Responses to the referee's comments

Referee 1#

General Comment:

The manuscript Measurements of ozone and its precursors in Beijing during summer time: Impact of urban plumes on ozone pollution in downwind rural areas by Xu et al present a field measurement on ozone and its precursors in 4 sequential sites in Beijing city, to investigate the effects of transportation and local chemistry in ozone concentrations. The experimental design is very interesting, and could be valuable for the proposed research goal. However, the current manuscript could not provide convincing evidence for the relative importance of regional transportation and local production in observed ozone levels. I would recommend a major revision before the MS could be accepted for publication.

Authors: Thanks a lot for the referee's comments. We have made major revisions as suggested by the referee. In particular, we give an estimate of the L_{OH} and OFP of CO and related discussions in the revised manuscript. Our multiple analyses including air mass types and correlations of O_3 with CO and photochemical age have indicated the effect of transport on observed ozone levels at the rural site SDZ. The relative importance of regional transportation and local production, as proposed by the referee, is really an interesting topic, and will be quantified in our future modeling work.

Specific comments:

(1) **The referee:** I wonder why the author use the current title suggesting the importance of transport, in fact, from the data evaluation, e.g. the correlation between ozone and chemical aging, it seems to me that the local chemistry might be more relevant.

Authors: Note that our measurements were carried out not only at the urban sites, but also at a rural site (SDZ), both of which belong to the Beijing Municipality. Our data analysis shows that that the local chemistry might be more relevant in the urban area and the transportation of urban pollution might have a large impact on the photochemisty in the rural area. Considering that the latter is the main issue addressed in this paper, we would like to still use the current title in the revised manuscript.

(2) **The referee:** The author provide very high levels of biogenic VOCs, namely isoprene, a-pinene and b-pinene, due to their high reactivity, the actually contribution could be much higher to ozone formation (because these species were largely consumed after being emitted into air); and secondly, their chemistry in ozone formation will be very local. I suggest the authors to do more detailed evaluation for these species.

Authors: We have taken biogenic VOCs as one of four VOC groups in the attribution of L_{OH} and OFP (see Fig. 5 and Fig. 6 in the revised manuscript) with related discussions including sources of biogenic VOCs in the urban areas (see Section 3.2 of the revised manuscript).

(3)**The referee:** I doubt the use of the ratio between benzene and toluene for source identification. The ratio could be very different from current source measurements, and also the ratio will change due to aging processes, I think it would not be appropriate when long-range transport was considered.

Authors: We have removed this part in the revised manuscript.

(4)**The referee:** The L_{OH} and OFP analysis did not provide support for the relative importance of transport and local chemistry, and this section uses mainly well known method, I would suggest largely shorten this discussion, and pay more attention to evaluate the role of transport and local production.

Authors: We have revised this section substantially (see "3.2 NMHC reactivity and ozone formation potential"). In particular, we give an estimate of the L_{OH} and OFP of CO with related discussions in the revised manuscript. Although the method is well known, the mixing ratios of CO and NHMHs, which are needed to calculate the L_{OH} and OFP, are unique and obtained by our measurements. Comparisons of L_{OH} and OFP between the BL (urban) and SDZ (rural) sites have provided valuable information on the photochemical characteristics in both urban and rural areas of Beijing. Relative higher percentage contributions of CO to L_{OH} and OFP and higher correlation between O_3 and CO at SDZ than at BL may indicate an importance role of transport in ozone production in the rural area.