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# ***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 #2**

Received and published: 3 September 2013

The authors present a bottom-up emission inventories for shipping in Baltic Sea and North Sea for years 2009 and 2011 investigating effects of IMO legislation in European ECAs on emissions and on fuel costs. Emissions from shipping have been in focus due to their high contribution to total anthropogenic emissions of SO<sub>2</sub>, NO<sub>x</sub> and PM. A thorough investigation of effects of the recent and future IMO legislation is important and within the scope of ACP. The emission model and its application on emission inventory for Baltic Sea and North Sea shipping have been presented by the authors earlier, the study of the effects of IMO legislation and of different mitigation scenarios is novel and

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the results are important contribution to state of the knowledge both for science and for policy makers. The emission inventories for shipping have been associated with substantial uncertainties and a detailed study like this one can improve understanding of distribution of fuel consumption/emissions between different ship categories and ship operation modes. However, here I would agree with comment of referee 1 that the fuel consumption by auxiliary power generation looks very high in proportion to the consumption by main engines, both comparing total fuel consumption in port to that at sea (my calculation gave 60%) and comparing fuel consumption by auxiliaries to ME at sea. Since these findings are not in agreement with earlier inventories, I would recommend specifying fuel consumption by auxiliary machinery (&boilers) by the different ship categories along with the ME fuel consumption. Please, check also consistency of the following 2 statements:

p.16115, l.20: ... use of the auxiliary engines may be responsible for more than a half of the total fuel 50 consumption

p. 16129, l. 18: Based on the fuel consumption statistics for IMO registered vessels, 38% (#same in both years?) of the total fuel was consumed by auxiliary engines in 2009 and 2011. ... Without shaft generators the predicted fuel consumption of main and auxiliary engines would be almost equal

Does the first statement (more than 50%) mean auxiliary engines if no shaft generation were not used? This is somewhat confusing.

The methodology of emission calculations in STEAM is presented in detail in earlier papers and is only briefly outlined in this manuscript. Here I would recommend presenting explicitly how PM<sub>2.5</sub> emissions change with the different fuels assumed in the study as numerous conclusions about PM emissions are done. Also the effects of exhaust cleaning systems should be described more clearly (p. 16120, l.26 – p.16121 l.2: 'amount of exhausted SOX and PM is not allowed to exceed the amount that would be exhausted by burning fuel with acceptable FSC' – does this mean that SOX and PM

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emissions are set to be equal to those from acceptable fuels or that emissions are set to those corresponding to actual EGCS applied?)

Apart from the issues given above the paper has good quality with respect to the clarity of title and abstract, structure and scientific presentation.

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

**ACPD**

13, C6486–C6488, 2013

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