

Interactive comment on “Future emissions from oil, gas, and shipping activities in the Arctic” by G. P. Peters et al.

Anonymous Referee #2

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The authors present estimates of present-day (2004) and future (2030, 2050) emissions from shipping and oil and gas production in the Arctic. Future conditions are expected to be more favorable to various activities in the Arctic region as sea ice extent is further reduced. Arctic climate may be especially sensitive to endogenous emissions of black carbon and other pollutants.

I recommend publication in ACP subject to revisions to address the following comments.

1. There is a closely related prior paper by Corbett et al. (2010) in ACP. This prior work should be prominently cited/acknowledged in the introduction. At present there is a brief mention of the prior work at line 12 on page 4930, but only as a source of emission factor data for particulate matter. A few sentences of text outlining differences

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in methodology & scope would also be appropriate. At a later stage of the paper, the authors might consider comparing their results with prior work if such comparisons are possible.

2. The estimates of future oil & gas production seem plausible, data on emission factors in section 3.3.1 are generally poor, as the authors acknowledge. Is there any reason to believe a dataset based on voluntary reporting by oil and gas companies is accurate? I would expect industry would tend to under-report. Also present-day emissions are heavily dominated by natural gas production in West Russia, with second-tier contributions coming from Alaskan oil production. The discussion of emission factors is not explicit about which oil companies are reporting emissions data for which regions. One might expect significantly less if any data reporting for West Russia, and perhaps different production practices (hence different emissions) as well. So while the authors have made good efforts to estimate the locations and possible future amounts of oil & gas production, the associated greenhouse gas and especially short-lived pollutant emissions seem quite weakly based in comparison for this sector.

Are the authors aware of any prior studies evaluating emissions from oil & gas production, and the accuracy of reported/published emission estimates in comparison to field measurements? Studies from more southerly latitudes could be considered given the general scarcity of data here.

3. Given the above uncertainties in emission factors, the precision of the estimates reported in Tables 2-3 seems overly optimistic. I recommend reporting 2-3 significant figures at most, currently they report values that are misleadingly precise.

Technical Corrections

4. In Figure 1, it would be helpful to show the Northern Sea Route. Obscure acronyms such as FRISBEE and AMAP should be avoided here if possible.

5. Figures 4ab there are color scales for transit shipping and oil & gas shipping fuel

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consumption, but what is shown on the figures is just a single line that appears as one color along its entire length. So the use of a color scale is not working with the way information is being presented in this figure.

6. In Tables 5 and 6, the authors should consider adding total GHG emissions as a further row, using global warming potentials (GWP) to combine CO₂, CH₄, and N₂O emissions into a weighted sum.

Editorial Comments

7. Page 4918, line 7, requiring should be require

8. Page 4918, line 12 mid-1990 means June-July 1990. I think what is actually intended here is "the mid-1990s", i.e. around 1995.

9. Page 4921, line 16, what does FRISBEE stand for?

10. A reference is needed at page 4922, line 8, for the statement about the time lag from investment decision to maximum plateau production being 50-100% longer than in comparable non-Arctic fields.

11. Why are costs in East Arctic Russia twice the existing cost level, whereas everywhere else in the Arctic only 50% higher?

12. Page 4922, line 17, if world oil price is exogenous, what is assumed and where does this information come from?

13. Page 4925, lines 24-25, the references to "information" do not make sense to me. "without better information we keep the information as estimates can be grouped to centralized grid-points if needed"

14. Page 4927, lines 1-5, the EDGAR estimates are poorly presented here. It is difficult to read through and make sense of. Perhaps include the EDGAR values that you want to compare with in Table 2 instead so the reader has the numbers lined up better for looking at and evaluating.

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15. Page 4927, line 7, fix grammar problem: we only use *a* bottom-up data based on...

16. Page 4928, lines 24-25, I think the parenthetical TEU numbers (3.9 and 5.6 million) are not needed, they make the text harder to read and they are just 1/3 each of the preceding numbers anyway so give no additional useful information.

17. Page 4929, line 19, like should be "such as" (with no comma)

18. Page 4932, line 12, omit "a", we do not find rapid aggregated emission increases (increases is plural)

19. Page 4934, I find the legal text Copyright (2011) all rights reserved appearing in the acknowledgments, and the sense of proprietary data and modeling tools being used here to be troubling. My understanding is the authors retain copyright of their paper anyway, so I wonder if this legalistic language is needed? Are the authors willing to share the modeling tools, input data, model outputs, etc. to interested readers who might want to evaluate the numbers more carefully or make use of them in other studies?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 4913, 2011.

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