**Response to reviewer #2**

General Comments:

In general the manuscript is well constructed and easy to follow. To my understanding, less previous studies were focus on investigation of real-world IVOC fleet emissions, this study showed that there are still some knowledge gaps between the real-world situation and laboratory-based results of vehicular IVOCs emissions. However, besides showing the measurement results and some relation analysis, there is a lack of in-depth data analysis and discussion, which could be attributed to less supporting data from other sources (only concurrent VOCs results were used, not even showed). Overall, the manuscript is recommended to be published in the form of "measurement report" after necessary revision.

Specific Comments:

Line 196-197: Here the Emission Factors ($EF_{IVOCs}$) for both GVs (13.29 ± 5.08 mg $km^{-1}$ $veh^{-1}$) and DVs (21.40 ± 5.01 mg $km^{-1}$ $veh^{-1}$) were determined from Equation (1). Similar parameters were estimated by Equation (2) with different outcomes showed in Line 205-206 (13.95 ± 1.13 mg $km^{-1}$ $veh^{-1}$ for GVs and 62.79 ± 18.37 mg $km^{-1}$ $veh^{-1}$ for DVs). It is unclear that how to obtain these values directly from Equation (1). To my understanding, the only affecting variable would be the vehicle count, but in this case it is difficult to tell how much of $EF_{IVOCs}$ are attributed to GVs and DVs, respectively. Please explain.

**Response:** Thank you for the comments. There might be some misunderstanding. Equation (1) was used to calculate the fleet-average emission factor of IVOCs ($EF_{IVOCs}$), which ranged from 13.29 ± 5.08 mg $km^{-1}$ $veh^{-1}$ to 21.40 ± 5.01 mg $km^{-1}$ $veh^{-1}$. Based on equation (2) (Ho et al., 2007; Kramer et al., 2020), the $EF_{IVOCs}$ of GVs and DVs could be derived via linear regression as 13.95 ± 1.13 mg $km^{-1}$ $veh^{-1}$ and 62.79 ± 18.37 mg $km^{-1}$ $veh^{-1}$, respectively. We have also modified this part of writing as below:

"Based on above equation (1), fleet-average $EF_{IVOCs}$ (GVs + DVs) ranged from 13.29 ± 5.08 mg $km^{-1}$ $veh^{-1}$ to 21.40 ± 5.01 mg $km^{-1}$ $veh^{-1}$, with an average of 16.77 ± 0.89 mg $km^{-1}$ $veh^{-1}$ (Average ± 95% C.I.)." (*Line 195-197*)

**References:**

Ho, K. F., Ho, S. S. H., Cheng, Y., Lee, S. C., and Yu, J. Z.: Real-world emission factors of fifteen carbonyl compounds measured in a Hong Kong tunnel. Atmos. Environ., 41, 1747-1758, https://doi.org/10.1016/j.atmosenv.2006.10.027, 2007.

Kramer, L. J., Crilley, L. R., Adams, T. J., Ball, S. M., Pope, F. D., and Bloss, W. J.: Nitrous acid (HONO) emissions under real-world driving conditions from vehicles in a UK road tunnel. Atmos. Chem. Phys., 20, 5231-5248, https://doi.org/10.5194/acp-20-5231-2020, 2020.

Line 289-290: It is mentioned that there is a difference between the $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio for DVs and GVs. Is it possible to differentiate this from your data set (say utilizing the principle of Equation (2))?

**Response:** Thank you for the comments. According to the reviewer's suggestions, we tried to use the principle of Equation (2) to resolve the $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratios for DVs and GVs, which was shown in the following figure. Although the correlation between $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratios and DVs fraction was not significant, $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio of DVs (54.9) did present much higher value than that of GVs (6.82). We also added this result to our revised manuscript as below:

"Furthermore, we also resolved the $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratios for DVs and GVs via liner regression (Text S3). As shown in Fig. S7, although the correlation between $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratios and DV fractions was not significant, the DVs did present much higher average $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio (54.9) than that of GVs (6.82)." (*Line 290-294*).

"**Text S3**

Linear regression analysis of diesel vehicles fraction and $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio

$$R = R_{DVs} \times \alpha + R_{GVs} (1 - \alpha)$$

where R represents the fleet average $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio calculated during the campaign. $R_{DVs}$ and $R_{GVs}$ are the $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratios for DVs and GVs, respectively. $\alpha$ is the fraction of DVs in the total IVOCs-emitting vehicles traveling through the tunnel." *(Supporting information)*

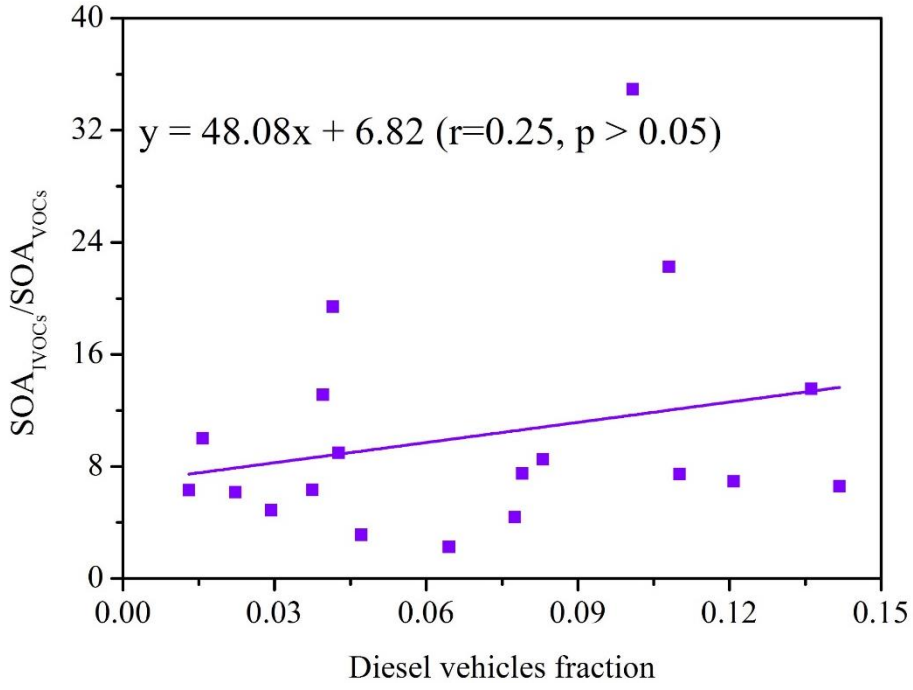


Figure S7. Linear regression analysis of diesel vehicles fraction and $SOA_{IVOCs}$-to-$SOA_{VOCs}$ ratio