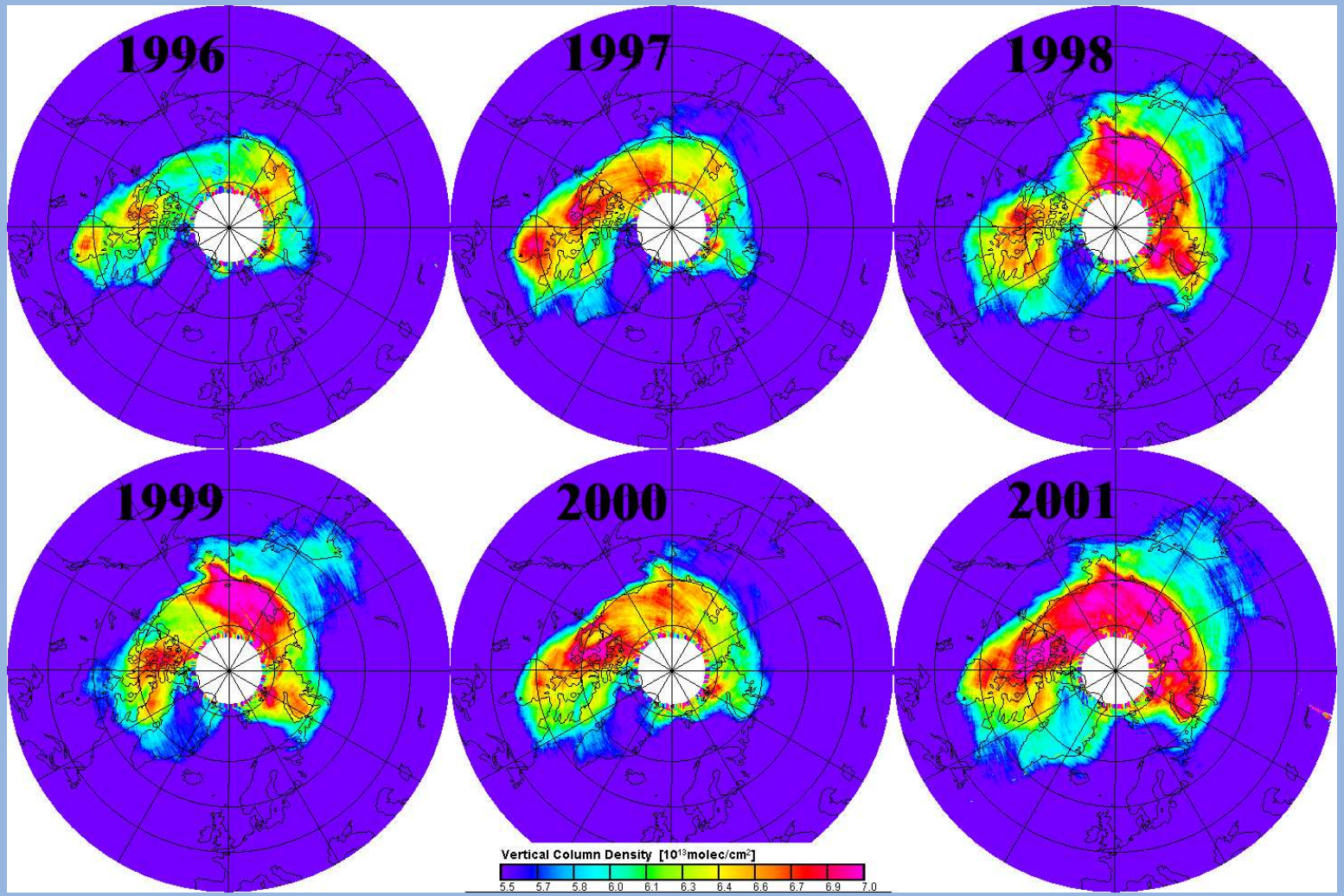




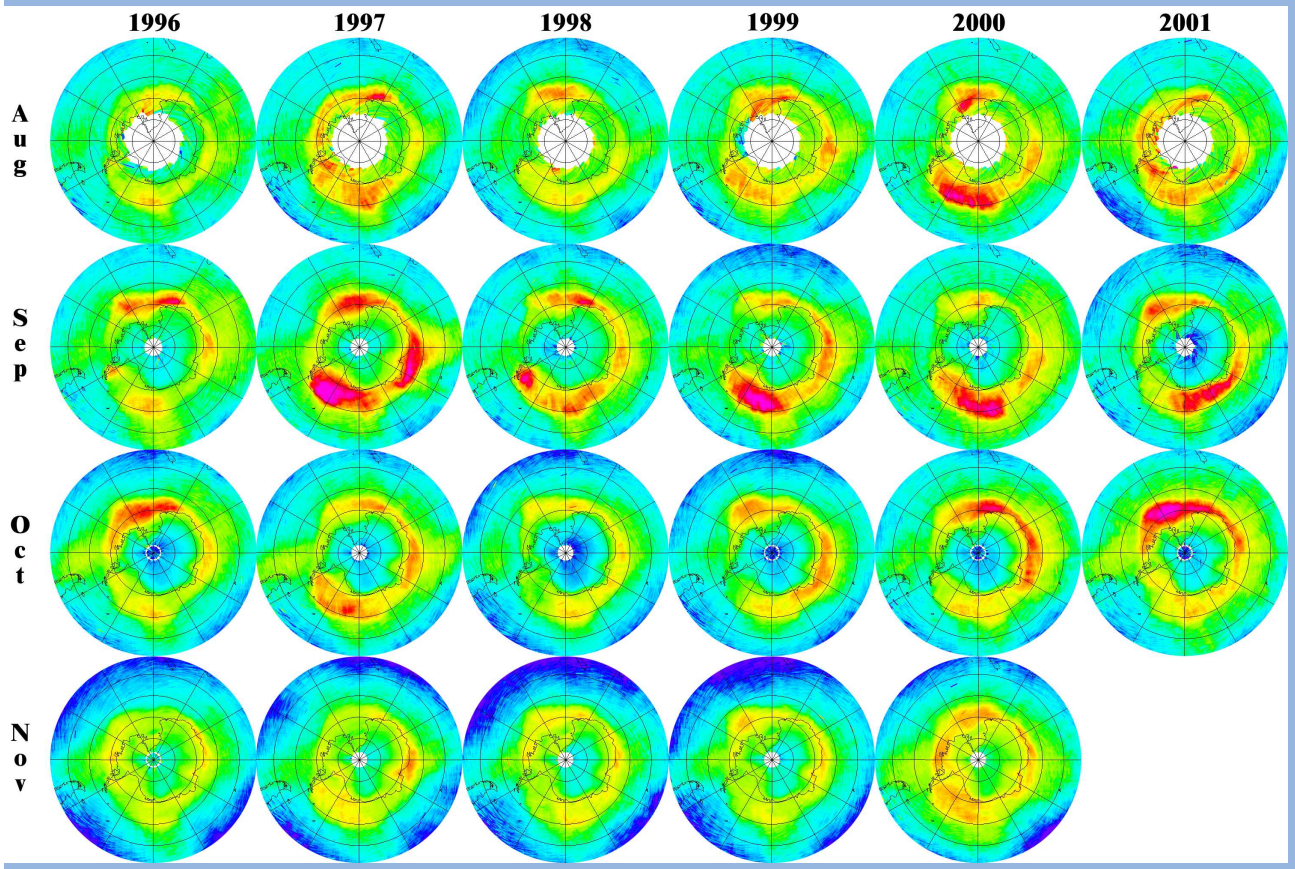


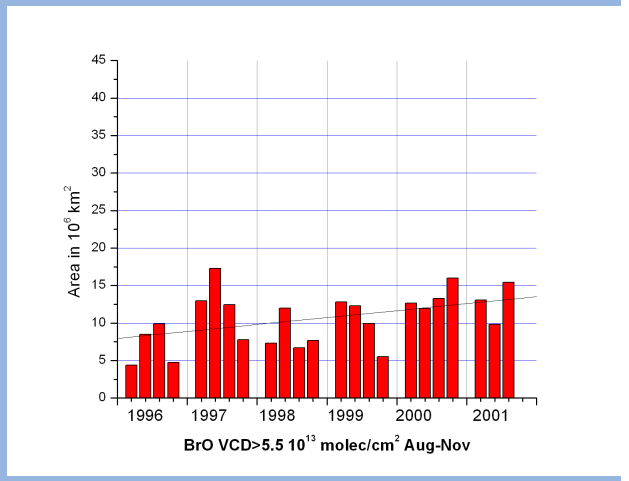


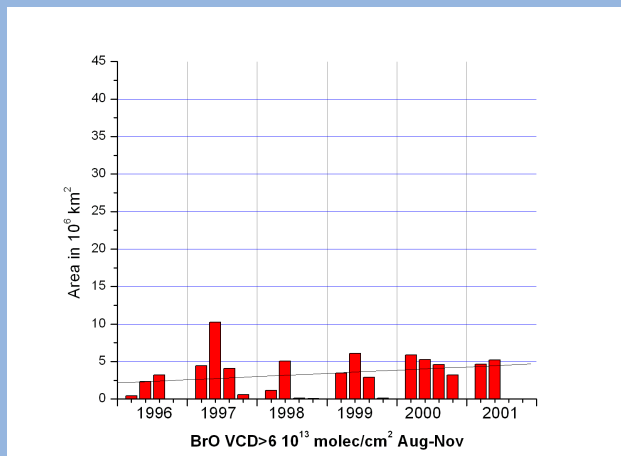
Mean BrO in the Arctic Spring (Feb-May)

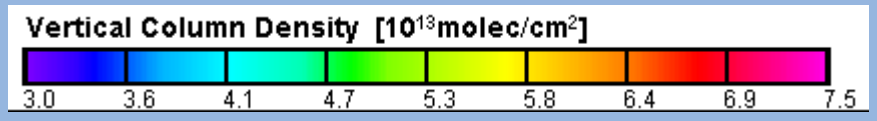


Monthly Mean BrO VCDs in Antartic Spring

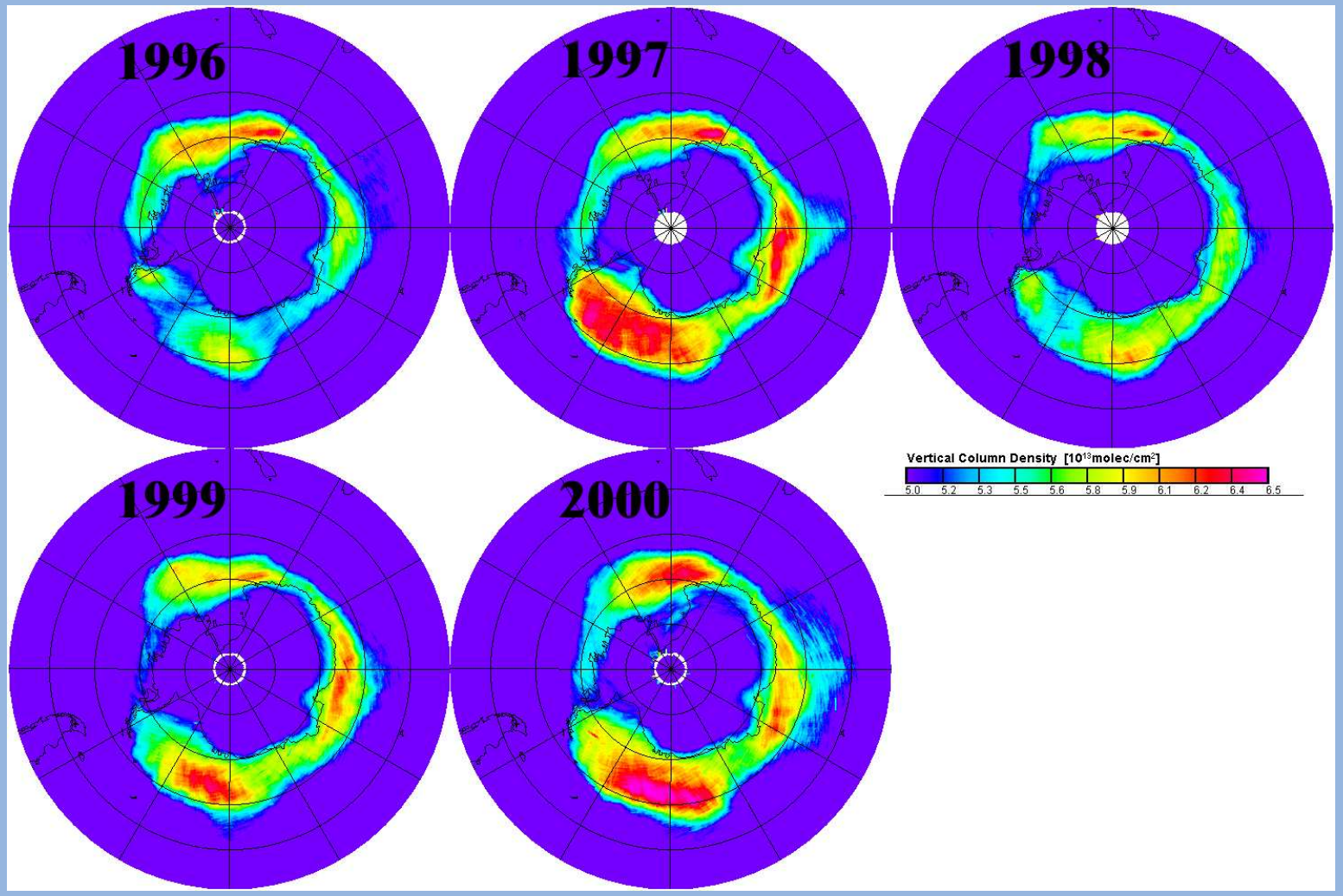




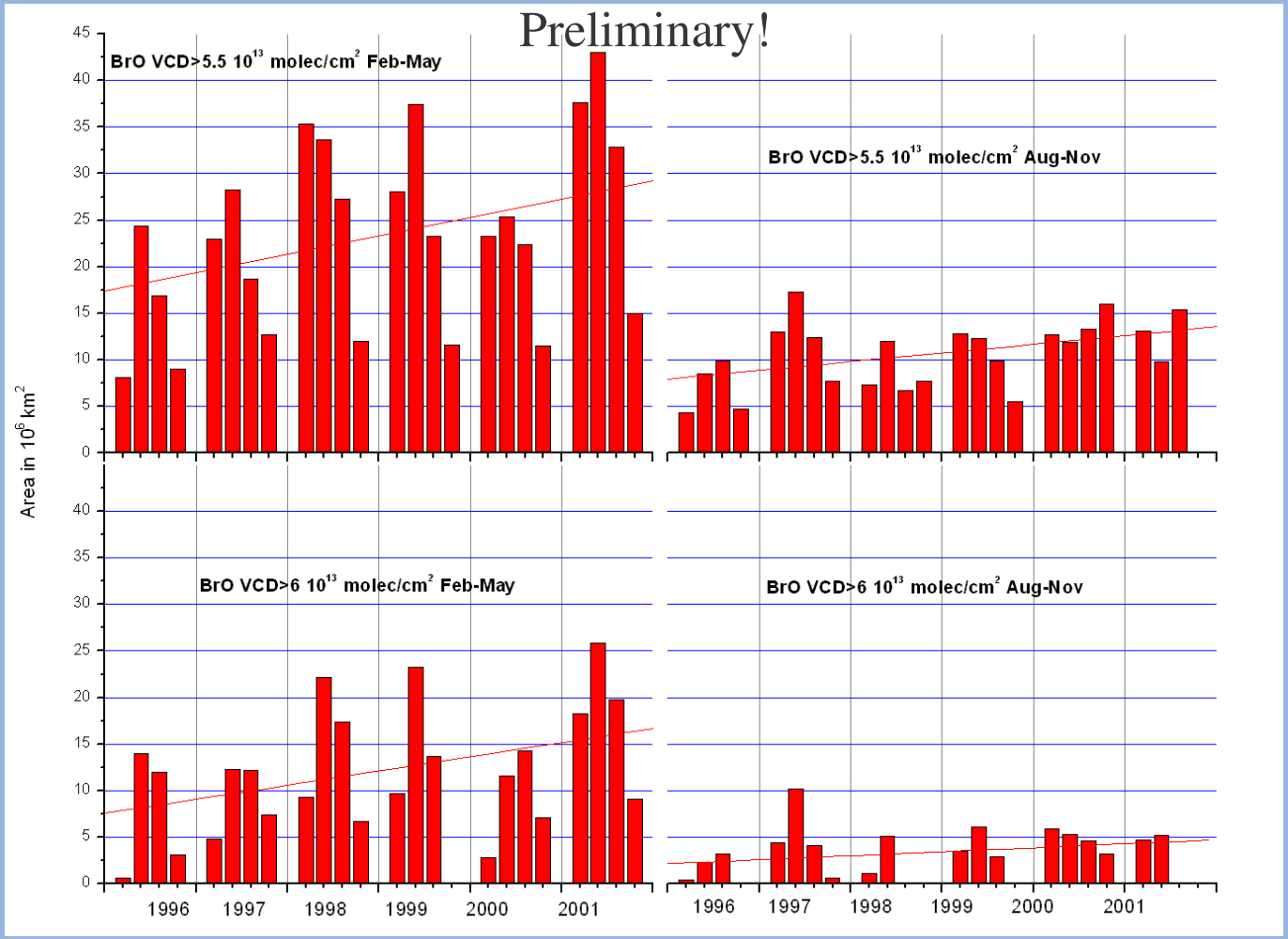




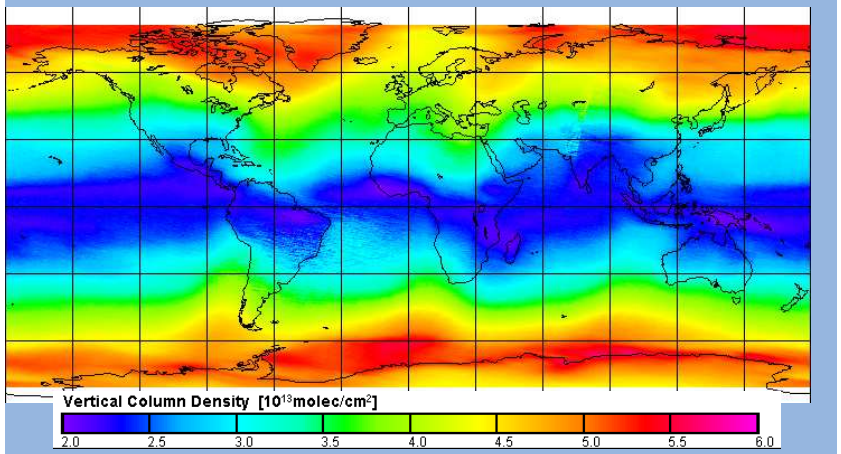
Mean BrO in the Antartic Spring (Aug-Nov)

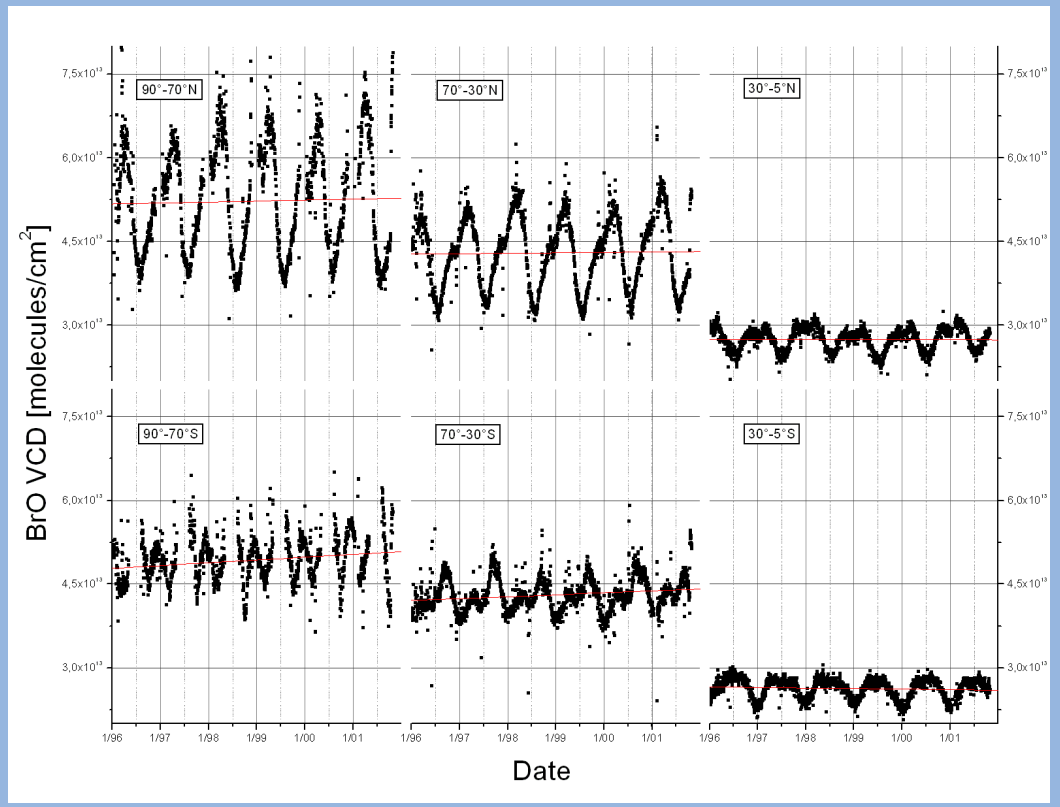


Area covered with BrO 'clouds'



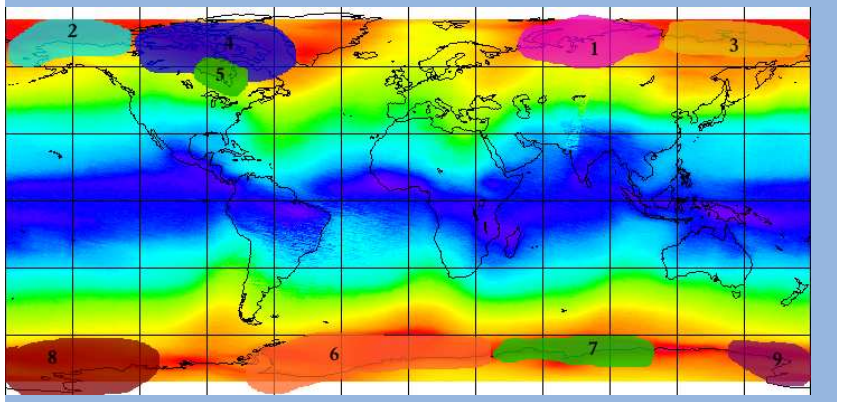
Zonal Mean BrO VCD Jan 1996 – Aug 2001

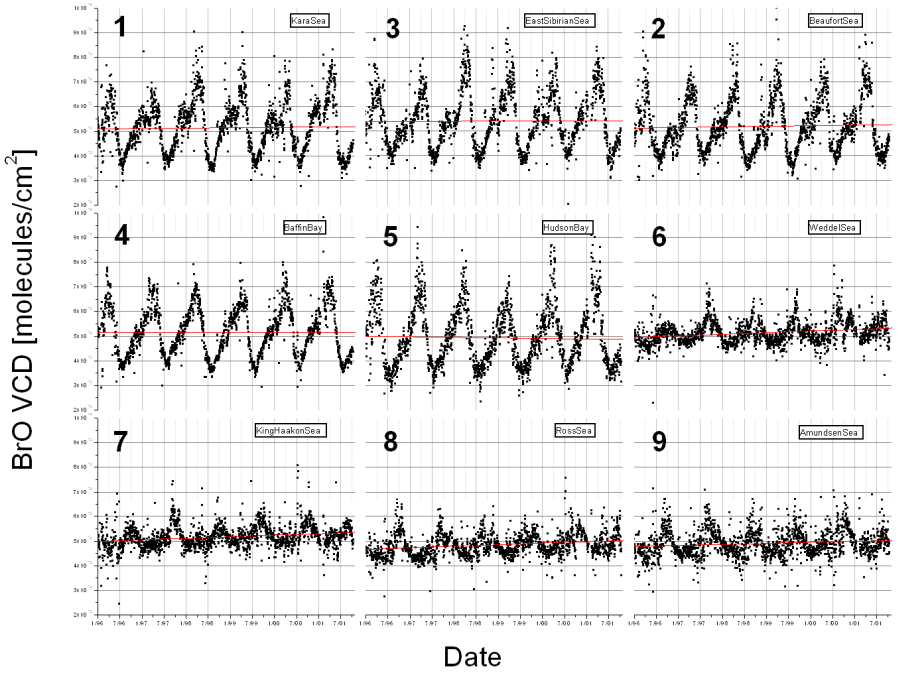




Time Series of Zonal Mean BrO VCD 1/96-10/01

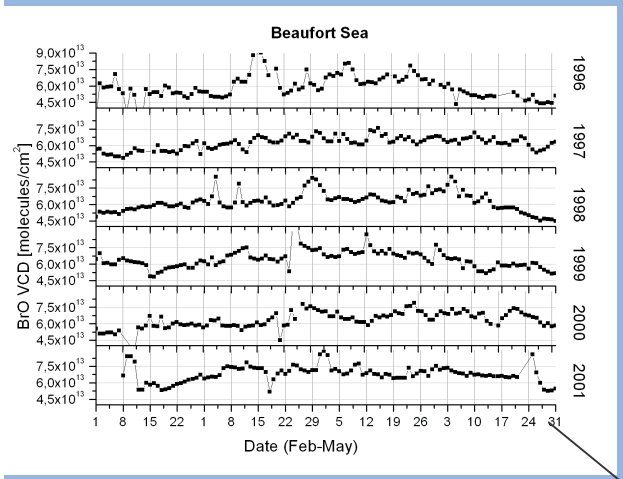
Regional Mean BrO VCD Jan 1996-Aug 2001

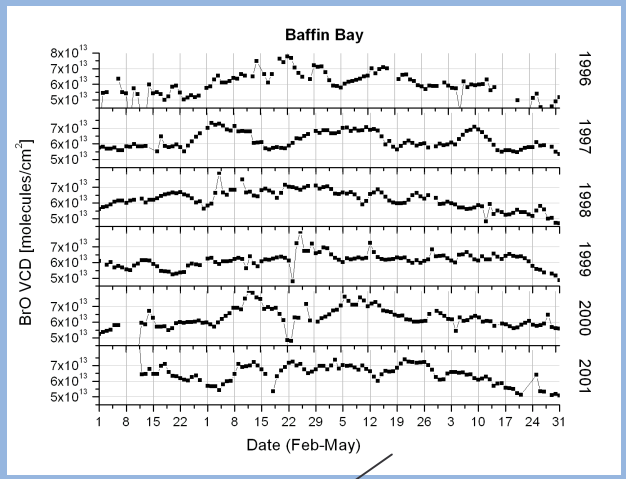


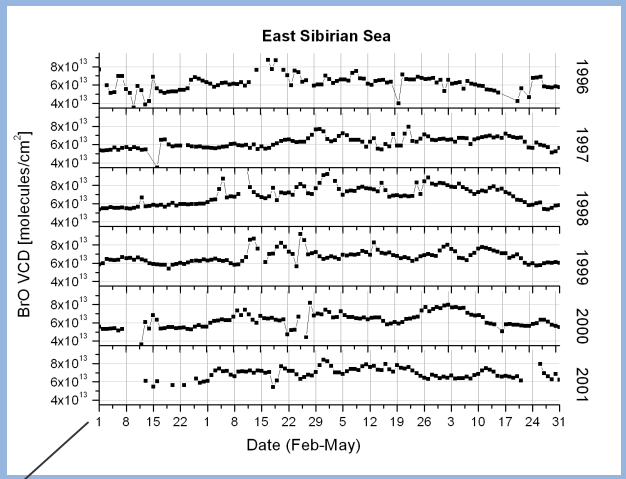


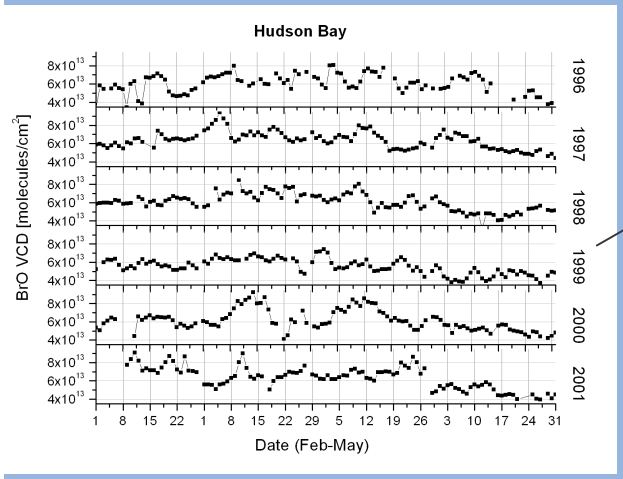
Time Series of Regional Mean BrO VCD 1/96-10/01

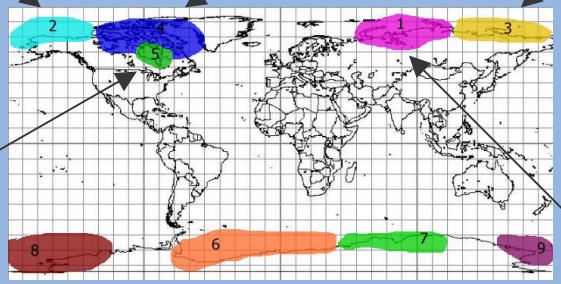
Arctic BrO VCD Time Series in Different Regions

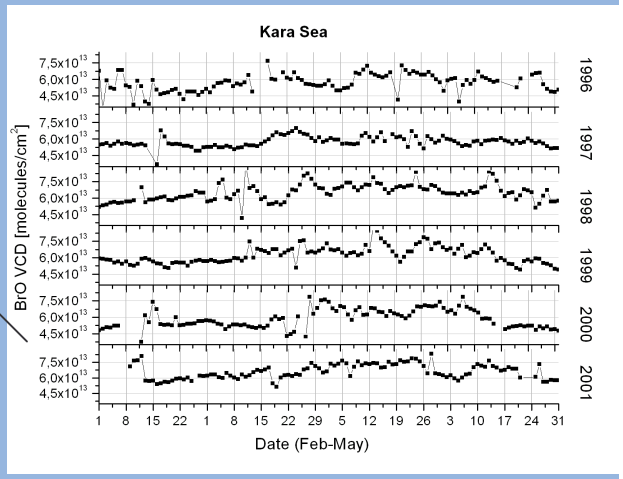




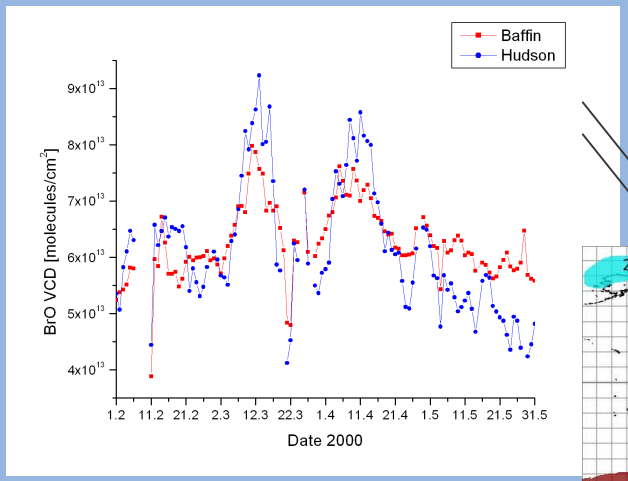




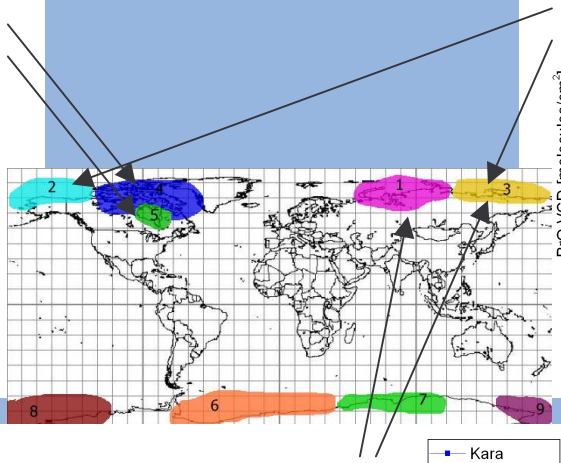


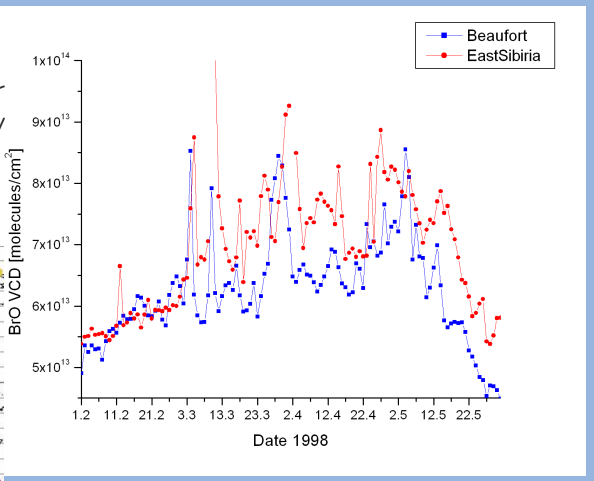


Comparison of Time Series in Arctic Regions

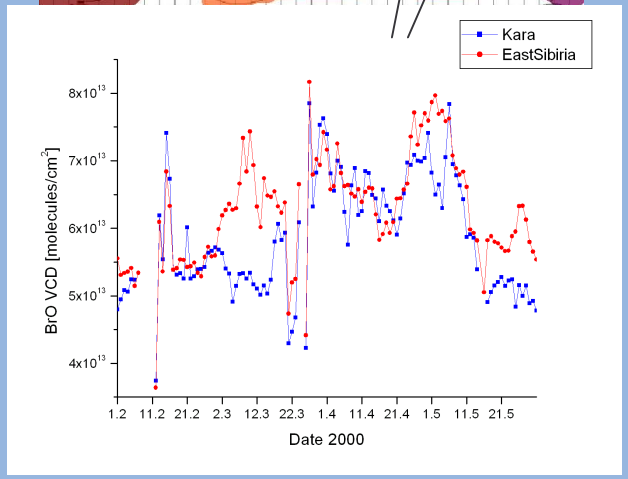


4+5



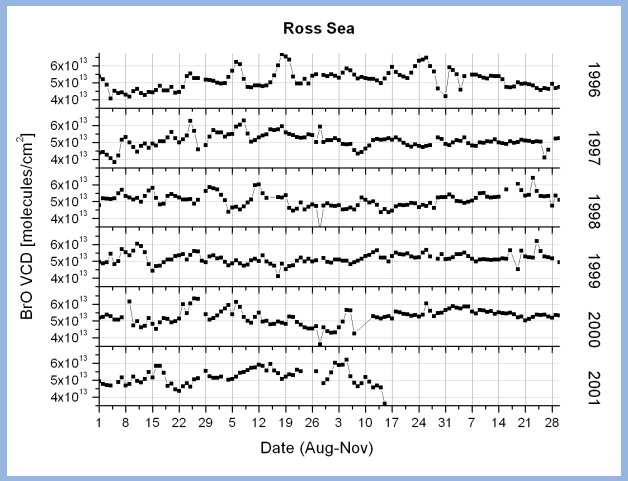


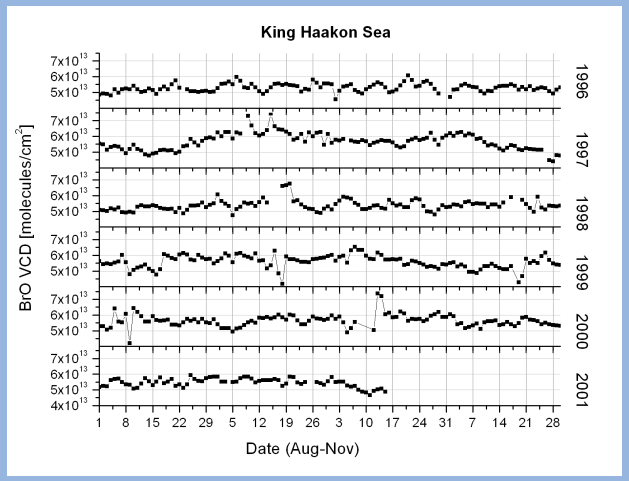
2+3

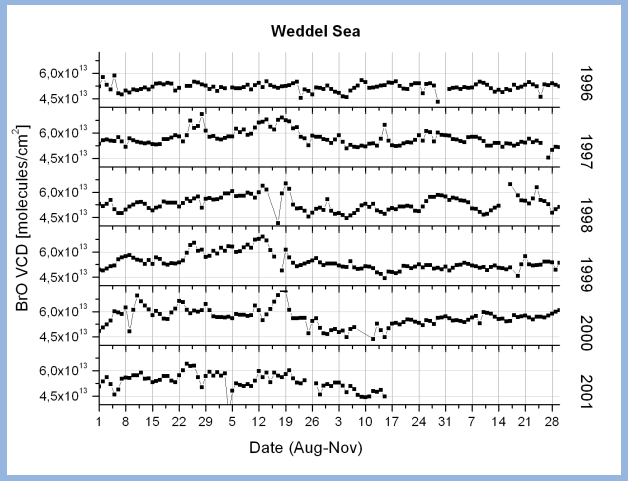


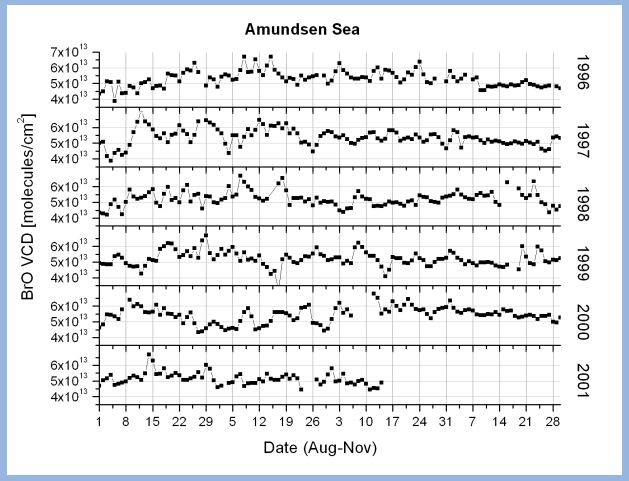
1+3

SP Regions

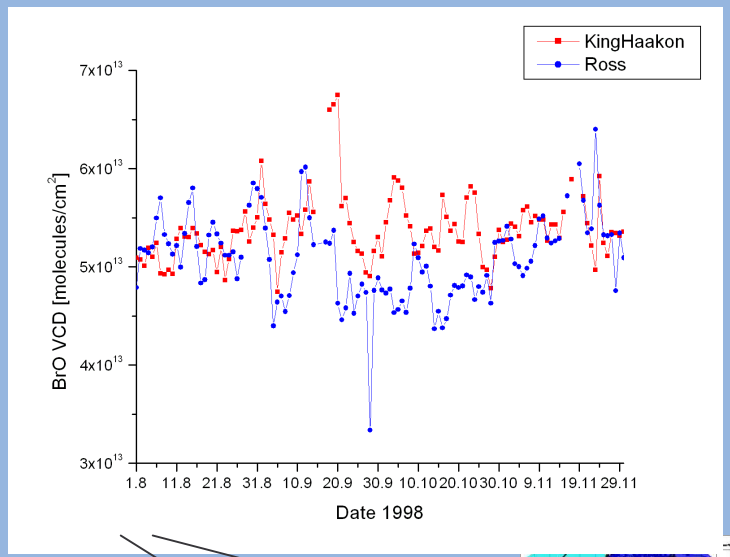

Ross Sea
BrO VCD [molecules/cm²]
Date (Aug-Nov)
1996
1997
1998
1999
2000
2001

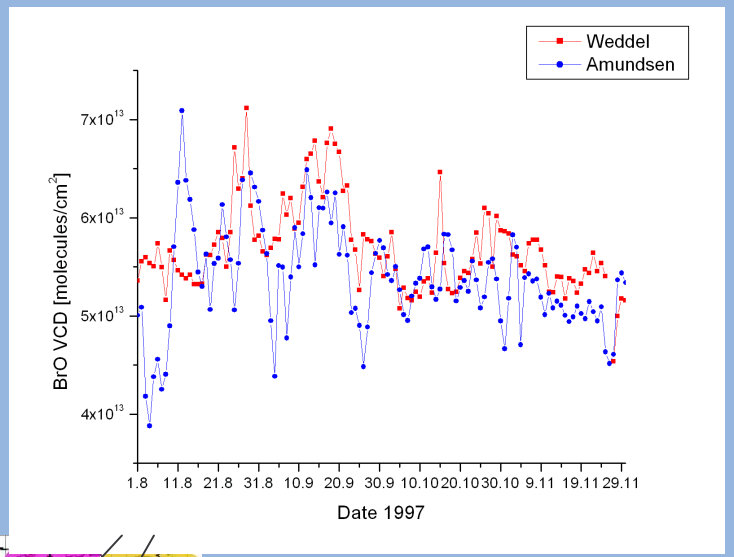

King Haakon Sea
BrO VCD [molecules/cm²]
Date (Aug-Nov)
1996
1997
1998
1999
2000
2001


Weddel Sea
BrO VCD [molecules/cm²]
Date (Aug-Nov)
1996
1997
1998
1999
2000
2001

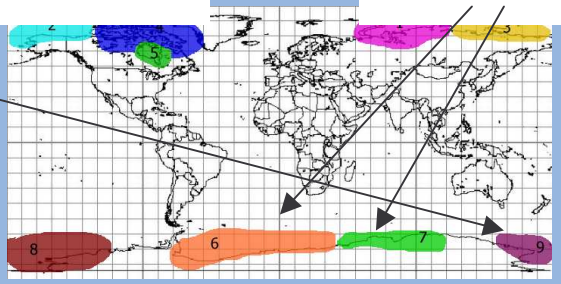

Amundsen Sea
BrO VCD [molecules/cm²]
Date (Aug-Nov)
1996
1997
1998
1999
2000
2001

Comparison of Time Series in Antarctic Regions





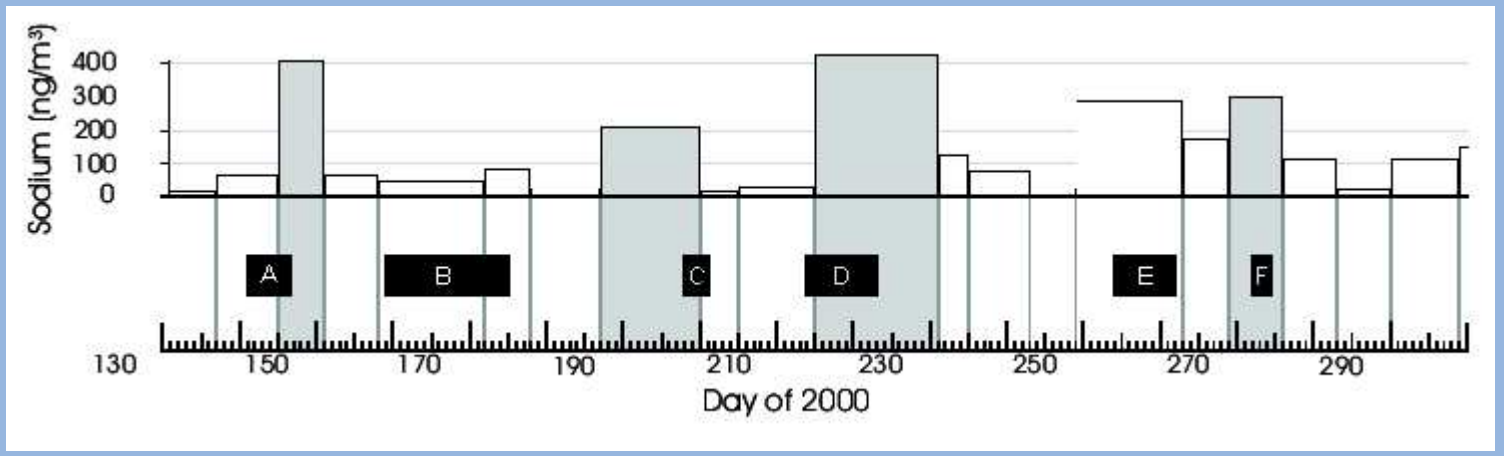
8+9



6+7

Frost Flowers as a possible source of BrO

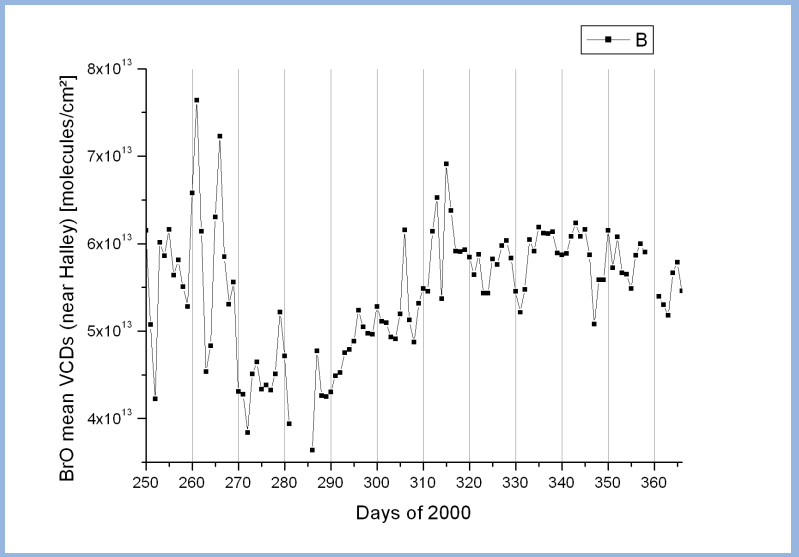
thanks to
A. Rankin
(BAS)
(QSCAT data)



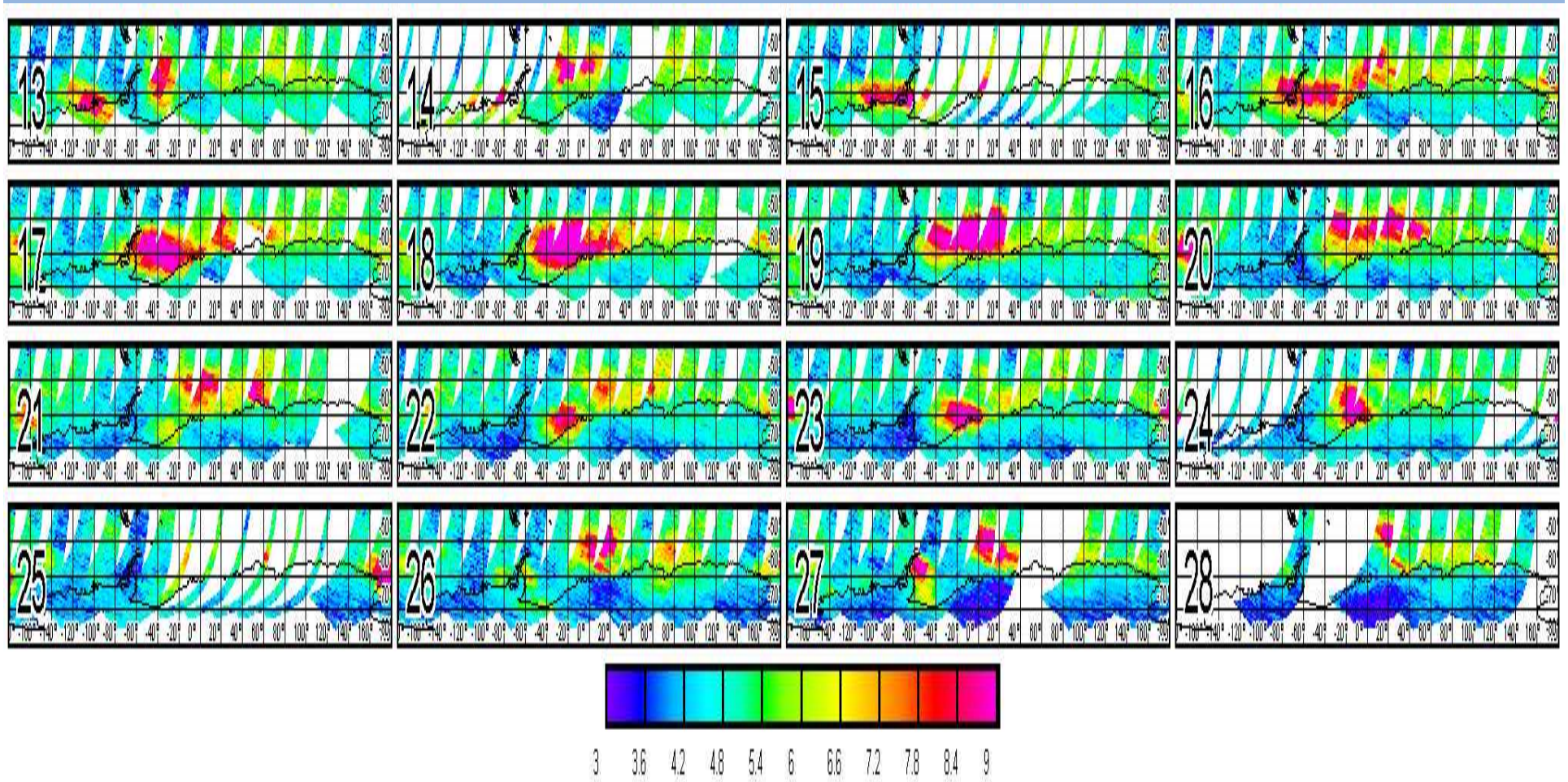
high BrO but no Frost Flowers at Sep, 17 (transport? 15.-21. Sept);

high BrO AND Frost Flowers at Sep, 22(! see also the peak at day 265/266);

low BrO but Frost Flowers at Sep, 26-28.



BrO near Halley Sept, 2000



Future Plans

- Can a stratospheric trend can be identified with GOME?
- Is the tropospheric trend correlated with a possible trend in the area covered with (one year old) sea ice or with changing meteorological parameters?
- What could be the reason for an increase in the area covered by BrO clouds?
- Can we identify transport?
- Are Frost Flowers really a source of BrO?

http://satellite.iup.uni-heidelberg.de

Dr. Thomas Wagner • Steffen Beirle • Nicolas Dross • Christian Frankenberg • Michael Grzegorski • Jens Hollwedel • Dr. Berit Kirchhoff • Muhammad Fahim Khokhar • Stefan Kraus • Sven Kühl • Suniti Shangavi • Christoph von Friedeburg • Dr. Walburga Wilms-Grabe