

## ***Interactive comment on “The evolution of shipping emissions and the costs of recent and forthcoming emission regulations in the northern European emission control area” by L. Johansson et al.***

### **Anonymous Referee #1**

Received and published: 31 July 2013

#### Second referee response

Revised Manuscript The evolution of shipping emissions and the costs of recent and forthcoming emission regulations in the northern European emission control area. Lasse Johansson, Jukka-Pekka Jalkanen, Juha Kalli and Jaakko Kukkonen

The first conclusion in the first referee response remains a burning question.

1. It should be explained why the fuel use of auxiliary engines seems to be in contra-

C5414

diction with many other studies and observations;

The authors gave an extensive reply on this comment in which several arguments were included. These arguments all contain valid information to a certain degree. Most of the questions were responded sufficiently by the authors. Some explanations were added to the manuscript also.

Nevertheless it remains hardly conceivable that auxiliary engines can be responsible for more than 50% of the total fuel consumption.

It is stated by the authors that their model uses bottom-up calculation. This means that results cannot be checked very easily. Not by a referee and probably even by the authors themselves.

Nevertheless in the end the results (the totals) have to obey to some simple math.

Somewhere in their response to the first referee comment authors estimate fuel usage in harbours approximately at 25%. This 25% of fuel in harbours is of course completely used by auxiliary engines. As a consequence to reach 50 percent fuel use by auxiliaries (on the total) it is necessary that at sea on average more than 1/3 of all fuel is used by auxiliaries. To my opinion this is a rather extreme average share of fuel used by auxiliaries at sea even when slow speed steaming is applied widely.

In another place in their response authors point at the circumstance that only 65% of time is spent at sea. This means that 35 percent of time is spent in harbours. Combined with the fact that the share of fuel in harbours is about 25% this means that fuel rate in harbours is about  $0.25/0.35 = 70$  percent compared to fuel rate at sea. It is very likely that fuel rate in harbours can not be 70 percent of the fuel rate at sea.

So two extreme situations seem to occur in the model to explain the high percentage (of more than 50 percent) of fuel spent in auxiliaries: 1. In harbours average fuel rate is 70 percent of average fuel rate at sea 2. At sea at least about 1/3 of total fuel use is consumed by auxiliaries

C5415

I kindly request the authors to check whether these two situations do occur in the model results.

When these two situations do not occur other explanations of high fuel usage by auxiliaries are needed. When these two situations in the model results do occur the behavior of the model should be checked with the assumptions and the expectations that are forthcoming.

The reasoning that this model has a complex bottom-up approach does not dismiss the authors from their duty to check whether the model behaves within the boundaries that may be expected.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 16113, 2013.