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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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This paper presents the decadal change of surface ozone at a coastal site in Hong Kong, and suggests that the increase in ozone levels is primarily due to the increased emissions of NOx in the upwind eastern China. Data used in the paper are well documented and I find the results to be very interesting. Several issues need to be clarified as described in my review below.

Main concerns:

The p values are used in the paper to assess the statistical significance of ozone or CO increase rates. A large range of p values is presented, e.g. $p<0.01$ for the annual increase and $p=0.07$-0.18 for the seasonal change, and the authors described that both annual and seasonal increase are statistical significant. The referee suggests the authors to add a general description of the statistical concept of the p-value in Section 2

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or the beginning of Section 3, and clarify that what level of p values should be generally considered as "statistical significant". This will help future readers to better understand the results presented in this paper.

Data obtained at three sites are discussed: the background site Hok Tsui, the WGL site used to examine the impacts different air-mass groups, and the urban site CW. Both Hok Tsui and WGL are very close to the urban center of Hong Kong and the adjacent PRD, but the authors conclude that the increase of surface ozone at Hok Tsui is mainly due to long-range transport from eastern China, instead of local effects of Hong Kong and PRD. To support the conclusion, the authors need to provide the readers a clear geophysical relationship of these sites, the urban HK and PRD. A map showing local topography, prevailing winds and locations of these sites along with HK and PRD, will help. This will help future readers of this paper better understand the function of the background site as described in page 10433, and data filtering described in Section 3.2.2.

Page 10440, line 5-10, the authors described that "the abnormally high ozone concentrations in 2004 coincided with the highest tropospheric NO2 columns in the PRD and the NCP for that year". But, comparing Fig.1 and Fig.5, I did not find such a relationship. Which season are you indicating? In fact, ozone is maximum in the autumn of 2004, but NO2 columns in the PRD and the NCP are maximum in the spring of 2004. If you are suggesting the autumn, I notice that NO2 columns are actually maximum in the autumns of 2005 and 2006. But, according to Fig.1, we do not see relatively high ozone levels at the study site in the autumns of 2005 and 2006. Wouldn't this somehow imply that the increase of ozone at Hok Tsui might not be directly due to the increase of NOx emissions in upwind eastern China?

Would the increase of shipping emissions in the past decades (Eyring et al., 2005) play a role? The study site is located in the southeastern tip of Hong Kong island. The trajectories analysis shows that 30% of air masses are from the Marine group, and 13% from the Aged Continental group (Fig.4). Both marine and aged continental air

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masses might be strongly affected by international shipping. Several model analysis (e.g., Dalsoren et al. 2009) suggested that the contribution of shipping emissions to surface ozone and acid deposition is large over some coastal zones. References:

Eyring V. et al., Emissions from international shipping: 1. The last 50 years. JGR, 2004JD005619

Dalsoren S. B. et al., Update on emissions and environmental impacts from the international fleet of ships: the contribution from major ship types and ports, ACP, 9, 2171-2194, 2009

Page 10441, line 25: It is not clear to me that how the increase in background ozone accounted for 66% of the increase in the total ozone in the urban area of Hong Kong. How did you get the value 66%? Increase at Hok Tsui (0.55)/Increase at CW (0.83) = 66%? The calculation is not defensible, considering the non-linear feature of ozone photochemistry and the complexity of dynamic transport processes.

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