

Interactive comment on “Weekly cycle of NO₂ by GOME measurements: A signature of anthropogenic sources” by S. Beirle et al.

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General comments

Basically it is a good idea to search for those features like the weekly cycle of NO_x within GOME data and use this observation to estimate the lifetime of NO_x in the troposphere. Nevertheless the promised scientific goals are only partly achieved by the used methods.

A distinction between anthropogenic and biogenic emissions is only possible if the main fraction of the anthropogenic emissions follow this weekly pattern. The distinction is based on a statistic method: With a global covering every tree days by GOME a particular place will be measured at a particular day of the week roughly 17 times a year - if there are no clouds. Therefore the determination of the source type for a given

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area is only possible on a large time scale. Furthermore seasonal variations can't be detected.

A comparison with biogenic source regions is missing.

The estimation of the lifetime of NO₂ in the atmosphere requires knowledge on transport, emission and weather conditions. Only for the transport a coarse approximation is made.

Specific issues and technical corrections

1 Introduction: "The estimation of the strength of different NO₂ sources ..." Roughly 90% of NO_x is emitted as NO therefore please use NO_x instead of NO₂.

3 Weekly cycle of tropospheric NO₂ VDC: "The absence of a weekend effect in our data probably indicates that the Chinese NO₂ emissions are dominated by power plants and heavy industry, operating throughout the week. On the other hand, in the US and Europe individual transport appears to contribute significantly to the NO_x sources." Wickert (2001) p.71: The plot shows that the contribution of individual transport to the weekly cycle is of minor importance compared to the variation in emissions by industry and power-supply.

4. Lifetime estimation: "Since the main source regions are located in the western part of Germany and the main wind direction is eastwards, the emitted pollutants remain within the area for at least one day. (A mean wind velocity of approx. 5 m/sec corresponds to a daily transport of 432 km, whereas the east-west extension of Germany is about 700 km.)" A mean value of wind speed describes the conditions of transport not sufficient. The removal of NO_x at higher wind speed is not compensated by a longer dwell time at lower wind speed since of the fast chemical degradation of NO_x. With the high NO₂ concentrations in west Europe (figure 4) the speed of the (main) westerly wind has a large effect on the NO_x concentration by transport.

"Therefore the lifetime of NO₂ in the troposphere can be roughly estimated." This is

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possible if transport and emissions are known. Furthermore the lifetime depends on chemical degradation and deposition i.e. actinic flux and humidity. Both parameters are highly variable in time.

"This helps to discriminate manmade from natural sources (...) and assess the contribution of local traffic to the NO_x sources." A comparison with natural sources is missing. A study on time dependency of biogenic sources is needed.

Figures 3 and 5: Type of the scale remains unclear: It is neither linear nor logarithmic. The chosen scale type amplifies the weekend effect. In a linear scale the weekend effect is as prominent as higher values at some working days. Particularly figure 5 (and partly figure 3): To which value the scale is normalized? None of the plots shows a mean value of 1.

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