Atmos. Chem. Phys. Discuss., 2, S524–S527, 2002
www.atmos-chem-phys.org/acpd/2/S524/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Analysis of a summer smog episode in the Berlin-Brandenburg region with a nested atmosphere - chemistry model" *by* S. E. Bauer and B. Langmann

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Received and published: 21 October 2002

We thank the reviewer for his comments on our paper. He asked mainly for a more clear description of the meteorological simulation and it's impact on the quality simulated chemical trace species. Further, the reviewer raised different points that should be clarified or discussed in more detail in the paper. We used his helpful comments to improve the paper and together with this comment we hope to address all his questions.

Meteorological simulation:
We do agree that a detailed description of the weather situation that occurred during the simulated episode is important to understand the pollution event. But please notice that



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Table 1: Observed Maximum Heights of the Mixing Layer in [m]

| | 23.7 | 24.7 | 25.7 | 26.7 | 27.7 |
|---|---|---|---|---|---|
| Lindenberg | 2800 | 2900 | 3800 | 2800 | 2300 |
| Kremmen | 3200 | 3000 | 3300 | - | 2300 |

the weather condition is already described in detail in an additional model validation paper (Bauer and Langmann, 2002).

The high mixing height that have been observed in about 3000 m height have been reported from radio sonde measurements from the meteorological observation stations Lindenberg and Kremmen (Stark et al. 1995). Table 1 summarizes observed maximum mixing heights at station Lindenberg and Kremmen as analysed by Stark et al. 1995. Before the 23$^{\mathrm{rd}}$ the planetary boundary height extended to a height of approximately 3000 m. Between the 23$^{\mathrm{rd}}$ and the 26$^{\mathrm{th}}$ the maximum observed planetary boundary height increased up to 3300 m, and locally up to 3800 m. After the 26$^{\mathrm{th}}$ the maximum mixing height decreased again reaching up to 2000 - 2300 m altitude.
The reviewer mentioned that overestimation of mixing heights with the model could further explain the simulated underestimation of ozone concentrations. GESIMA simulates daily maximum mixing height between 2000 and 3000 m and REMO between 2000 and 2500 m, with higher mixing heights during the first days and lower mixing heights after the 26$^{\mathrm{th}}$. The planetary boundary height is generally underestimated in both models. Thus the slightly underestimated mixing height can not explain the underestimated rural ozone concentrations.
For more detailed discussion of the meteorological simulation see Bauer and Langmann (2002).

The reviewer commented on our choice of the three areas we defined to discuss the



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NOx/VOC regimes in the model simulation. We classified the following three regimes: urban, rural and total domain. The reviewer criticized that the results of the total domain depend on the extension of the model domain.
In this study we draw conclusions about air chemistry in Berlin Brandenburg. This area is made up of the city of Berlin and a rural environment. We think that the results from the total domain are interesting to understand how this two extremes (urban and rural conditions) interact. As a matter of course this result than only is valid for the region of Berlin Brandenburg but that is what we are discussing in the paper.

The reviewer asked which recommendations we would give regarding emission control strategies. Our study showed, that during summer smog conditions with strong solar radiation, high temperatures and weak near surface wind velocities, other ozone concentration determining factors than local anthropogenic emissions, like transport and biogenic ozone precursors are becoming very important. However the anthropogenic emissions are the only variable that can be addressed by emission control strategies, because we do not want to advice deforestation. Therefore to achieve any influence on summer smog anthropogenic $NO_x$ emission need to be reduced dramatically and over a wide area. For example to reduce ozone concentrations during that episode, emissions should have been reduced at least German wide. But to give more precise information about potential emission control strategies further model studies are necessary.

The reviewer was asking where the ozone plume we showed in Fig. 2 where originating from: As the formation of an ozone plume is always depending on the distribution of the precursor species, the local wind regime and the composition of the transport airmass we will give here a description of that specific day to answer the question: Tuesday, July 26, belongs to the *episode II* category. The atmosphere over Berlin-Brandenburg is more highly polluted than during *episode I*. During that day the distributions of the pollutants is strongly influenced by the changing wind direction which occurred during



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that day. The predominant wind direction is easterly during the night. In the morning ozone is completely destroyed close to and downwind of Berlin and the motorways. Some hours later strong local gradients in ozone concentrations have developed. The southerly component of the wind direction increases in the eastern part of the domain, while in the western part the wind comes from the western direction. In between this convergence zone high concentrations of ozone precursor occur initializing high ozone concentrations. A narrow band of high ozone concentrations is formed which is advected across Berlin during that day.

***References***

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