Atmos. Chem. Phys. Discuss., 3, S1600–S1602, 2003
www.atmos-chem-phys.org/acpd/3/S1600/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Weekly cycle of NO_2 by GOME measurements: A signature of anthropogenic sources" *by* S. Beirle et al.

S. Beirle et al.

Received and published: 25 September 2003

We thank M. Schultz for his positive assessment of this study and his constructive comments. He gave some helpful suggestions for technical correction and reformulated some sentences that we thankfully followed. The major topics of the reviews (error analysis, seasonal dependency and lifetime estimation) are addressed in our AC General remarks.

Reply concerning specific aspects:

GOME pixel size The size of the GOME pixels is the most crucial limitation for the study of individual Metropolises. Therefore we think it is necessary to mention it in the introduction as well as to discuss it in the retrieval section.

Weekly Cycle of Cloud cover Over Germany, the mean cloud cover is 0.450 on weekdays and 0.457 on Sundays. The weekday cloud covers vary between 0.431 and 0.479

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

with a standard deviation of 0.018. Especially the finding that for Germany the day with the highest cloud cover shows no abnormal features in the NO2 VCD gives us confidence that the influence of cloud cover of our study is negligible. This is also true for the US where we found no enhancement of cloud cover on Sundays.

Error estimates See General remarks. The quantitative comparison of e.g. the USA and Europe is quite complex. Figure 3 obviously can only display a set of representative locations. The selected cities were chosen to demonstrate the impact of the weekend effect, but also to give a representative figure of our results: the weekly cycle is clearly observable in every large city in the USA, while there are exceptions in Europe (Essen). A comparison between the cities in the US and Europe would crucially depend on the set of chosen cities.

Cultural differences Our discussion of cultural differences is naturally incomplete, and is meant to provoke a scientific exchange. We thank M. Schultz for his input and expanded this section in the revision.

Major holidays The addition of major holidays is indeed a very good idea. Nevertheless, the statistical analysis of single holidays like Easter, Thanksgiving or Christmas with GOME fails due to the low data coverage. (at a given location there are on average only 2 measurements (6 year period) on one specific day like Easter Monday)

The GOME track effect We believe that the quite high Sunday values for Essen (Fig 2), which are contradictory to the quite large reduction for Western Germany (Fig. 3), can be explained by the GOME track: the Sunday tracks tend to measure the Ruhr area and Benelux at the same time, similar to the Tuesday tracks.

Lifetime estimation See General remarks.

The inversion of the problem is a very good idea. However, we tend to keep this exemplary study as it is and expand the determination of the lifetime of NO2 for different locations and seasons in a future study. The inversion, though, cannot be performed

ACPD

3, S1600–S1602, 2003

without any assumptions (or data) about emissions. Since GOME measures every day at 10:30 local time, no information on the daily cycle can be retrieved. So at least the shape of the diurnal cycle has to be assumed in an inversion study.

Profile We now clarify in the retrieval section that we assume a constant NO2 profile for our retrieval. This does not affect our results as long as the profile shape is independent on the day of week.

Figure 2 Figure 2 contains some redundant information. Nevertheless, having one plot each day holds information about the normal day to day variation of NO2 VCD. This illustrates the impact of statistic and systematic errors. Especially the influence of the GOME track could not be visualized in an average image. The deviations from the mean are shown in Figure 3, so Figure 2 displays absolute values to provide additional information. Though, we seize the suggestion (to compare only Sunday and week-day means) for the additional plot, showing the weekend effect for winter and summer separately.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 3451, 2003.