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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model calculations of the effects of present and future emissions of air pollutants from shipping in the Baltic Sea and the North Sea" *by* J. E. Jonson et al.

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General comments: This is a fine paper showing the environmental impacts of current and new air quality policies in North Sea and Baltic Sea international shipping. The methodology uses state of the art ship emission inventory models and atmospheric chemistry transport models. The ship emission inventory model (STEAM) uses a novel concept where automatic identification signals from ships are used to determine the shipping activity in a great temporal and spatial detail and subsequently detailed emissions are calculated. This is also one of the first studies to show the impacts on PM2.5 levels in the Baltic Sea states of a nitrogen emission control area in the Baltic Sea and

North Sea. In addition it is one of the first studies to show the air quality impacts of the stricter sulphur regulations that entered into force by 2010.

Specific comments: Page 21949: line 20. IHS Fairplay is used for ship technical specifications. However, it does not cover all ships that sail in the North and Baltic Seas. The authors are encouraged to explain how they dealt with missing specifications for ships that are not in the HIS database. Page 21950: line 17-19: the Authors state that EC, OC and ash emissions do not depend on fuel type. I think this needs clarification. Although ash content in fuel oils may not differ much between distillate fuels with 1.5% S (allowed before 2010) and 1% S (allowed after 2010), a change from high sulphur heavy fuel oils (1.5% S in HFO) to low sulphur distillate fuels oils (0.5 or 0.1 % Sin MGO) does involve a reduction in ash content as well and hence the ash emission factors. So, the authors could explain better what fuel types (distillate or not) were assumed before 2010 (mainly HFO), in 2011 (. . .) and after 2015 to 2030 (0.1% S in MGO ?) and the relation with PM emissions. Maybe also explain there that most of the PM emissions from ship engines are in the PM2.5 range and only a small share is in the PM2.5-PM10 range. Page 21955: line 7: It may be worthwhile to explain a little more about the NOx titration. Maybe the authors can put the calculated effects in perspective of what order of magnitude of NOx reductions are needed on both land and sea in order to have real ozone reductions even in the polluted areas of Northern France, Belgium, the Netherlands, Denmark.

Technical corrections: 21944 line 2-6: too many comma's in one sentence. 21944 line 21: present emissions levels = current ? 21945 line 12: other sources = land-based sources 21945 line 21: from shipping = from international sea shipping 21945 line 22: restyle sentence 'the most significant. . ...Directive'. 21945 line 27: decided = mandatory 21946 line 1-2. Make clear that the SECA's started in 2006 (Baltic) and 2007 (North Sea) 21946 line 11-13: see specific comments: I think you can't make this statement this strong. It does depends on HFO versus distillate. 21946 line 18 add underlined: . . .in all sea areas around the European Union in the last two decades.

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21946 line 25-26. Remove complete sentence: 'This will happen. . ..Area'. 21946 line 26: What did you assume for the share of LNG? 21946 line 29: TIER III is about 75% reduction in NOx emission limit compared to TIER II, not 80%. 21947, line 21: The evaluation of the environmental and health effects. . . 21947, line 27: high resolution = high temporal and spatial resolution 21948, line 13-14: from the clean sector.. Mace head = suggestion: collected at the boundaries of Europe such as Mace Head, Ireland. Page 21948: line 16. State clearly that you used only one meteorological year (for historic years 2009 and 2011 and the projections year 2030) because you want to show the impacts of emission policies and not differences due to meteorological changes. It is good if you can characterize / qualify the meteo year 2010 in terms of sun (ozon episodes), rain, wind strength and ruling directions compared a longtime average. I think 2010 is not an extreme year in terms of sun and temp and ozon episodes. 21949, line 2:-5: make clear that this is about land-based emissions. 21949, line 20: see Specific comments. 21949, line 26: tyhis resolution is fines than the resolution that is applied by the EMEP model. So these emissions were agregated to the $\frac{1}{4}$ by 1/8 degress of the EMEP model? 21950, line 20: see Specific comments. 21951, line 2: Can u say something on reduction in total PM2.5 and add this total to Table 1 at the Right? 21951, line 2-10 need some English editting. 21952, line 12-14: Please check whether you can connect the YOLLS and Loss of statistical Life Expectancy (LLE) like you do in your explanation, since there are some differences in the approach of the two calculations. 21952, line 18: change the word 'assumed' into 'used ' (the dose response realtionship you refer to is not assumed but it is a proven relationship). 21952, line 19: change the word 'assumptions' into 'dose-response relationships'

21953 line 28: . . .... the effects on PM2.5. This is explained by the fact that larger part of the PM emissions from sea shipping has a particle size below PM2.5. 21956 line 19: . . .are directly comparable in terms of emissions changes. 21956 line 22: '. . .expected changes in land and sea-based emissions in Europe'. 21957 line 22-23: explain that we talk about the NOx contribution to PM in the form of nitrates. 21958 line 1: From 2015 sulphur fuel quality regulations. . . 21958 line 6: foreseeable 21958 line 7: The

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transition to TIER II on new ships and ships becoming more efficiënt. . .. 21958 line 17-19: 0.1% fuel oil is a distillate oil. 1.5% S is probably not a distillate fuel oil. Be clear what is distillate and which one is not. 21965: See table, change Dep-N into Dep-NOx. Or is it only the moleculair weight of N (originating from oxidised N) that is given here? 21970: PM2.5 : no subscripting is used, units need to be separated: μg/m3 or μg.m-3

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 21943, 2014.