

## **Responses to referee #2:**

This manuscript reports atmospheric measurements of O<sub>3</sub>, NO<sub>x</sub> and VOCs made during the HaChi summer field campaign and provide interesting information on the contribution of VOCs to the photochemical activity in this area of North China Plain. From observed VOC-to-NO<sub>x</sub> ratios and the use of a photochemical box model, the authors also infer that the chemical regime of O<sub>3</sub> formation is NO<sub>x</sub> limited in this region.

This manuscript is well structured. The language is clear and precise. Substantial conclusions have been reached and I believe this paper will be interesting for the atmospheric community. I recommend publication in ACP after the authors address the following points:

**We appreciate the referee for valuable comments and suggestions. We have addressed each concern as below and revised the manuscript accordingly.**

Major comments:

I share the concerns of Anonymous Referee #1 about the modeling results and also urge the authors to provide more details on the modeling procedure used for this study.

**Thank you for this comment. Also according to questions raised by referee #1, we have provided more detailed information on the modeling work in the manuscript.**

There is no discussion of previous studies investigating the photochemical activity of the North China Plain area. Is there a lack of such studies? If previous studies have been published, the authors should cite them in their manuscript and should discuss how it compares to their work?

**We thank the referee for this suggestion. Most of previous studies in the NCP focused on ozone photochemical processes at rural sites (e.g., Wang et al., 2006; Ge et al., 2010) or in urban Beijing (e.g., Shao et al., 2009; Tang et al., 2010). It was for the first time that ozone precursor relationship was investigated at a suburban site inside the highly polluted NCP to help improve understanding of regional pollution and photochemistry. The campaign site is far away from typical urban emissions, yet surrounded by a cluster of polluted urban centers, especially the twin megacities of Beijing and Tianjin. Thus, the site neither resembles an urban site nor a relatively clean rural site. Therefore, no direct comparisons between results of our work and previous studies have been made in the discussion section. Some previous studies have been cited in introduction. Following the referee's suggestion, we have added more related references and summarized their important results to provide a more comprehensive view of photochemistry in the NCP.**

**Ge, B. Z, Xu, X. B., Lin, W. L., and Wang, Y.: Observational study of ozone production efficiency at the shangdianzi regional background station, Environmental Science, 31, 1444-1450, 2010.**

**Shao, M., Lu, S. H., Liu, Y., Xie, X., Chang, C. C. and Huang, S.: Volatile organic compounds measured in summer in Beijing and their role in ground-level ozone formation, *J. Geophys. Res.*, 114, D00G06, doi:10.1029/2008JD010863, 2009.**

**Tang, X., Wang, Z. F., Zhu, J., Gbaguidi, A. E., Wu, Q. Z., Li, j., and Zhu, T.: Sensitivity of ozone to precursor emissions in urban Beijing with a Monte Carlo scheme, *Atmos. Environ.*, 44, 3833-3842, 2010.**

**Wang, T., Ding, A., Gao, J. and Wu, W. S.: Strong ozone production in urban plumes from Beijing, China, *Geophys. Res. Lett.*, 33, L21806, doi:10.1029/2006GL027689, 2006.**

Minor comments:

Abstract L9-12: The contribution of the key species to the total VOC reactivity should be reported here as %

**According to the referee's comment, we have reported the contributions of key species to total VOC reactivity in the abstract: "Key species associated with ozone photochemical production are 2-butenes (18%), isoprene (15%), trimethylbenzenes (11%), xylenes (8.5%), 3-methylhexane (6%), n-hexane (5%) and toluene (4.5%)."**

Were oxidation products of isoprene such as methacrolein and methyl vinyl ketone measured during this field campaign? If so, do these measurements support the authors' hypothesis stated P8607 L1-5 about isoprene?

**Methacrolein and methyl vinyl ketone are major degradation products of isoprene and ozone producers themselves. Unfortunately, we were not able to measure any of those carbonyls during the field campaign. We would like to expect future studies on this specific aspect and have therefore added: "To support this hypothesis, further efforts involving the development of VOC emission inventories, and direct measurements of free radicals and major isoprene degradation products along the transport pathway would be highly appreciated."**

P8616 Table1: Indicate the day associated to each scenario

**According to the referee's comment, we have added the day associated with each case in Table 1.**