

2nd round of review to acp-2015-845

Anonymous

1 General comments

The authors took the time to address the issues pointed at by the first round of reviews. The updated manuscript now successfully presents robust and interesting scientific results. It can now be published with only few remaining technical modifications.

- 5 The effort to compare the present results to most of the available literature in Sect. 4.2 is really appreciated, as the works on the Arctic are quite scattered and not often compared in comprehensive reviews.

2 Technical comments

- 10 – p.4 l.83: Shakhova's papers are highly controversial and should not be cited as an absolute reference. More recent works suggest that hydrates emissions to the atmosphere are not that significant in the Arctic. Please prefer some of the following publications rather than Shakhova's. For Svalbard: Grave et al. (2015; doi: 10.1002/2015JC011084), Lund Myhre et al. (2016; doi: 10.1002/2016GL068999). For Laptev: Berchet et al. (2016; doi: 10.5194/acp-16-4147-2016), Stranne et al. (2016; doi: 10.1002/2015GC006119) or Thornton et al. (2016; doi: 10.1002/2016GL068977)
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- p.18 l.388: Sect. 4.1, 4.2, 4.3 are 20, 100 and 30 lines long respectively, which makes the result discussion quite unbalanced. Sect. 4.2 is well structured with high quality content, but please consider splitting it into sub-parts to guide the reader in the discussion.
- p.11 l.221: in "GEOS-5 meteorological (met)", "met" looks a little bit clumsy when reading it the first time. Maybe replace by something like "GEOS-5 meteorological (hereafter GEOS-5 met)", or more elegant.
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- p.21 l.465: Berchet et al. (2015) applies a regional atmospheric inversion as in this manuscript with surface atmospheric sites and not "flux towers". Please reformulate this sentence.
- fig. 1: Siberia looks quite empty here, which is less and less true, fortunately. Somewhere in the discussion should be mentioned the effort by different teams to put instruments in Siberia: JR-STATION by NIES, ZOTTO by MPI, one site near Laptev Sea by FMI, etc. Environment
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Canada maintains continuous sites in North American Arctic as well. One or two sentences should acknowledge that using all these sites in an inversion system (possible follow-up of the present paper) should improve the inversion results and might reduce (or not?) the gains of using satellite data (though they would be always welcome).

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