

Summary: The manuscript; “Arctic shipping inventories and future scenarios” by J.J. Corbett et al. describes a new emission inventory for emissions of trace gases and aerosols in the Arctic region for present day and future scenarios taking into account, for example, possible increases in shipping due to reductions in summer sea-ice. The topic is interesting and warrants publication in ACP. However, there are several points which need to be addressed before the paper can be published.

The paper focuses largely on the input data used for the construction of the BC emissions but there is not much discussion about emissions of others species, in particular NO<sub>x</sub>. Some additional information should be added to the text. Also, there are some estimates about the climate impact of increased Arctic shipping emissions with the main estimate given in the abstract. However, the text provides very little detail about how these numbers were derived and I suggest removing this part (see comment below). The abstract and conclusions should focus on summarising the main work presented in the paper which is the development of the Arctic shipping inventory for present-day and future conditions. My more specific comments follow:

1. Does the paper address relevant scientific questions within the scope of ACP? Yes.
2. Does the paper present novel concepts, ideas, tools, or data? Yes, the paper presents a new emission inventory for Arctic ship emissions.
3. Are substantial conclusions reached? A new dataset is described – an attempt is made to apply the emission changes to estimate equivalent changes in future GWPs etc. However, very little detail is given about how the numbers in Table 15 have been derived. My suggestion is to remove this section and to include a short discussion about possible implication of their scenarios in the Discussion section. A much more thorough analysis would be needed if something more concrete were to be included on this topic. It is rather dangerous to include such estimates when it is not clear what they were based on. In any case there are many uncertainties related to making such estimates warranting a separate, more detailed study. There is no conclusions section.
4. Are the scientific methods and assumptions valid and clearly outlined? Yes, in general although certain points need to be addressed:
  - emissions from fishing are not included in this inventory – this should be made clear at the beginning of the paper and some further discussion should be included about the contribution this source makes to the totals (it varies between species).
  - emission factors – there should be some discussion about the uncertainties giving a range for current emissions
  - p6 : engine load factors – where were these numbers taken from ?
  - it would be useful in Table 3 to give the % of total global ship emissions – also the totals in Tables 3, 4 and 5 should match up.
  - p8 : more detail is needed about how the future scenarios (BAU, hi-growth and MFR) were constructed for the different species – for example, there is no discussion about NO<sub>x</sub>.
  - p11 – it’s not very clear why the authors also chose to include diversions through Suez as well as through Panama in their estimates of % diverted shipping to the Arctic. The references for these diversions are from either a website or from a report which is not cited – how good are these estimates?
  - Is there any possible overlap between growth in Arctic shipping and diverted shipping to the Arctic which could impact their assumptions?

- It needs to be made clearer in the text what is presented in Figure 3 by referring to the relevant tables. Also, there is a lack of detail regarding how the scenarios were derived for the different pollutants. The number of tables could be reduced if the figures are showing the same thing.
  - Tables 13 and 14 are hardly discussed at all and the labels are not very clear – why do « non-Arctic » and « global with Arctic » give the same totals for certain years (2004, 2030)?
5. Are the results sufficient to support the interpretations and conclusions? – see points above.
  6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? In general OK but there is a lack of detail as noted previously.
  7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes, although there maybe be newer references that could be used, for example, in the Introduction in this discussion about sea-ice.
  8. Does the title clearly reflect the contents of the paper? Yes.
  9. Does the abstract provide a concise and complete summary? Yes, but needs to be amended (see above).
  10. Is the overall presentation well structured and clear? Yes, in general.
  11. Is the language fluent and precise? Yes.
  12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes.
  13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
    - p7, parag 3 : wording is unclear – how were the errors estimated ?
    - p9, line 7 : what is HFO ?
    - p10, line 9 : correct to ‘ .... produced by ...’
    - p11, last line – GlobalSecurity.org is not reference.
    - p12, first parag. of the Discussion section – strange use of the word « asymmetric » - I think the authors mean « different » trends
    - Tables – see previous comments. Also, there are 15 tables in the paper – if any of the material could be provided graphically with the tables in supplementary material this would help the readability of the paper.
    - Figures – I had trouble printing the figures so there may be a formatting issue. The figure captions are not properly laid out – use of capital letters etc – see ACP format.
  14. Are the number and quality of references appropriate? Yes.
  15. Is the amount and quality of supplementary material appropriate? Not applicable.