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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Rates and regimes of photochemical ozone production over Central East China in June 2006: a box model analysis using comprehensive measurements of ozone precursors" *by* Y. Kanaya et al.

Anonymous Referee #1

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This article investigates the net photochemical ozone production rates at the top of mount Tai, located in the middle of Central East China, a region with high ozone concentrations. The approach is based on box model calculations constrained by measurements of ozone and ozone precursors. It provides some interesting results for the ozone chemistry of the region but it lacks of real peroxy radical measurements to test the fast photochemistry and justify in an independent way their findings from the measurements point of view. Nevertheless I would suggest publication of the article after taking into account the comments below.

It is implied from the discussion of Figure 1 in page 12973 that convection from the boundary layer to the top of the mountain during daytime is the major cause for the differences between high and low ozone days. I think more justification is needed apart from the diurnal cycle of ozone and NOy. For example the authors could look at other tracers for convection as water vapour mixing ratio to justify if convection makes the difference between high and low ozone days. They could also probably look the transport for the high and low ozone days using back trajectories. My impression from figure 1 is that there differences in the regional ozone transport between the high and the low ozone days with the high ozone days being more affected by boundary layer air.

The authors state in page 12974 that the production and loss rates of the radicals were almost in balance. What does it mean almost in balance? Does it mean that the box model did not reach a steady state for radicals? I guess constraining a box model with measurements you expect to reach a steady state after a few diurnal cycles.

I would suggest that the authors add error bar values for the calculated daily values of ozone formation, loss and net production for the high and low ozone days in page 12975.

The authors state at line 19 of page 12975 that their calculated value of 58 ppbv/day is slightly larger than 32 ppbv/day from another study. From my point of view this difference is not slight. The value of this study is almost double compared with the other study. The authors should specify what they mean with the word "slight". Similarly at line 24 of page 12975, the authors state that their value is roughly consistent with the production rate of 38 ppbv/day estimated from another study at the same location. The authors should specify what they mean with the wording "soughly consistent".

At lines 5-7 of page 12975 the authors explain that the modeled F(O3) was higher at high ozone days than in low ozone days because the modeled peroxy radical concentration was higher. This is expected since the calculated values of F(O3) from the box

model are proportional to the modeled values of peroxy radicals. Unfortunately, there are no real measurements of peroxy radicals to justify in an independent way.

At lines 14-15 of page 12976 the authors reach a conclusion that the observed ozone build up is not merely affected by local chemistry although earlier in the paragraph they state that in-situ (local) photochemistry is capable of explaining the ozone build up in high and low ozone days. This makes confusion to the reader. More clarification is needed. The paragraph should be rewritten in a more thorough and consistent way.

At lines 17-21 of page 12977 the authors state "The analysis also implied that the ozone production should have been more efficient in the fresh air mass where ...". This sounds sensible but how it is implied in this study from the analysis of the measurements and the model calculations? More clarification is needed.

To my knowledge there is limited referencing and comparison to similar experiments at high altitude sites e.g. MLOPEX experiments at Mauna Loa Observatory, FREETEX experiments at Jungfraujoch and other.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12965, 2009.