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Gridded vertical tropospheric NO$_2$ columns from GOME-2/MetOp-A

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This document describes the global gridded monthly vertical tropospheric NO$_2$ columns retrieved from the GOME-2 instrument onboard the MetOp-A platform, as described in *Hilboll et al. (2013b)*.

1 Version history

Version	Date	User	Summary of changes
4.2	2014-11-28	hilboll	- fix BUG in matching of FRESCO+v6 cld data
			- increase temporal resolution of B3dCTM
4.0	2014-07-31	hilboll	Initial public release

2 Dataset description

This dataset of tropospheric NO$_2$ columns is based on the retrieval of trop. NO$_2$ columns which is described in *Richter et al. (2005)*, applied to the measurements by the GOME-2 instrument onboard MetOp-A.

For this version of the tropospheric NO$_2$ column dataset, the stratospheric correction was performed using the *Bremen 3D CTM* (*Sinnhuber et al. (2003a, 2003b)*), using the interpolation scheme described in *Hilboll et al. (2013a)*. The temporal resolution of the model was 200s and 600s for chemistry and transport, respectively.

All measurements are aggregated to monthly averaged 0.0625° grids. The conversion to vertical tropospheric column densities has been carried out analogously to *Hilboll et al. (2013b)*:

Tropospheric air mass factors (AMFs) have been calculated with the radiative transfer model SCIATRAN (*Rozanov et al., 2005*). The vertical distribution of tropospheric NO$_2$ has been taken from a climatology of NO$_2$ mixing ratios from the MOZART2 model (*Horowitz et al., 2003*), and surface spectral reflectance from GOME measurements (*Koelemeijer et al., 2003*). Both aspects are explained in detail in *Nüß (2005)*. The AMFs have then been spatially interpolated to a 0.125° grid. Measurements

with a cloud coverage exceeding 20% have been filtered out using the FRESCO+ algorithm (version 6; *Wang et al., 2008*). Additionally, we applied an intensity filter to discard scenes with very large surface reflectivity. This is necessary as the used albedo or surface spectral reflectance climatology (*Koele-meijer et al., 2003*) does not account for short-term changes in reflectivity for example from snow; in addition, the FRESCO+ cloud fractions have large uncertainties over bright surfaces.

3 Data availability and format

This dataset can be downloaded as monthly aggregated HDF4 files from the DOAS-group @ IUP-UB's website, as annually aggregated `*.zip` files. The HDF4 files can be read, e.g., using the GDAL library.

4 Example

VCD_{trop} NO$_2$ GOME-2/MetOp-A 2011-08 (v4.2)

VCD NO$_2$ [10^{14} molec cm^{-2}]
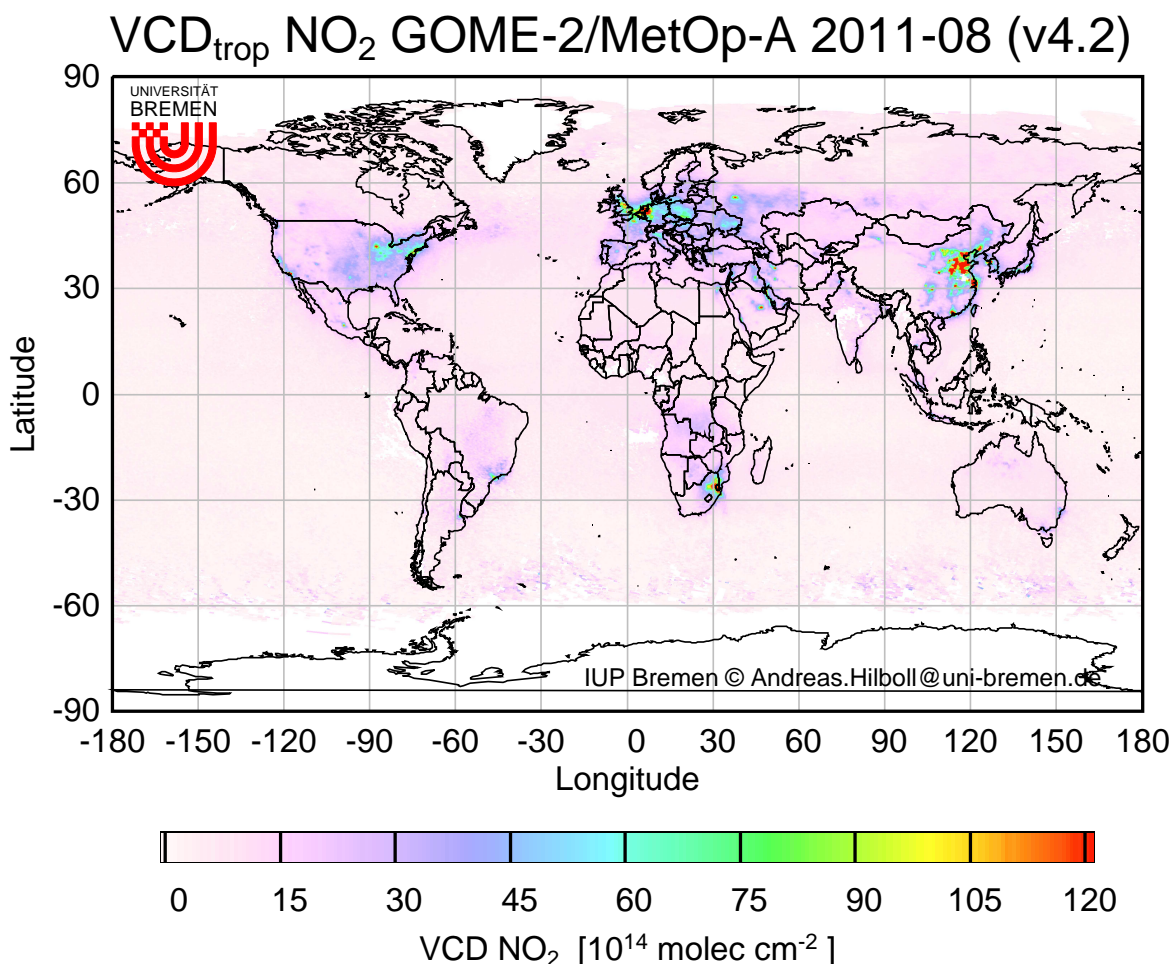
5 Terms of use

These data are produced at the University of Bremen and are not official EUMETSAT data products. We ask people who wish to use our data

- to keep us involved in the project and to discuss relevant findings with us

- not to pass on the data without our approval

- to clearly identify the data source in any presentation using the data by giving reference to *Hilboll et al., 2013b*, and to clearly state the data version *v4.2*.

- should the GOME-2 data be a substantial part of a publication, we would like to be asked to be co-authors. This is of course a matter that needs to be discussed for each individual case.

6 Acknowledgements

7 References

- Hilboll A, Richter A, Rozanov A, Hodnebrog Ø, Heckel A, Solberg S, Stordal F, Burrows JP: **Improvements to the retrieval of tropospheric NO2 from satellite – stratospheric correction using SCIAMACHY limb/nadir matching and comparison to Oslo CTM2 simulations**, *Atmos. Meas. Tech.*, **6**, 565–584, `10.5194/amt-6-565-2013`, 2013a.

- Hilboll A, Richter A, Burrows JP: **Long-term changes of tropospheric NO$_2$ over megacities derived from multiple satellite instruments**, *Atmos. Chem. Phys.*, **13** (8), 4145-4169, `10.5194/acp-13-4145-2013`, 2013b.

- Horowitz LW, Walters S, Mauzerall DL, Emmons LK, Rasch PJ, Granier C, ... Brasseur GP: **A global simulation of tropospheric ozone and related tracers: Description and evaluation of MOZART, version 2**, *J. Geophys. Res.*, **108** (D24), 4784, `10.1029/2002JD002853`, 2003.

- Koelemeijer RBA, de Haan JF, Stammes P: **A database of spectral surface reflectivity in the range 335–772nm derived from 5.5 years of GOME observations**, *J. Geophys. Res.*, **108** (D2), 4070, `10.1029/2002JD002429`, 2003.

- Nüß JH: **Improvements of the retrieval of tropospheric NO$_2$ from GOME and SCIAMACHY data**, PhD thesis, Universität Bremen, Bremen, 2005.

- Richter A, Burrows J P, Nüß H, Granier C, Niemeier U: **Increase in tropospheric nitrogen dioxide over China observed from space**, *Nature*, **437** (7055), 129-132, `10.1038/nature04092`, 2005.

- Rozanov A, Rozanov VV, Buchwitz M, Kokhanovsky AA, Burrows JP: **SCIATRAN 2.0 - A new radiative transfer model for geophysical applications in the 175-2400 nm spectral region**, *Adv. Space. Res.*, **36** (5), 1015-1019, `10.1016/j.asr.2005.03.012`, 2005.

- Sinnhuber BM, Weber M, Amankwah A, Burrows JP: **Total Ozone during the Unusual Antarctic Winter of 2002**, *Geophys. Res. Lett.*, **30**, (11), 1580-–1584, `10.1029/2002GL016798`, 2003a.

- Sinnhuber M, Burrows JP, Chipperfield MP, Jackman CH, Kallenrode M-B, Künzi KF, Quack M: **A Model Study of the Impact of Magnetic Field Structure on Atmospheric Composition during Solar Proton Events**, *Geophys. Res. Lett.*, **30** (15), 1818—1821, `10.1029/2003GL017265`, 2003b.

- Wang P, Stammes P, van der A RJ, Pinardi G, van Roozendael M: **FRESCO+: an improved O2 A-band cloud retrieval algorithm for tropospheric trace gas retrievals**, *Atmos. Chem. Phys.*, **8** (21), 6565-6576, `10.5194/acp-8-6565-2008`, 2008.