

## ***Interactive comment on* “The impact of ship emissions on air quality and human health in the Gothenburg area – Part II: Scenarios for 2040” by Martin O. P. Ramacher et al.**

### **Anonymous Referee #1**

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This study predicted the impact of ship emissions on air quality and human health in the Gothenburg area. Air quality simulations for four future scenarios were conducted to evaluate impacts of emission changes from 2012 to 2040, local shipping activities in 2040, and local port measures.

Major comments:

1. I can understand that the impacts of following items can be evaluated in this study as described in the lines 7-9 of the page 13.

(1) the impact on air quality in Gothenburg through a change in total emissions from 2012 to 2040 (2) the impact of local shipping activities in 2040 in two different scenarios

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(3) the additional impact of local port measures (shore-side electricity) in scenarios for 2040

But, how can these results be utilized? For example, if predicted improvement of air quality is compared with the air quality standards or any targets, you can say that existing emission regulations for ships are enough or not. Health impacts were calculated in this study. They can also be compared with any targets to judge if existing regulations are enough to suppress health impacts below the certain target. However, such a judgement was not conducted in this study. Number of scenarios are very limited and do not include any additional emission control measures for ships. In the current design, it is also difficult to judge if local port measures are necessary or not. Please add more explanations on utilizing the results of this study.

2. As mentioned in the lines 17-19 of the page 2, in combination with the increasing ship traffic which grows roughly by 2 % per year and the future foreseeable significant decrease of emissions from other anthropogenic sectors, the relative importance of NO<sub>x</sub> emissions from shipping for urban air quality will thus likely remain high. In addition, as mentioned in the lines 6-7 of the page 4, scenarios for transported cargo volumes, composition of the fleet, as well as energy efficiency improvements need to be developed and put into perspective with probable emission reductions at land. Then, how were future changes in ship traffics, cargo volumes, and fleet compositions treated in this study? How are emission increases by them compensated by reductions by regulations?

3. While overall descriptions of Gothenburg should be included in the Part I paper, some readers may not know where Gothenburg is and how it looks like. Simple descriptions may be helpful. In addition, all the contours do not show any geographical and administrative boundaries. They may be also helpful to recognize where land, ocean, and ports are.

Specific comments:

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P1, L27-30 Two expressions, “wide use of shore-site electricity” and “implementation of on-shore electricity”, are confusing. They correspond to the same thing, right?

P3, L4-5 Critical not only for NO<sub>2</sub> and O<sub>3</sub> but also PM<sub>2.5</sub> as mentioned above.

P3, L10 Where is “this region”? It is not explicitly mentioned in preceding sentences.

P5, Figure 1 This figure is not mentioned in any sentence in the manuscript.

P5, L4 What is the reason to couple TAPM and CMAQ instead of using TAPM or CMAQ only? Is that described in the Part I paper?

P5, L16 I think that evaluations cannot be done for the future year 2040.

P6, L9-14 Is it appropriate to use different horizontal resolutions for air pollution and meteorological fields? How to interpolate or extrapolate either of them?

P7, L22-23 I suppose that a scaling factor for combustion in industry for energy purposes is large because their VOC emissions are very low. Please check their emission amounts in GAINS. But that is not in the case in the emissions used in this study shown in Figure 2. It might be due to inconsistent definitions of sectors. Is there any appropriate reason explaining why their emissions significantly increase in Gothenburg?

P12, L5-6 I cannot understand differences between BAU2040 and EEDI2040 for fuel efficiencies. What kind of policies are assumed in each scenario? Why fuel efficiency is higher in BAU2040 than EEDI2040? What is the motivation to compare these two scenarios? Please add more explanations to clarify significance of EEDI2040 scenario.

P13, 3.3 Scenario setup Were simulations conducted for twelve months in 2012?

P15, L4-5 Is 7% reduction a high potential? In fact, I cannot understand which part of Figure 4 this sentence describes.

P15, L18-20 I cannot believe such high PM<sub>2.5</sub> concentrations according to Figure 4. In addition, I think the units of absolute and relative differences of PM<sub>2.5</sub> in Figure 4 are

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opposite.

P17, L4 It is confusing to represent changes in negative contributions to O3 as “increasing”.

P20, L16-19 I think longer lifetime of secondary components in the atmosphere should be also one of reasons.

References Some references have no years. Particularly, it is difficult to distinguish IMO reports.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-319>, 2020.

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