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Comment

Interactive comment on “Tropospheric ozone climatology over Beijing: analysis of aircraft data from the MOZAIC program” by A. J. Ding et al.

Anonymous Referee #1

Received and published: 25 July 2007

This paper provides an interesting climatology of ozone profiles above Beijing using 10 years of MOZAIC data. The topic is appropriate for ACP and the findings will be of great interest to researchers studying the impact of China’s industrial boom on the country’s air quality. However, I have several concerns that need to be addressed, upon which the paper could be published in ACP.

Specific Comments

The overall effect of the pooled statistical analysis is to provide equal weight to each group regardless of the sample size. This is only an effective approach if each group contains enough measurements to yield a truly representative sample size. I am concerned that the sample sizes of some groups may be inadequate. Ozone is so variable

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that you need at least 20 profiles in a given month to produce a mean that is reliable within +/- 15 % for the extratropical mid-troposphere, according to: Logan, An analysis of ozonesonde data for the troposphere: Recommendations for testing 3-D models and development of a gridded climatology for tropospheric ozone JGR, 1999.

In Figure 2 where the data are placed into 36 groups, do all of the groups have at least 20 profiles? If not, can the authors show that the sample size is adequate? To increase the sample size the authors can place the data into 24 groups, for 12 months and just two time periods per day.

In Figure 3 the pooled plot uses data only between 10:00 and 14:00 LT, while the conventional average appears to use data from all times. If the pooled and conventional method are to be compared then they both need to show data from the same time of day. Otherwise the reader can't tell if the differences between the two are due to the time of day or the averaging method.

It does seem plausible that the agricultural fires in the NCPs were the cause of the increased column NO₂ above the Beijing region during June. But to be more convincing the authors need to estimate the quantity of NO_x produced from the fires using standard NO_x emission factors for biomass burning and estimates of the area burned. Are the fire emissions significant in comparison to anthropogenic emissions?

Page 9807 What is the rationale for only running back trajectories for "fine weather conditions" based on the absence of rainfall? Is there some reason to believe that the trajectories are less accurate if they are released under poor weather conditions? I don't think this is the case and I don't think the authors should bias there analysis away from poor weather conditions. Trajectories should be analyzed for all weather conditions.

Page 9808 The authors try to explain the high ozone mixing ratios associated with the westerly trajectories as being influenced by air that originated south of Beijing and was then lofted into the mid-troposphere by orographic lifting. But if this were the case,

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and if the trajectories are reliable, wouldn't this transport pathway be revealed by the trajectories? It appears that this is not the case and the 3 km trajectories indicate rapid transport from the west with no influence from the NCPs south of Beijing. The authors need to suggest another explanation for the high ozone values.

In the conclusions (and on page 9808) the authors state that the broad mid-tropospheric ozone enhancement during summer could be due to stratosphere-troposphere exchange but don't provide any evidence for this in the paper. These speculative statements need to be removed or the authors need to provide evidence. The authors also suggest that biomass burning in Asia could be responsible for the summertime ozone peak. But this feature is seen at many locations at mid-latitudes, so couldn't it be that the mid-tropospheric air above Beijing in summer is just reflecting the overall mid-latitude cycle of mid-tropospheric ozone?

The standard of English is fairly good but there are many instances of grammatical mistakes or awkward phrasing, too many for me to point out in this review. The authors should work with a colleague (or ACP editor) with excellent English skills to revise the text.

Technical comments:

The font sizes in Figures 1, 4, 5, 7, and 9 need to be increased.

Abstract line 16 delete "sources"

Page 9797 line 11 change to "tropospheric O₃ in China"

Page 9799 line 5 Saying that MOZAIC makes measurements regularly all over the world is an overstatement. MOZAIC does not fly to or over Australia, the Pacific Ocean, the South Atlantic or the Indian Ocean. Furthermore, the flights do not regularly visit all locations. In fact many locations are only visited in certain seasons, or were sampled during the early MOZAIC years but are not sampled now. A more accurate statement would be that the 5 (now 3) MOZAIC aircraft make near-daily flights between Europe

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and a variety of destinations throughout the world.

Page 9797 line 14 Do you mean reprocessed instead of reproduced?

Page 9801 line 2 What are the vertical and temporal resolutions of the FNL data? Are you just using analyses? State that this is a global model.

Page 9806 line 12 and the caption of Figure 8 change “wind streams” to “streamlines”

Page 9806 line 19 change “subtropic High” to “the subtropical high”

Page 9808 line 1 change “west-coming” to “westerly”

Figure 10 Why are the lines solid in some places and dotted in other places?

Page 9808 line 9 The origin of the elevated ozone in the mid-troposphere is very uncertain and this sentence needs to reflect the uncertainty. It should be reworded to: “but may be due to transport of biomass burning”

Page 9808 line 22 China is not a subcontinent. This sentence should read: “....trend of O₃ in China.”

Page 9809 lines 4 and 6 use the term “annual rate of change”

In Figure 13 the NO₂ data are presented such that it appears that the Beijing and NCPs NO₂ values are from mutually exclusive regions and can simply be added together. But from the description in the text it appears that some the 1x1 degree box around Beijing may overlap part of the NCPs box, which would then lead to counting some NO₂ values more than once. Are the two regions mutually exclusive?

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 9795, 2007.

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