

The authors thank the referee for the constructive comments. Our replies to the comments and our actions taken to revise the paper (in blue) are given below in yellow color.

Anonymous Referee #2

General Comments The present paper is a timely study on using a top-down approach for estimating benzene and toluene emissions in Pearl River Delta (PRD) and Hong Kong, China. In general PRD is currently suffering from high ozone levels. Clearly, effective and robust control policy formulation very often relies on good emission inventory and supported by associated modeling work on control scenarios. Unfortunately, the so-called “accurate emission inventory” does not exist and we may never know the “true value”. Nevertheless, more independent work on estimating VOC emissions will certainly help and reduce uncertainty. Therefore, it is quite encouraging to note the use of a top-down approach to compare with the existing bottom-up emission estimates of benzene and toluene. Hopefully, this kind of work will shed more light on the effective evidence-base control policy formulation and useful for decision makers when tackling the regional ozone problem.

Specific Comments 1. In the abstract and introduction sections, there is a lack of analysis on the significance of the present work and its implications in terms of control policy formulation. For example, in the abstract section the discrepancy issue articulated in section 3.5 and the conclusion section was not mentioned. RE: page 24853 (lines 24 to 28). In other words, the authors should point out the implications of underestimating the emissions of these highly reactive aromatic compounds on the control of vehicular emissions and/or evaporative loss and solvent emissions. Also, the implications on underestimating these aromatic compounds on ozone formation should be highlighted.

Response: Thank you for reminding us about the significance of the present work and its implications in terms of control policy formulation. The main topic this study wants to present is the difference between the top-down and bottom-up estimates in terms of either the total emissions or spatial distribution. Readers from various fields will pick up the information they want. Based on this study, conclusion cannot be drawn on “implications of underestimating the emissions of these highly reactive aromatic compounds the control of vehicular emissions and/or evaporative loss and solvent emissions”, since the inversion could not distinguish emissions at sector level.

2. Fig 8, the use of yellow color as a label/legend may not reproduce well in black & white copying. Better annotation is recommended.

Response: The symbols in Figure 8 are not the same, so they are suitable even in black & white copying

3. RE: page 24847, lines 3 to 6. “in agreement with previous studies, mixing ratio levels of benzene and toluene in PRD region are overall higher than those in Hong Kong, which is most likely due to the fact

that Hong Kong often receives clean air masses from the ocean.”. Clarification on the root cause of finding higher levels of toluene and benzene in PRD when comparing with HK should be made here. First of all, Hong Kong is part of PRD, so when Hong Kong receives clean air masses from the ocean so do PRD. Therefore I would suggest the key issue here is about emissions from high emitting areas. Furthermore, the Heshan site in PRD is located downwind of Guangzhou and other rapidly developing cities. High VOC levels are therefore reflected in the measurement results.

Response: We agree with the comments. Hong Kong can directly receive clean air masses from the ocean, while the air masses have to cross over some land (emission sources) before reaching central PRD. We agree that emission strength in PRD is higher than that in Hong Kong, which contributes to the higher VOC concentrations in PRD than in Hong Kong. Thus, in our revised manuscript, we have changed to “which is in part due to the fact that Hong Kong often receives clean air masses from over the ocean and that emissions in Hong Kong are lower than in the PRD”. By the way, in this study and many previous studies, Hong Kong is not defined as part of PRD, though in some studies, Hong Kong is.