

Interactive comment on “Increasing surface ozone concentrations in the background atmosphere of southern China, 1994–2007” by T. Wang et al.

Anonymous Referee #1

Received and published: 23 June 2009

Review of “Increasing surface ozone...” by T.Wang et al

This paper presents an analysis of ozone data from the Hok Tsui site in Hong Kong. The analysis uses a variety of techniques to examine trends in ozone including analysis of the seasonal means, use of local winds, CO filtering and segregation using back trajectories. The paper is well written and fairly clear, although I would like to see some additional details e.g. R2 values and N for all calculations.

While the results are interesting, and generally consistent with our “expected” result, I am a bit concerned on the statistical methods and the statistical significance. Of all the “trends” reported in the paper, only the trend in monthly means (Figure 1) is statistically significant at a P value of 0.05 or lower, which is the usual criteria for significance. The authors attempted to look for trends in certain subsets of the data (by season, air flow,

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etc), however none of these reached a significance level of 0.05 or lower. Obviously our “expectation” is that ozone has increased in the air flow coming out of mainland China. However in the air arriving to Hong Kong from East China (Table 2) the slope is only slightly greater than for the entire dataset (0.64 vs 0.55) and the result is not statistically significant. ($P=0.08$). Using the CO concentrations as a screening tool might be useful, but if CO is also increasing, then doesn't this represent a bias in the analysis?

I think it is very important that we let the data speak for itself and not jump to pre-ordained conclusions. For example, if the data support the idea that the ozone trend is present IN ALL AIRMASS CATEGORIES (not just East Asian), that what does that tell us? While clearly emissions in China have increased, it is not clear what has happened to other sources over this same time period (eg SE Asian biomass burning emissions). Specifically, if the airflow in summer is generally not from China, then why is the summer trend nearly the same as in other seasons and with nearly the same statistical significance?

I would like to see the authors do some additional statistical analysis using methods other than Ordinary Linear Regression (OLR). I believe the authors should review some of the past work comparing statistical methods and incorporate other statistical methods. Since each method makes its own set of assumptions, and usually it is difficult to verify rigorously these assumptions, conducting the analysis using several methods will result in a more robust analysis. I would encourage the authors to review some past work which has focused on a variety of statistical methods, for example:

Hess, A., H. Iyer, and W. Malm, 2001. Linear trend analysis: A comparison of methods. *Atmospheric Environment* 35, 5211-5222.

Jaffe D. and Ray, J. Increase in Surface Ozone at Rural Sites in the Western U.S. *Atmos. Environ.*, doi: 10.1016/j.atmosenv.2007.02.034, 2007. (compares trends with deseasonalized data and Thiel's method)

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Weatherhead, E. C., G. C. Reinsel, G. C. Tiao, X. L. Meng, D. Choi, W. K. Cheang, T. Keller, J. DeLuisi, D. J. Wuebbles, J. B. Kerr, A. J. Miller, S. J. Oltmans, and J. E. Frederick, 1998. Factors affecting the detection of trends: Statistical considerations and applications to environmental data. *Journal of Geophysical Research* 103(D14), 17,149-17,161.

I did not find the satellite discussion helpful. Many others have published these and it is quite clear that Chinese emissions are increasing relatively rapidly. I think the authors should focus on doing the best job they can do explain the data from Hong Kong.

A few other minor comments:

Pg 10436, line 4: How is winter treated? I assume that the year is plotted based on Jan and Feb and that the previous years December is included in the winter average, correct? Pg 10436, line 26: Define local. I assume you mean direct NO titration, correct? Figures 1, 6 and 7: R2 and P values will improve if the data are deaseasonalized.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 9, 10429, 2009.

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