Referee comments to Eide et al., Reducing CO2 from shipping – Do non-CO2 effects matter?ACP-2012-386

The manuscript accesses effect of CO_2 emissions reduction measures applied on world shipping on environment in terms of change in concentration and deposition fields of air pollutants and on climate in terms of radiative forcing and temperature changes. The climate impact due to both CO_2 and other climate forcers are assessed. The assumptions used in the study are sound and have been already published by the authors (Eide et al., 2011) and the tools and methodology used for assessments, the combination of global chemical transfer model, radiative transfer model and simple climate model are well established and have also been published earlier. The manuscript is well written, however, at places clarifications or references would help its transparency, mainly in connection with the used emission factors.

1. The BC and OC emissions in relation to the total PM emissions are 2.4 and 8%, respectively in your emission inventory. Especially 8% of OC in PM sounds low. There are only few data published and the variability is quite large so it would be good to spent few words on discussion of assumptions behind using the actual emission factors. What reference have been used and which were the assumptions for emission factors and PM compositions used (type of fuel and engine)?
2. For sulphate part in PM 40% have been used, citing Petzold et al, 2008. What are their assumptions considering type of fuel and engine (HFO and 4-stroke engine, engine load) and what are the assumptions in your emission inventory (eg. are there some assumptions of use of MGO or other fuels in the 2010 fleet?). Primary sulphate (emitted from the chimney) is often relatively small part of the total sulphate generated by shipping, this could be good to stress in the text as there is often confusion about role of primary and secondary sulphate in different communities (air pollution modellers, global modellers).
3. p.8, l. 25-27: (for SECAs) SO_X, PM and OC emissions are not distributed uniformly …
   on p. 12, l. 34-37: It is noted that the change in sulfur emissions will likely 35 influence on emissions of OC and BC (e.g. Lack et al. 2011; Lack & Corbett, 2012). While this may substantially impact on BC and OC emissions, their relative importance to sulfur is minor (see Figure 6a) and is disregarded in the following.
   These 2 statements are in disagreement to me – SO_X is obviously reduced in SECAs but how do you treat PM and its components $SO_4^=$, BC and OC? Please, harmonize these 2 paragraphs and explain how do you treat PM and its components.
4. p. 13, l. 27-31: Replicating the analysis for a scenario in which no low sulfur mandate is enforced, we find that the warming in 2050 is twice that in the low-sulfur case, and that cooling is delayed until 2090 – I might be confused here but you show that on the short term the RF from the reduction scenario is dominated by strong warming from sulphur reduction (less sulphur = warming, Figure 6). But here my understanding is that no sulphur regulation causes warming in 2050 doubled (more sulphur = warming). Am I missing something here or is there 1 'no' too much?

Some recommendations to the authors:

Abstract – l. 7-8 'In the reduction inventories CO_2 emissions are reduced … Is there a possibility to describe the studied mitigation strategies in few words? This would make the abstract more

concrete. The same applies for the rest of the manuscript, one need to go to Eide et al. (2011) to find out what mitigations are considered.

p. 3 l. 13: This harms ecosystem growths – maybe biodiversity or just ecosystems?

p.3 l. 15: asymmetric growth in nitrogen poor regions – maybe asymmetric plant competition?

p.4 l.2: IMO regulations are on SO_X and NO_X. The PM is regulated only indirectly through secondary PM formation. This statement is often used and quite confusing.

p. 4 l. 15-17: What year are the reductions at USD 50 related to, 2030?

p.4, l.34 – 39: some references? e.g. Lack et al., 2012.