Yang et al. manuscript discussed an important issue of on-road mobile source emissions estimation based on the real-world traffic data. Overall, I think it is a good paper to be published after a few improvements. Based on my review, I would like to share a few comments and suggestions with authors.

1. While this paper covers well on on-road vehicle emissions from running exhaustion process, it lacks on addressing another critical vehicle emissions from evaporative processes which occur from on-road and off-network. Although authors mentioned in the manuscript that their study is limited to cover evaporative emissions due to the spatial coverage issue, it is very important to cover the evaporative emissions since they could contribute up to 30-40% of total emissions from vehicles depending on the regions. At least authors can provide more detail information on why they are estimating evaporative emissions other than spatial coverage issue.

2. Mobile source emissions, especially in a megacity like Beijing, are known to be a significant contributor of not only primary but secondary air pollution. Chemical characteristics of hydrocarbon emissions from mobile sources are very important to correctly understand secondary formation. I suggest authors to describe relationship between THC to NMVOCs at least, and more preferably include some level of discussion on major chemical species emissions by vehicle type.

3. It would be nice to see the flow diagram figure of EMBEV-Link (Core-programs/modules with inputs and outputs) to understand the model structure better.

4. It also shows why high-resolution activity data like hourly average speed, traffic density and VKT by each link can enhance the quality of hourly emissions. However, the hourly average speed calculated by congestion by link could also provide a biased speed-sensitive emissions since there should be more than a single speed value to present the traffic pattern during the congestion. The average speed would be most frequent speed during the traffic hour but there are higher and lower speed to be considered. Authors can easily find several journal papers that describe the importance of using average speed distribution factors by speed bins instead of a single average speed value. Although there is a merit to their approach to compute hourly average speed value, I think it should also mention about the future study on comparing the results against to the average speed distribution factors.

5. Although authors pointed out the importance of NOx emissions from HDT outside of Five Rings, it does not mention the sensitivity of diesel engine to local meteorological condition. It is a known fact that NOx from diesel vehicle shows a significant dependency to local ambient temperature and humidity. While covering this section will be out of scope of paper at this point, I think it is important for authors at least to mention its potential local meteorological condition impacts to NOx emissions

from HDT as well and what might be the impacts from it.

6. It is also not within the scope of this paper but it should consider to mention about how the EMBEV-Link can be updated to implemented to support photochemical modeling system other than a dispersion modeling system.