# Impact of L1v8 on total ozone retrievals.

C. Lerot, N. Theys and M. Van Roozendael (BIRA-IASB)

SQWG-3, PM #3 (DLR - Oberpfaffenhofen)

5-6 May 2015

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# Impact of L1v8



- One day per month analyzed with SDOAS for the entire mission.
- L1v8 vs L1v7
- Baseline: Full calibration including M-Factors, L1b-c extractor for L1v8 provided by DLR.

# Fit Residuals RMS

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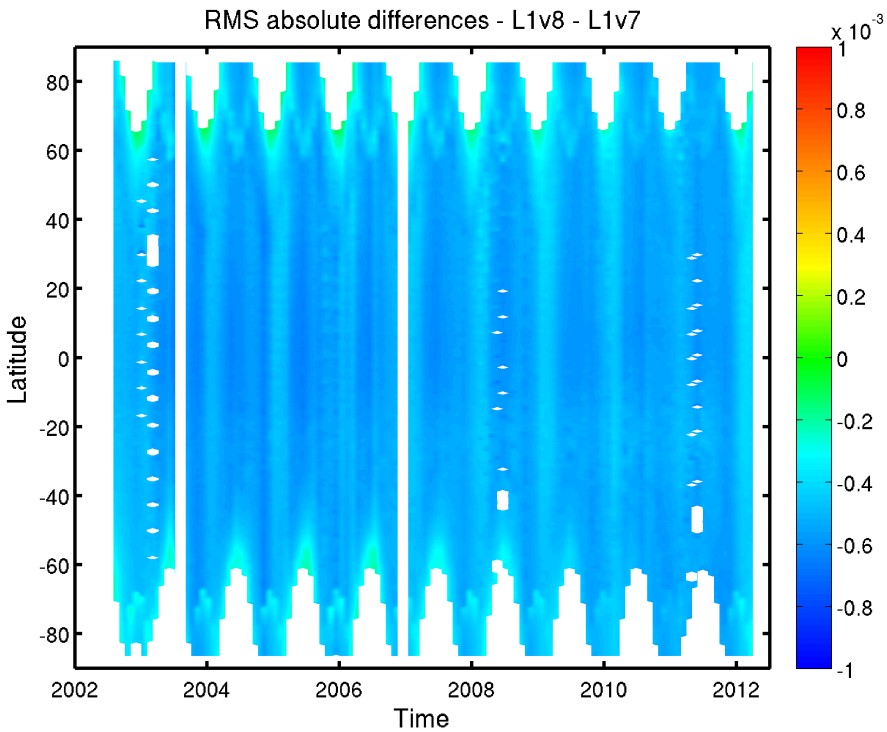


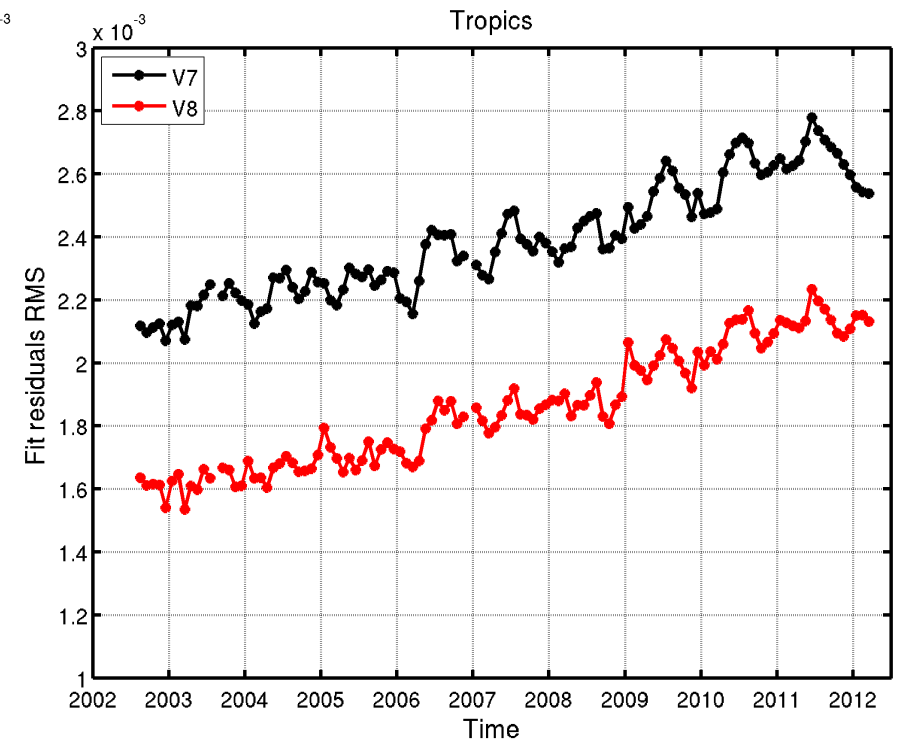


- Residuals significantly reduced with L1v8, as identified before in the verification data sets.
- Time dependence similar for the two versions.

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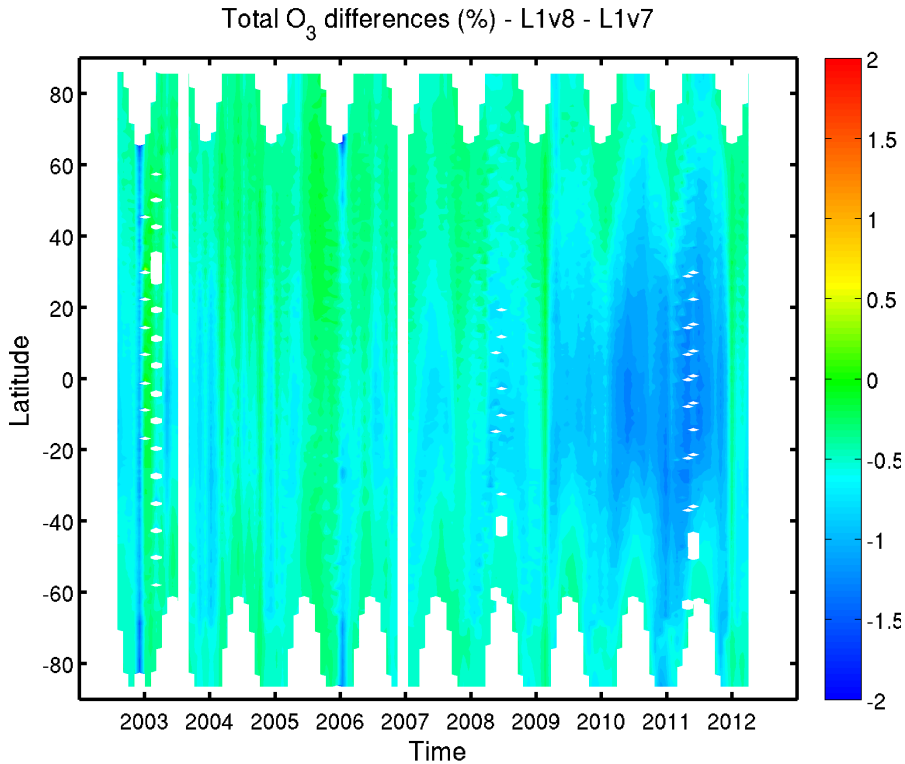
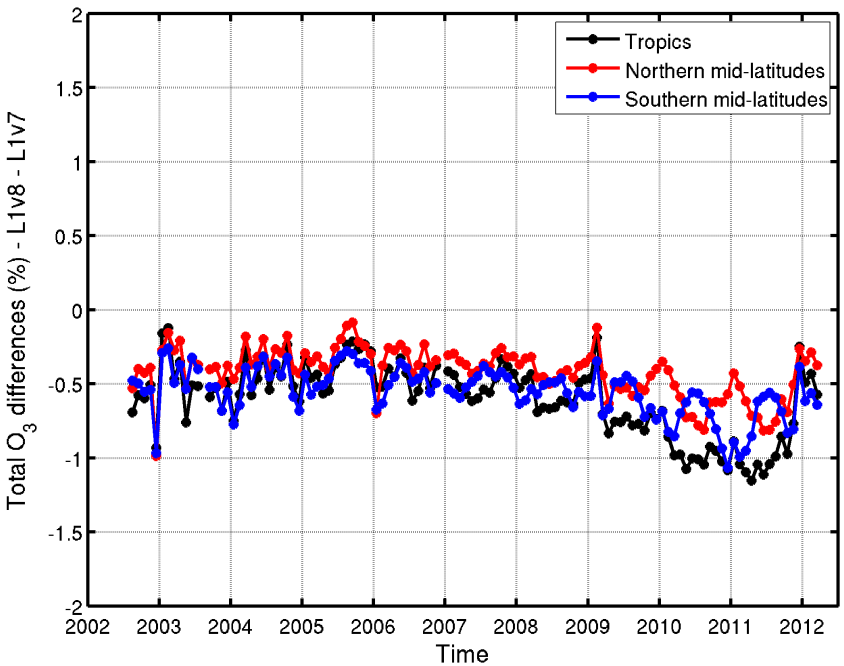
# Total ozone columns





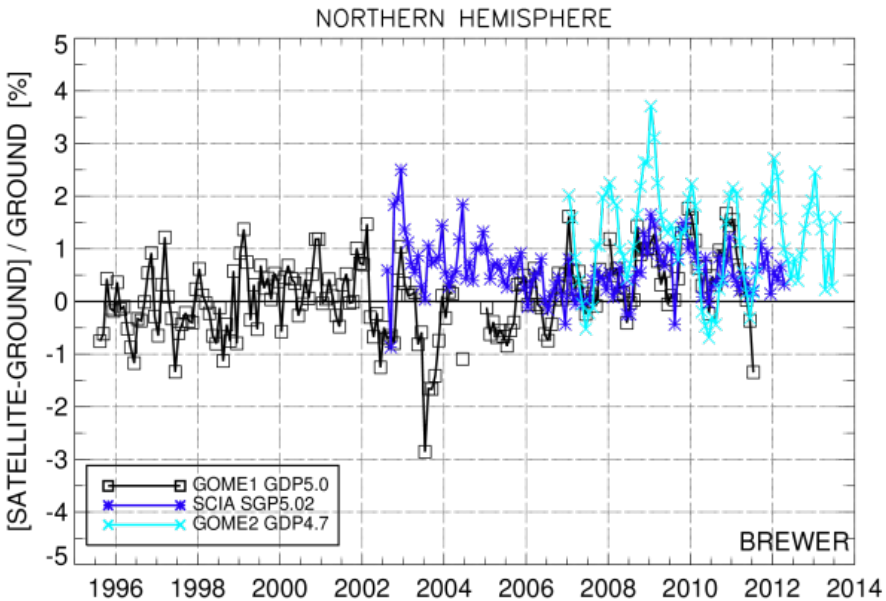



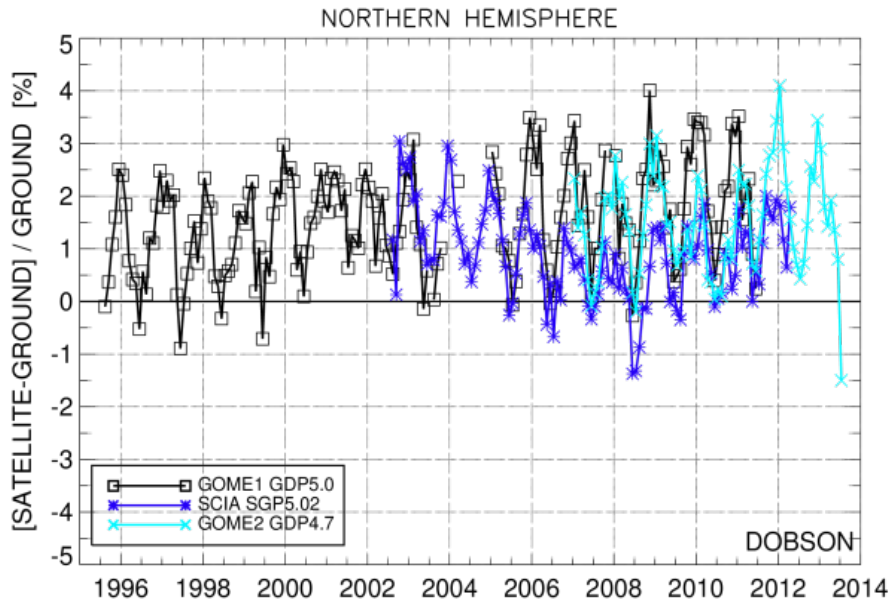

- The impact of the switch from L1v7 to L1v8 appears to be mostly a bias of ~-0.5%.
- Differences slightly increase after 2009 in Tropics.

# Total ozone columns: validation of SGP5.02



Courtesy of MariLiza Koukouli (AUTH, University of Thessaloniki)

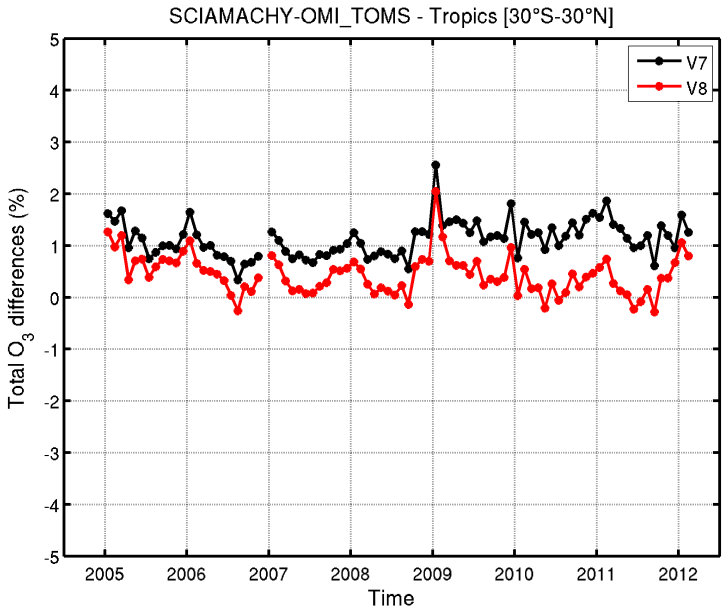


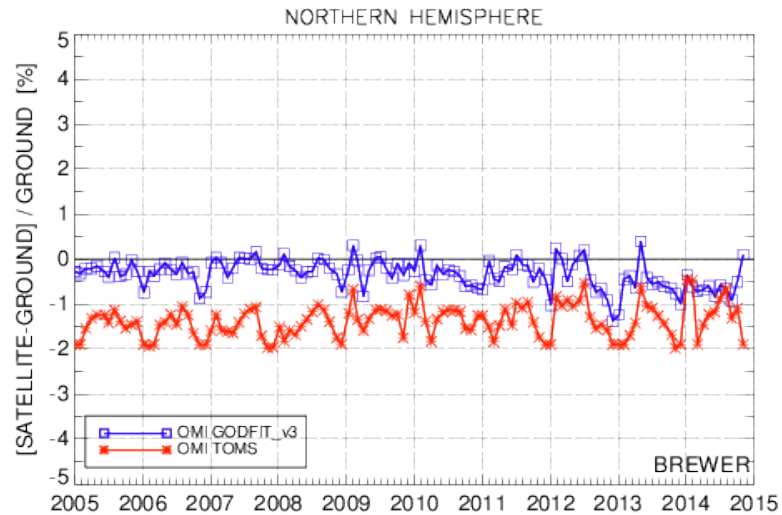



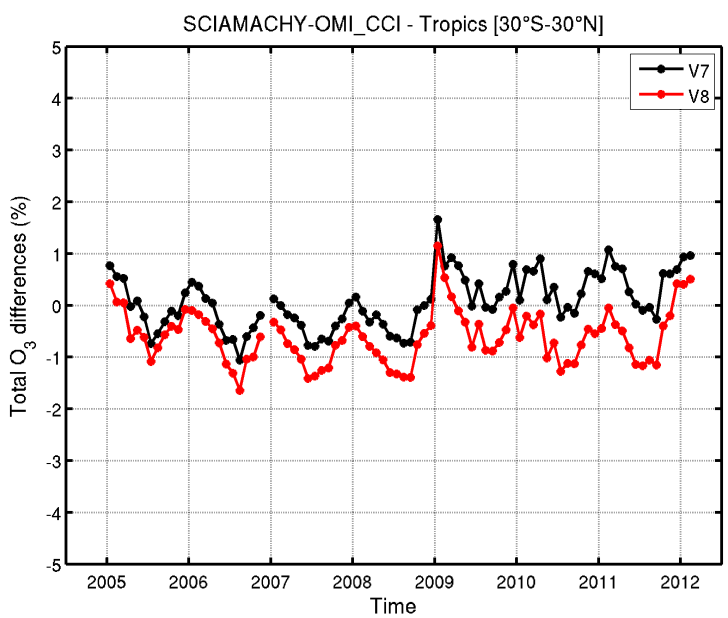

- Validation of operational products, including SGP5.02.
- Overall, SGP5.02 is of good quality.
- Relatively stable in time, with some small fluctuations in the range of 0.5%.
- Changes due to L1v8 are in the same of order of magnitude as current variability in SGP5.02.

# Comparisons with other space sensors in Tropics






- OMI total O3 products are very stable in time.
- SCIA-OMI differences are very similar for both L1 versions. Maybe very slightly more stable with L1v8 over the period 2005-2012?
- Validation might give another perspective.
- In any case, the impact of the new L1 is limited.

# Status of the tropospheric BrO product,

N. Theys, C. Lerot and M. Van Roozendael (BIRA-IASB)

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# Method developed for GOME-2

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*Theys et al., Global observations of tropospheric BrO columns using GOME-2 satellite data, ACP, 2011.*

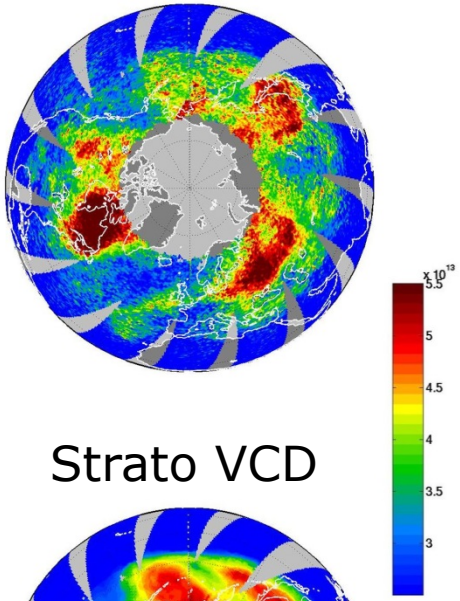
Already in SGP

$$VCD_{tropo} = \frac{SCD - VCD_{strato}.AMF_{strato}}{AMF_{tropo}}$$

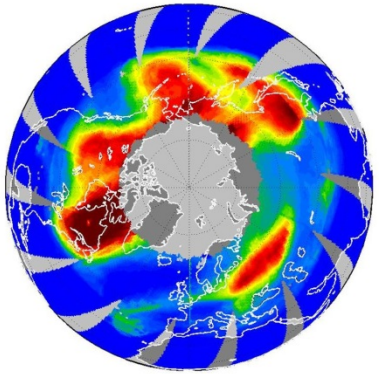
To be implemented

- **SCD:** DOAS fit in 332-359 nm (GOME-2) or in 336-351.5 nm (SCIA)
- **$VCD_{strato}$ :** stratospheric BrO climatology using parameterization based on
  1. $O_3$ VCD (proxy of the dynamics of the stratosphere)
  2. $NO_2$ stratospheric VCD (photochemistry)
- **AMF:** dependence on geometry, albedo, clouds, profile shapes

Total VCD




Strato VCD



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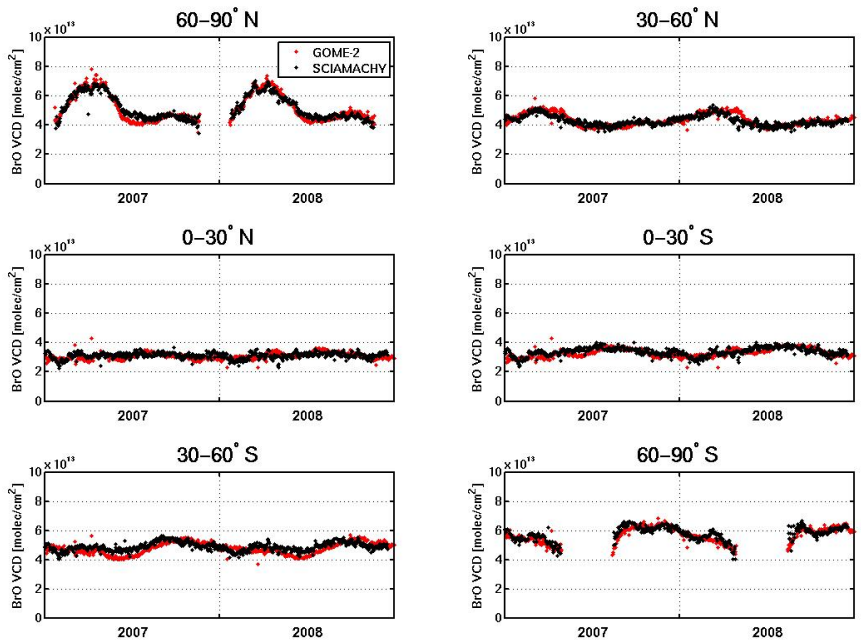
# Transfer to SCIAMACHY

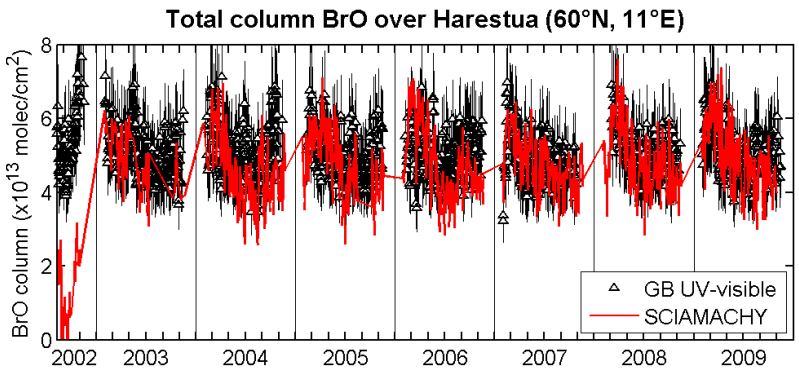


- Same algorithm applied to SCIAMACHY – main difference:DOAS fit in 336-351.5 nm (SQWG settings)
- Processing completed: 2003-2010 (for total columns), 2008 (for tropospheric columns, as a test year)
- Consistency check of invididual steps: completed

## 1. Total VCD (SCD/GeomAMF)

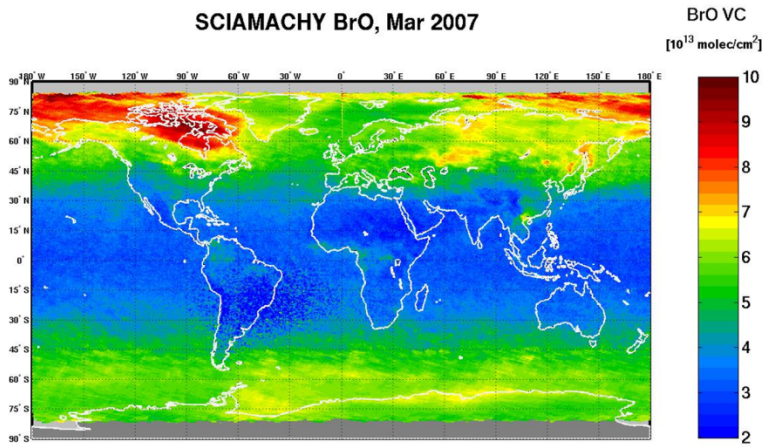


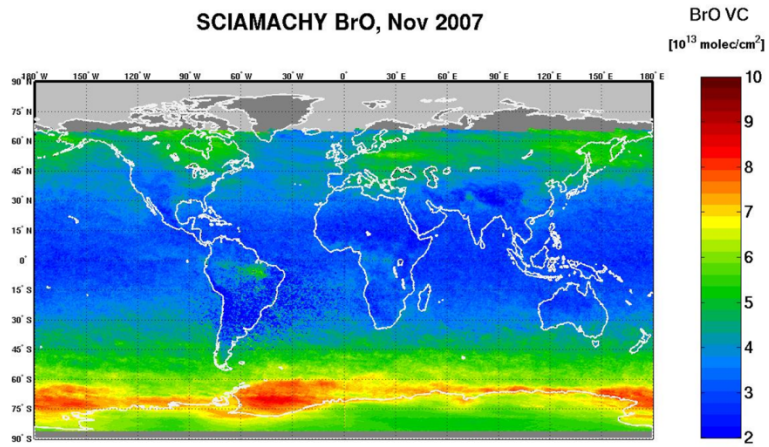

**Monthly zonal averages (SZA<80°)**

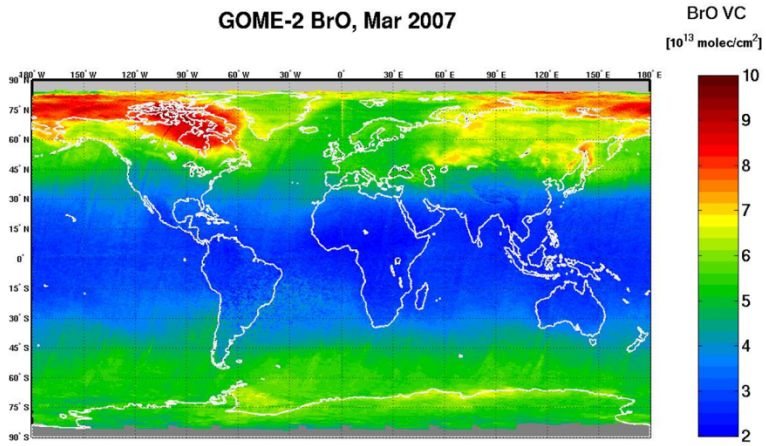


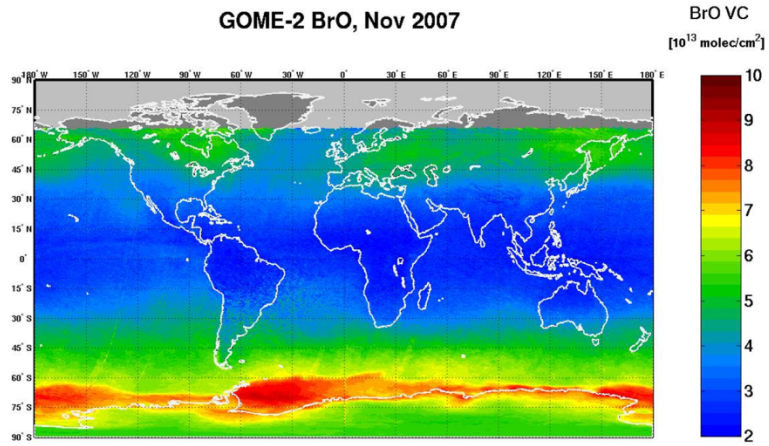

**Courtesy of F. Hendrick**

# 1. Total BrO VCD (SCD/GeomAMF)



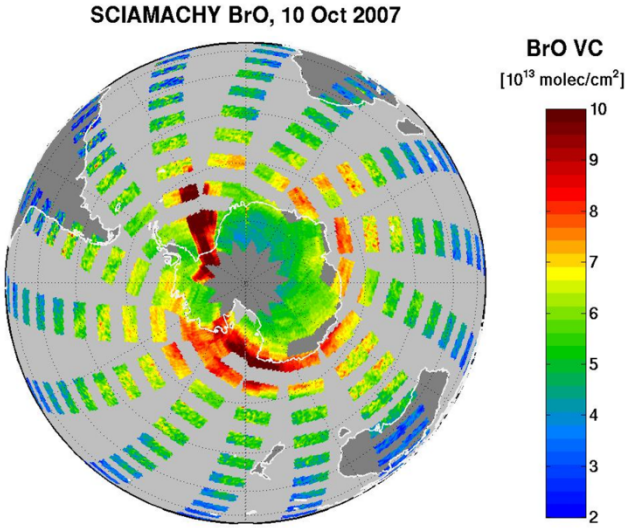



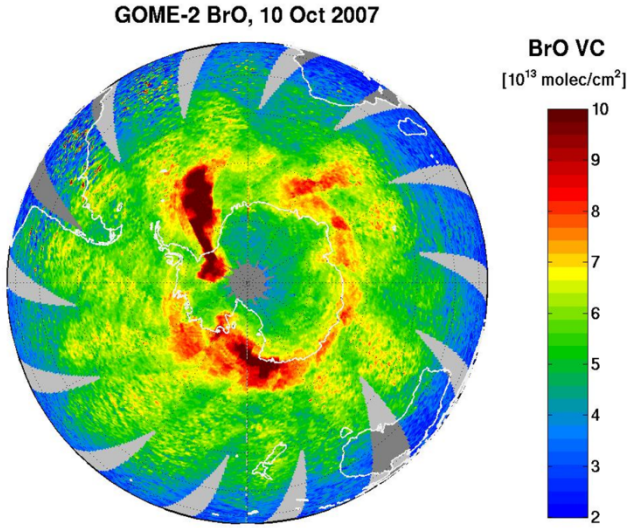



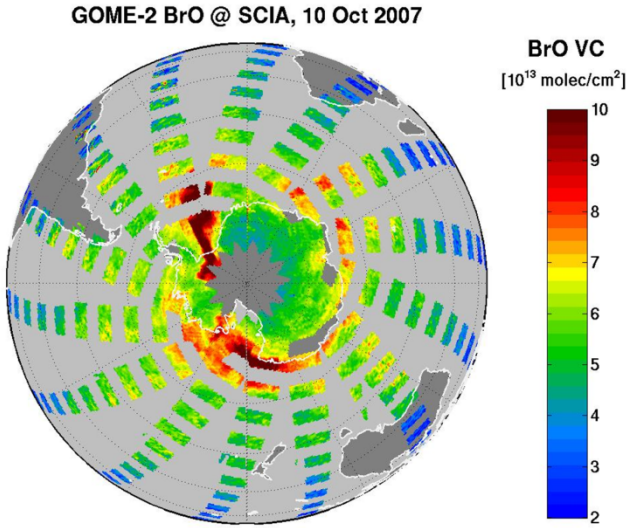



# 1. Total BrO VCD (SCD/GeomAMF)






=> Very good consistency

# 2. Stratospheric BrO VCD



- The stratospheric BrO correction consists in removing the stratospheric BrO $SCD^{strato}$ from the fitted SCD. $SCD^{strato} = VCD^{strato} \times AMF^{strato}$.
- The statospheric BrO profile required to calculate $VCD^{strato}$ and $AMF^{strato}$ is extracted from the stratospheric BrO climatology (<!> different from the version currently implemented in SGP).
- This climatology uses as input stratospheric O3 columns (as an indicator of the stratospheric dynamics) and stratospheric NO2 columns (as an indicator of the photochemical state of the atmosphere):

1. **O3 columns:** taken from the O3_CCI SCIAMACHY product. Data source is not important because the required accuracy (~10%) on the total O3 columns for the stratospheric BrO correction is always fullfilled.

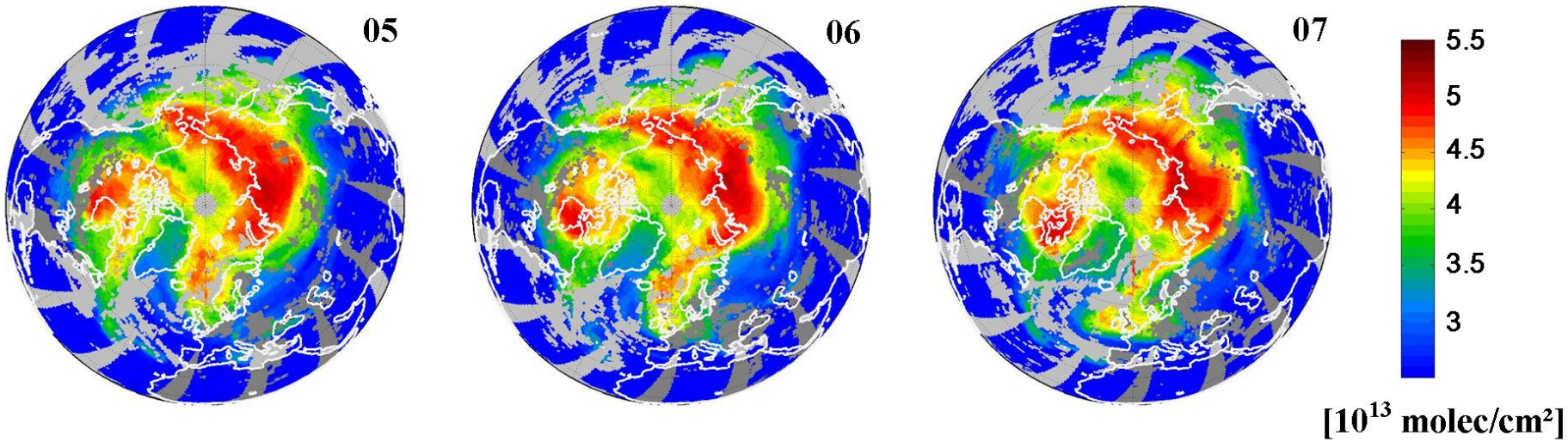
2. **NO2 columns:**

- GOME-2 (original work): the stratospheric NO2 column from the operational product is used (spatial filtering approach; Valks et al., 2011)

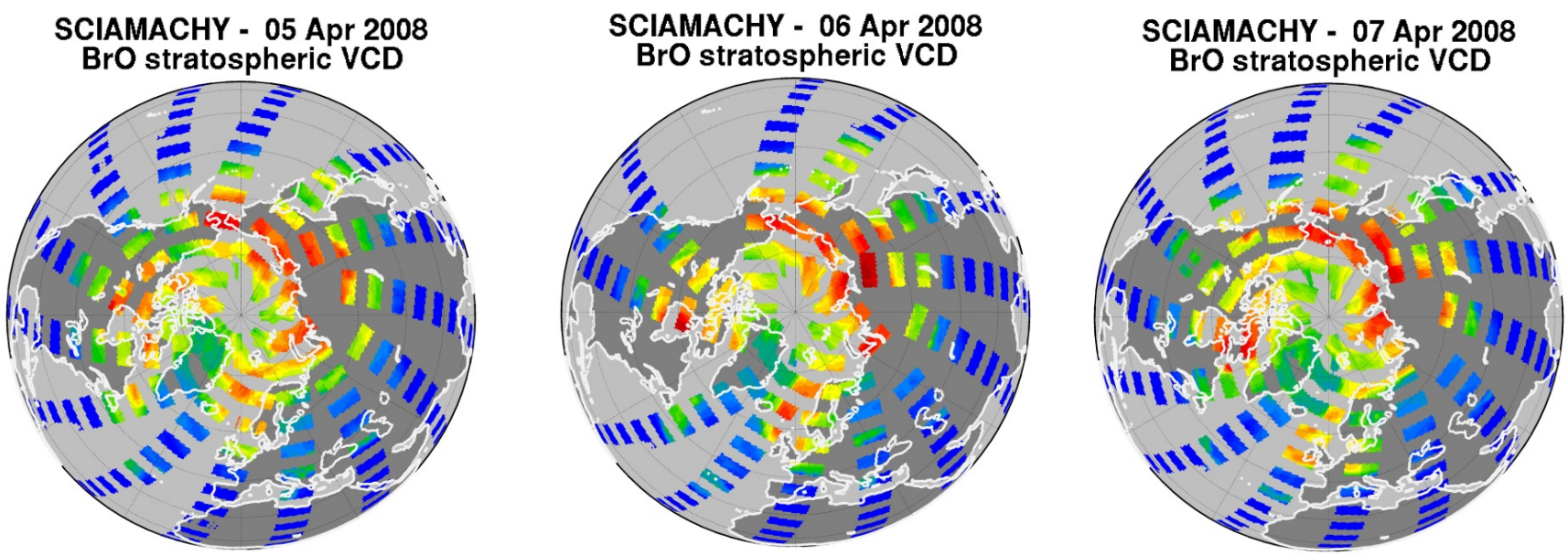
- SCIAMACHY: the stratospheric limb NO2 columns interpolated at the nadir states are used from two different sources: IUP-Bremen (A. Hilboll) and SGP (M. Meringer)

# Stratospheric BrO VCD

## April 2008

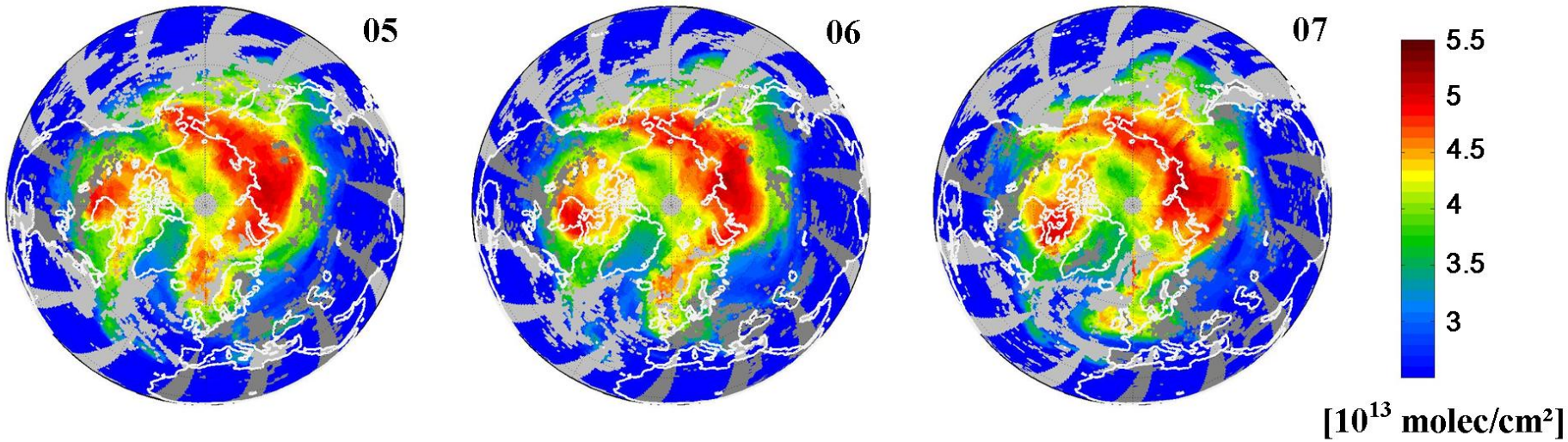



Limb IUP

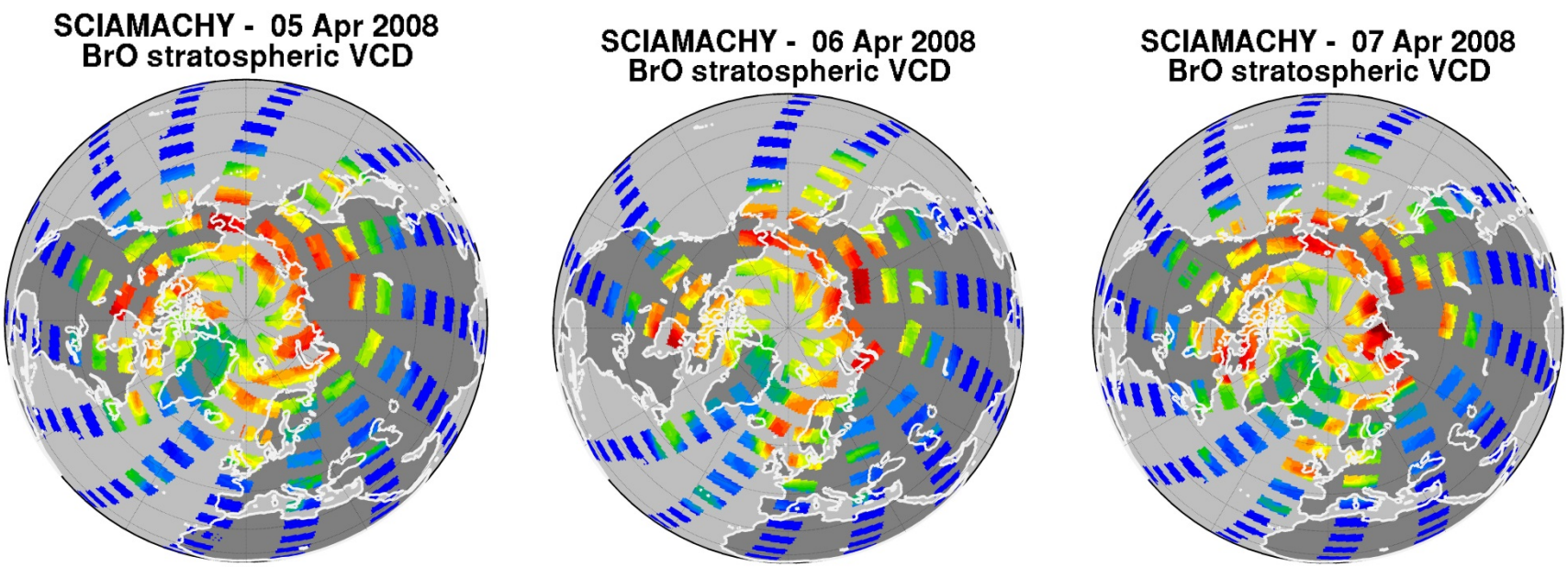


# Stratospheric BrO VCD

## April 2008




Limb SGP



# 3. Tropospheric VCD

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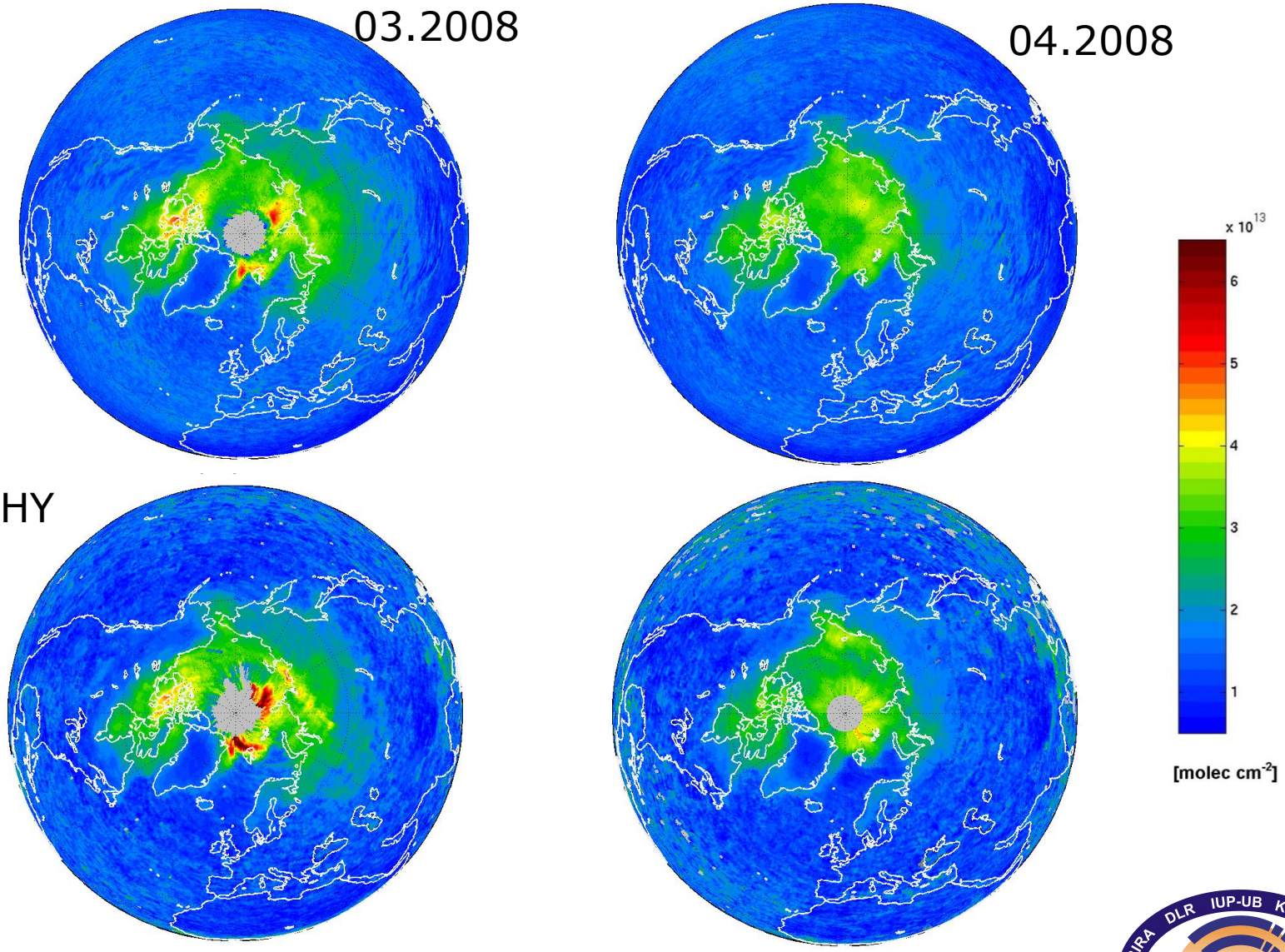
03.2008

04.2008

GOME-2

SCIAMACHY




Good overall consistency with SCIAMACHY

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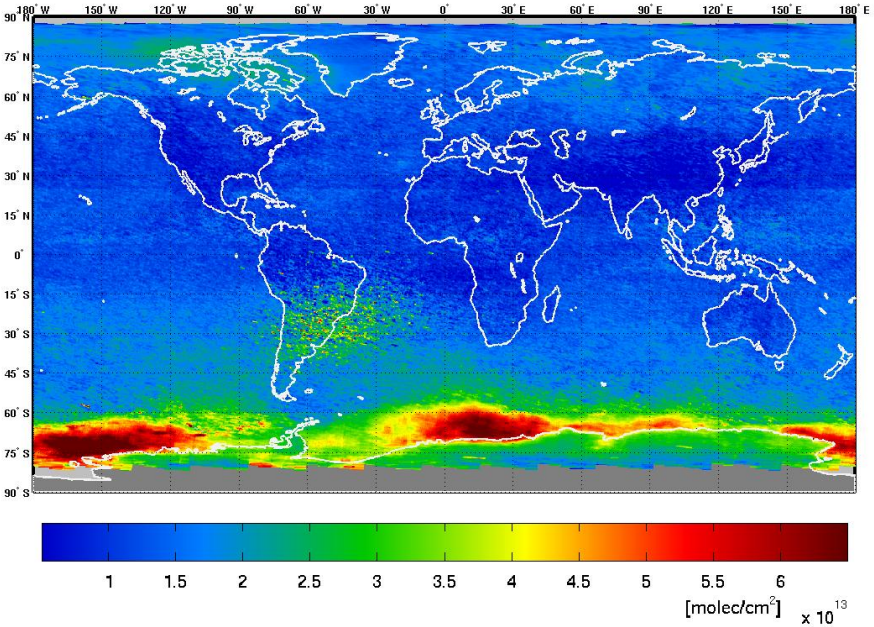
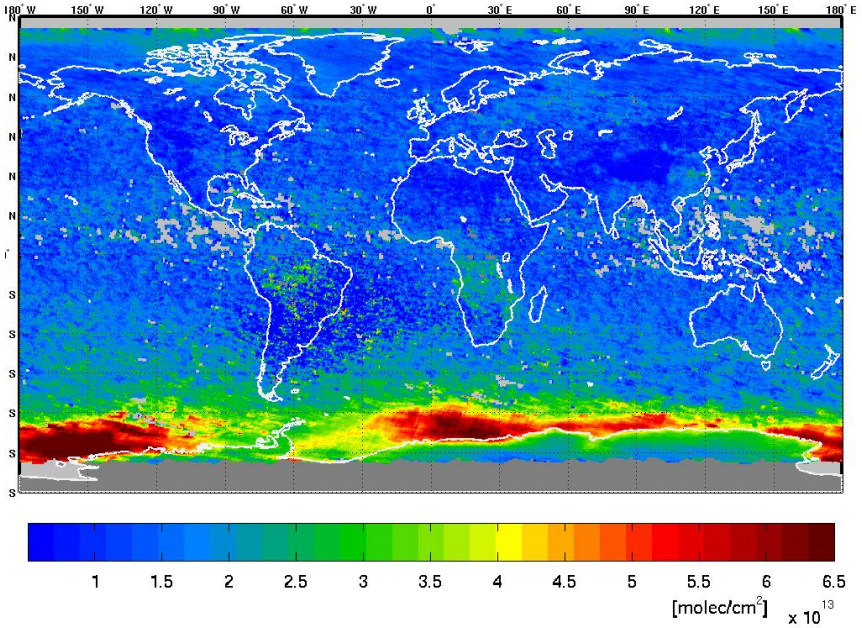
# 3. Tropospheric VCD



GOME-2 09.2008




SCIAMACHY 09.2008



# Outlook



- **Status:** transfer of the scientific algorithm to SCIAMACHY completed.
- **Future work:**
  - Support to implementation within SGP:
    1. Implementation and use of stratospheric BrO climatology.
    2. Calculation of $VCD^{strato}$ and $AMF^{strato}$ using the climatology.
    3. Calculation of $AMF^{tropo.}$
    4. Calculation of $VCD^{tropo}$.
  - Improvement of the algorithm in ozone hole conditions will be investigated. Any change needed for that will be related to the ancillary data and won't impact the implementation.
- **Note:** This product has to replace the current total BrO product. The total BrO column following the new approach results from the sum of $BrO^{strato}$ and $BrO^{tropo}$.