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Comment on acp-2021-212

Anonymous Referee #2

Referee comment on "Ship emissions around China under gradually promoted control policies from 2016 to 2019" by Xiaotong Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-212-RC2>, 2021

Review of the paper

Annual ship emissions around China under gradually promoted control policies from 2016 to 2019

by Xiaotong Wang and co-authors

The paper describes changes in shipping emissions around the Chinese coast between 2016 and 2019. The existing and previously published ship emission inventory model (SEIM) was updated and applied to AIS ship position data for 4 years and the results are analyzed for the effects of policy measures on ship emissions for different ship types and different distances to the coast.

The paper presents interesting results that can be of use for subsequent air quality simulations but also for policy measures to further reduce ship emissions along the Chinese coast. The papers needs significant language improvements, it is sometimes quite difficult to understand what the authors want to say. This should be done by a native speaker or through a professional language check. I will not mention all sentences that need improvements and clarification, because they are simply too many. However, these corrections need to be done before the paper can be published.

The paper also suffers from imprecise descriptions and some open questions concerning the results, but those can be treated in a revision. I recommend publication of this article in ACP after moderate revisions of the contents and major revisions of the language.

Major comments:

Lines 8-28: In the abstract and throughout the paper it needs to said clearly which area is considered, when relative emission changes are given. I assume that the numbers mostly refer to the 200 nm zone along the Chinese coast, however, the area under investigation is much bigger, as shown in Fig. 11.

Lines 76-89: The number of 30 billion AIS signals does not say much about how complete

the data is. You should say something on possibly missing data during certain times and how homogeneous the data is in time and space. In addition, you should give some information on the STSD, even though it might be described elsewhere, already. This could be done in the supplementary material. It is essential to know which technical information about the ships is typically available and which not. It is also surprising that 3.5 million vessel profiles are included given the fact that the number of large ocean going vessels is typically given as approx. 100,000. Is the rest of the data sets about small fishing boats (which won't have AIS in most cases) or about Chinese river vessels? This information can also be provided in section 2.3.

Line 104/105: What is the purpose of the "double nested domain"? What are the potential "boundary effects"?

Line 105/106: What is the GBRT method? In how many cases do the default values have to be estimated because of missing ship properties?

Line 111-114: This is a nearly exact repetition of a text from the introduction. You should avoid such repetitions.

Line 118: how long is "long time gap"? So in which cases is the restoration method applied?

Line 160 and Table 1: How are the total main engine power and the total dead weight tonnage calculated?

Line 165 – 169 and Figure 3: In Figure 3 it looks like there are short periods of one or few days during which the activity drops significantly (e.g. mid June, beginning of July, beginning of August). What is the reason for this? Is this bad weather, non-working days or something similar? Or are these periods with missing AIS data?

Line 182: You should consider that a method very similar to the route restoration method described here was already introduced by Aulinger et al. in 2016 (*Atmos. Chem. Phys.*, 16, 739–758).

Line 222: What are the criteria for a method to be "basically satisfactory"?

Line 253: Can you say something about how well the emission inventory might agree with real world emissions? Despite possible methodological problems, which might be difficult to avoid (e.g. because of missing technical information about the ships), can you say something about the percentage of ships that do not follow the DECA rules (i.e. the non-compliance rate)?

Line 283/284: Can you say why the SO₂ emissions you calculate might be higher than those in Li et al. (2018)? I understood that RVs have very low sulfur emissions which would mean that they won't contribute a lot to the total emissions, even when they sail in coastal waters. Or could they switch fuel when leaving the river?

Line 295-308. In my opinion, this investigation w.r.t. flag state does not add much information. Because shipping is international and the flag state does not even say something about the vessel owner, this analysis does not tell much.

Figure 9: Short term drops in emissions are apparent in the time series, which do not correspond to the spring festival, e.g. mid of 2017, approx. Sept 2018. What is the reason for them?

Figure 10: What is the reason for the steep short term increase in emissions in some ports

in 2018 (Tianjin, Ningbo Zhoushan, Shenzhen)?

Line 336/337: Could you explain which role wind direction plays for ship activities?

Line 374: How can the improved emissions reduce uncertainties in an air quality model? It might improve the results of an air quality model application.

Line 398: I cannot see how a North Atlantic shipping route would be visible in this emission inventory. Perhaps you mean a North Pacific route? A similar argument holds for the mentioned Asia-Europe routes: Do you know from the AIS data where the ships are heading?

Line 424: There is just one scenario defined (the No-DECA scenario). I would not call the emission calculation for the years 2016-2019 that consider all regulations in place a scenario. Therefore, you do not define "another" scenario.

Line 455: Here you should make clear that the numbers refer to the 200 nm zone (if I am not mistaken):

Line 471/472: The sentence is repeated from lines 393/394. You should avoid such replications.

Minor comments:

Line 86: modify to "In addition, a scenario ..."

Line 122: What is a "multidimensional analysis"?

Line 162: replace "improvement" with "increase"

Line 196. Skip "diagrammatic sketch"

Line 225 and several other places: replace "implement" with "implementation"

Line 314: What do you mean with "ship emission intensity"? Isn't this just daily emissions?

Line 335: What is meant with the "updating iteration speed of fleet"?

Line 350: avoid expressions like "dramatically".

Line 394 and line 472: I think "aggrandized" is not the right expression here.

Line 487: What do you mean with "complexity of registration and operation"?

Author contributions: Initials are sometimes used in different order as in the list of authors. Who did the SEIM model runs? Who extended the model? What are "multiple analytical perspectives"?

References: Skip the test articles by Aman

Figure 4b includes several spelling errors.

Figure 6: the y-axis does not fit to the RV sulfur content, in particular after 2017/07.

Figure 7, b and c: Blue bars for 2013 should be included in the legend. Does the 2013 bar represent the sum of OGV, CV and RV or are RV missing?

Figure 8 might be skipped because of its low contribution to the scientific value of the paper.

Figure 13: replace "comparation" with "comparison"

Figure 14: mention that this refers to the 200 nm zone.

Figure 15: The horizontal bars giving the changes in % should be aligned along a vertical zero-line.