Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 4, 1913-1924, 2004
www.atmos-chem-phys.net/4/1913/2004/

Highly resolved global distribution of tropospheric NO_2 using GOME narrow swath mode data

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Abstract. The Global Ozone Monitoring Experiment (GOME) allows the retrieval of tropospheric vertical column densities (VCDs) of NO_2 on a global scale. Regions with enhanced industrial activity can clearly be detected, but the standard spatial resolution of the GOME ground pixels (320x40km^2) is insufficient to resolve regional trace gas distributions or individual cities. Every 10 days within the nominal GOME operation, measurements are executed in the so called narrow swath mode with a much better spatial resolution (80x40km^2). We use this data (1997-2001) to construct a detailed picture of the mean global tropospheric NO_2 distribution. Since - due to the narrow swath - the global coverage of the high resolution observations is rather poor, it has proved to be essential to deseasonalize the single narrow swath mode observations to retrieve adequate mean maps. This is done by using the GOME backscan information.

The retrieved high resolution map illustrates the shortcomings of the standard size GOME pixels and reveals an unprecedented wealth of details in the global distribution of tropospheric NO_2. Localised spots of enhanced NO_2 VCD can be directly associated to cities, heavy industry centers and even large power plants. Thus our result helps to check emission inventories.

The small spatial extent of NO_2 "hot spots" allows us to estimate an upper limit of the mean lifetime of boundary layer NO_x of 17h on a global scale.

The long time series of GOME data allows a quantitative comparison of the narrow swath mode data to the nominal resolution. Thus we can analyse the dependency of NO_2 VCDs on pixel size. This is important for comparing GOME data to results of new satellite instruments like SCIAMACHY (launched March 2002 on ENVISAT), OMI (launched July 2004 on AURA) or GOME II (to be launched 2005) with an improved spatial resolution.

Final Revised Paper (PDF, 1446 KB) Discussion Paper (ACPD)

Citation: Beirle, S., Platt, U., Wenig, M., and Wagner, T.: Highly resolved global distribution of tropospheric NO_2 using GOME narrow swath mode data, Atmos. Chem. Phys., 4, 1913-1924, 2004. Bibtex EndNote Reference Manager