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Interactive comment on "Characterization of photochemical pollution at different elevations in mountainous areas in Hong Kong" *by* H. Guo et al.

Anonymous Referee #2

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General comments:

The paper presents the characterization of photochemical pollution near the summit of Mt. Tai Mao. The pollutants and meteorological conditions of the summit site were compared with those of the urban site at the foot of the mountain to explore the possible reasons (NO titration, vertical meteorological conditions, regional transport, and mesoscale circulations) causing frequent O3 episodes at the summit site in autumn, but only one O3 episode at the foot of the mountain. Numerous methods and concepts were used in this study to explain the physical and chemical processes of the O3 episode observed at the summit. Some of these approaches are reasonable and able to produce robust results (e.g., NO titration and meteorological conditions). Nevertheless, some inferences (e.g., high O3 concentrations at TMS were mainly influenced

by mesoscale circulations and photochemical O3 formation was VOC-sensitive or both NOx and VOC-sensitive at TMS) derived from either unfit approaches (eg., Mbox without considering NO titration) or weak results are controversial or less persuasive (specific comments). In general, the study is beneficial for understanding photochemical pollution at the mountain site and serves as a complement to previous studies conducted in low-elevation areas of PRD. Thus, this manuscript can be considered for publication after the specific comments below have been addressed.

Specific comments:

Page 29035 Lines 5-12: Figure 2b shows that both TMS and TW had similar patterns of O3 with broad maximum values at approximately 1500 h. Moreover, Ox reached a maximum value at TW during 1500 h to 1600 h, which was later than that at TMS. In Lines 1 to 4 of Page 29010, the authors stated that the air mass arriving at TMS was generally more aged than that at TW, which may be attributed to regional transport and/or mesoscale circulations. In general, the maximum O3 in the downwind area is usually a few hours later than that in the source area. In the source area, O3 builds up after sunrise and usually reaches a maximum value at approximately 1300 h to 1400 h. It seems a bit late for maximum O3 and Ox at TW. The authors need to clarify this phenomenon.

Page 29036 Line 26 - Page 29037 Line 14: Attaining the mixing ratios of OH radical through the relationship between isoprene and its oxidation products seems controversial. In urban areas, isoprene not only has biogenic sources but also anthropogenic emissions (Borbon et al., 2001). Defining the processing time t for isoprene would be difficult because of the different diurnal emission patterns of the two sources. Furthermore, adopting the identical processing time for isoprene ("precursor") and its "products" in Eqs. 4 and 5 seems unreasonable.

Page 29040 Line 27 - Page 29041 Line 8: With regard to strengthening the conclusion of influence of air mass transport, numerous VOCs can be employed as tracers of spe-

cific source regions, and they might be helpful for assessing the influence by regional air masses from the highly polluted PRD.

Page 29042 Lines 21-26: The model employed for calculating O3 did not consider NO titration. However, the influence of NO titration must be significant at TW to affect O3 levels seriously.

Page 29044 Lines 26-27: VOC/NOx ratio should only give a rough ideal as to whether it is a NOx-sensitive or VOC-sensitive environment, which is crucial for ozone formation. However, VOCs are a complex mixture of compounds with large difference in reactivity with respect to ozone formation. The true impact of VOCs to ozone formation is more relevant to the reactivity of individual VOC species rather than to the total amount of VOCs.

Page 29045 Lines 26-27: Observed anthropogenic VOCs at downwind remote or rural sites (e.g., TMS) are mostly transported from the upwind source areas and regarded as residues left from photochemical reactions during transport. These VOC residues are not suitable for the calculation of O3 formation potentials.

Page 29057 Figure 2b: An increase in O3 was observed from nighttime to the next morning (before 0400 h LT) at TW. However, a decrease in NO titration was unable to enhance O3 levels before dawn. The authors should try to expound on the possible causes of this phenomenon.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 29025, 2012.