Comments from Fan Zhou:

We would like to thank the reviewer for his helpful comments. We hope that we could address all questions and unclear points satisfactorily.

Legend: Author comments in blue, Referee comments in black.

The authors claim that "In contrast to relative emission factors (in grams per kilogram fuel), the emission rates (in grams per second) do not need further knowledge about the fuel consumption of the ship and can therefore be used directly to investigate the effect of ship traffic on air quality." In the part of Introduction, the relevant discussion is mainly about the measurement of emission factors. Whether there are other studies that measure emission rates? If there are relevant studies, it is recommended to supplement them and carry out necessary comparison (emission rates and emission factors), discussion, and analysis.

To our knowledge there are no studies which report on emission rates for inland ships. There are some studies reporting on SO_2 and NO_2 emission rates of sea ships (e.g., Berg et al., 2012; Berkhout et al., 2012; Prata, 2014). We added these to the introduction.

Emission factors are often used in the compilation of emission inventories, so can emission rates be used in the compilation of emission inventories? If so, whether there are relevant studies.

To our knowledge there are currently no studies which use emission rates for the compilation of an emission inventory. We think emission rates can be used for this task, but only for the region where they are derived.

In the introduction, it is suggested to supplement the discussion on the related research of inland ship emission monitoring, and the particularity of this research. On the whole, the content of the introduction is relatively small, so it is suggested that the authors make supplement on recommendations 1, 2, and 3.

We expanded the Introduction in regard to suggestions 1 and 2.

"The on-shore measurements were carried out using standardized air quality monitoring stations". I suggest a detailed introduction of the equipment, such as principle, accuracy, precision, measuring range, sensors. And comparison with related studies.

We added a detailed description of the used instruments, the measurement principle and the respective uncertainties to section 2.

I feel that the analysis of uncertainty factors is too little, and need to explain the possible error sources and effects in more detail.

We added more details regarding which uncertainty factors are important to section 3.5. We also added a Figure to the appendix to show an example of the Monte-Carlo-simulations (see

Figure 1). Specifically the following paragraph has been added:

The largest sources of uncertainty of the derived emission rate are the wind speed, wind direction and stability. Wind speed and wind direction influence the shape and the time of appearance of the modelled peak. The area of the peak changes as a function of wind speed, lower wind speeds lead to a larger peak, while higher wind speeds lead to a smaller peak. Also the peaks shift in time. With lower wind speeds than assumed, the modelled plume arrives at the measurement site later than expected, while with higher than assumed wind speeds, it arrives too early. The wind direction has similar effects and also changes the peak area and the time of arrival of the peak maximum. Stability however only changes the modelled peak area, more unstable conditions lead to smaller modelled peaks, as the plume can also grow vertically and the pollutants are dispersed over a larger volume. In contrast more stable conditions leading to larger modelled peaks, as the vertical dispersion is hindered. The source position does not play such an important role and neither the changes in latitude, longitude or height show significant changes of the modelled peak within the considered uncertainties. Also the resulting uncertainty within the measured peak area is small compared to the uncertainty caused by the wind speed, wind direction and stability. An example of the Monte-Carlo-simulations and the respective influence on the modelled peaks can be found in the Appendix.

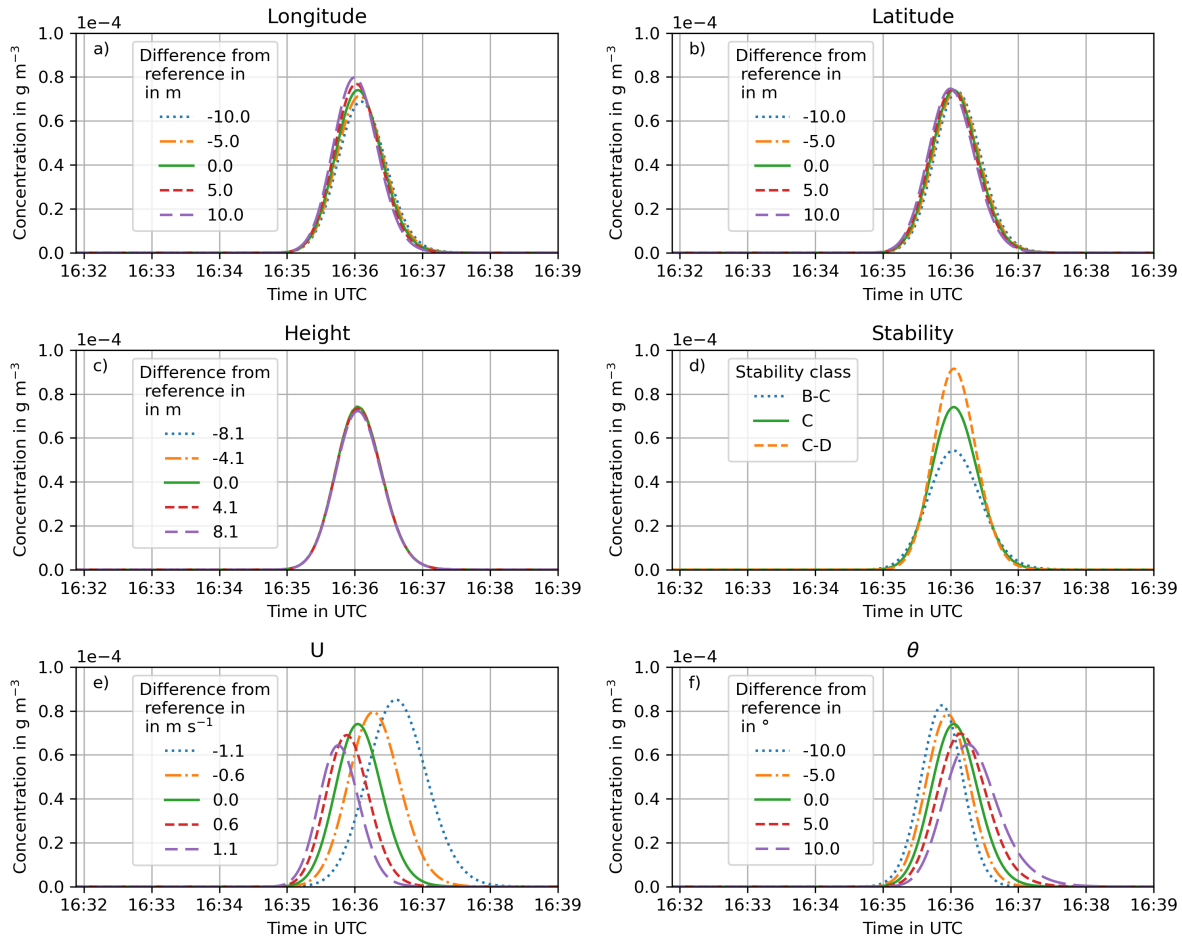

Figure 1: Monte-Carlo simulations for the example plume shown in Figure 4. In each plot one parameter has been changed within its respective uncertainty and the resulting model peaks are shown. The uncertainties shown in the plot legends are always expressed as deviation from the reference simulation, e.g. in plot a) -10 m means that the ship positions have systematically been moved 10 m to the west, while 10 m means each position has been moved 10 m to the east. The reference simulation (no uncertainty) is shown as a green solid line.

6. In line 153, I think it would be clearer and more concise to present the results of the two experiments separately. Also, abbreviations do not seem to be used. DURH and NERH.

We split the results into parts, describing DURH and NERH separately. Also changed to use the abbreviations DURH and NERH.

7. If I understand correctly, this emission rate refers to the emission rate of the target ship (from AIS). Then I think it should be stated in the abstract and the text, otherwise there seems to be a certain ambiguity.

We've tried to adjust the summary and body to make things clearer.

8. Confusion of logic and structure in Result. The results of emission rate were chapter 4, compared results were chapter 4.1 and 4.2, respectively. Three subsections might be more appropriate; “In order to validate the emission factors within the CLINSH project”, but the results in chapter 4 are emission rate. In other words, the result is emission rate, but validation is emission factor. Please clarify the logic in your argument.

"Emission factors" has been changed to "emission rates". We also refactored the whole Result section to improve readability.

Technical corrections:

1.Please add descriptions that NO_x=NO+NO_2, when the NO_x first appeared.

Done.

2. Some of the symbols in Figure 2 are not clear, Va, Vb, IV, up, down.

Changed Figure 2 to show ship length instead of ship class, also the direction of travel was changed from "up" and "down" to "upstream" and "downstream".

3. line 154, Does “quality criteria” means that raised in 3.4 “Quality control”? If so, please mention it.

Done.

4. Figure 5, symbol don’t know what it means. Although mentioned in Table 2, it seems inconvenient to read.

Thank you for your comment. Unfortunately, we could not find a way to make this figure more convenient to read.

5. In conclusion and other parts, one sentence as a paragraph is not recommended unless it’s an important conclusion.

Changed all one sentence paragraphs to include them into previous / following paragraphs.

References

Berg, N., Mellqvist, J., Jalkanen, J.-P., and Balzani, J.: Ship emissions of SO_2 and NO_2: DOAS measurements from airborne platforms, Atmospheric Measurement Techniques, 5, 1085–1098, https://doi.org/10.5194/amt-5-1085-2012, 2012.

Berkhout, A. J. C., Swart, D. P. J., van der Hoff, G. R., and Bergwerff, J. B.: Sulphur dioxide emissions of oceangoing vessels measured remotely with Lidar: RIVM Report 609021119/2012, 2012.

Prata, A. J.: Measuring SO_2 ship emissions with an ultraviolet imaging camera, Atmospheric Measurement Techniques, 7, 1213–1229, https://doi.org/10.5194/amt-7-1213-2014, 2014.