Biogeosciences
Discussions

Interactive comment on "Natural and anthropogenic methane fluxes in Eurasia: a meso-scale quantification by generalized atmospheric inversion" *by* A. Berchet et al.

Anonymous Referee #1

Received and published: 24 November 2014

General comments:

Berchet and coworkers present a study of the methane fluxes for Eurasia with special interest paid to Siberia. They use surface observations from a collection of sites throughout the region in a Bayesian method they have developed in prior publications to provide objectively quantified uncertainties for the wetland and anthropogenic emissions.

I have three main comments/concerns:

I like the attempt at an objective quantification of uncertainty. Although I admit I struggled to understand the discussion of the marginalized Bayesian inversion. Reading the

prior publications in this series (Berchet et al. ACP 2013 and Berchet et al. GMDD 2014) certainly helped although I think some effort could be paid to increasing the clarity of the presentation of the technique to those not previously familiar with the enhancements they have developed. Because so many steps are required in this technique, I would suggest incorporating a flow chart into the paper to give the reader something to hang onto and chart progress as they read their way through the convoluted steps required in pre-processing and actual inversion. As they are laid out now it is easy to get lost.

One area I am a bit concerned about is the thresholds for 'hot spots' and ill-defined plumes (while understanding that their inclusion can be problematic). They are never defined beyond vague language and the exact thresholds could make their exclusion either relatively inconsequential or result in the loss of important information that could bias the estimates. I never got the sense that there was any attempt to understand how much impact the removal of hotspots and thin plumes has on the overall budget. Is it minor, major? This makes me wonder about how much improvement we gain from the inversion (with its approach that avoids poorly quantifying uncertainties) if we don't also attempt to quantify how important was the information excluded.

Lastly, it appears that very few of the discrete samples are discarded (Figure 2 sites like SDZ, TAP, UUM) as compared to the continous measurements. Does this demonstrate that the system is placing too much confidence in these samples? Considering how many samples are removed from the more continuous time series this seems strange. I wonder if this is a sampling bias and how will it influence the inversion.

On the whole, I think this is an important first step and the results of this work will be useful for future works and in determining optimal locations for further observation sites. I think the paper is publishable after modifications.

Other smaller comments:

The manuscript could use English copy editing. Usually it was clear what was intended

but in general some clean up is needed.

p. 14591 line 26: total production of?

line 29: absolute concentration? atmospheric mixing ratio?

p. 14592 l 11: Didn't Winderlich also use 3 other towers besides ZOTTO? (Demyanskoe, Igrim, & Karasevoe)

l 29: Add in the acronym CTM here since it is referenced later but never defined (that I could see).

In the manuscript, 'tuple' is used. Is this naming convention coming from programming?

p. 14595 l 29: How many Monte Carlo runs were performed?

It wasn't clear to me if the marginalized approach still has to assume a Gaussian distribution of uncertainties or not. If so, does the Gaussian assumption hold when you are forced to remove consideration of hotspots of methane?

p. 14606 l. 7: Thin plumes in what respect?

p. 14607 l. 21: Why is it possible to invert the accidental release plume at Elgin (Berchet et al. 2013 ACP) but not here? The scale?

p. 14611 l. 26: Indeed, this is where a study like this has great utility – Pointing out where observation sites would be ideally located.

p. 14613 l.15: But the hotspots are removed so how is it possible that the inversion is seeing 'punctual leaks and purging releases of gas'?

p. 14614 l2: 'a not negligible' - confusing. Try 'some' or 'a small' or 'a significant' whichever best fits.

Fig 3: To make it easier to read, make the outlines of the stars white. Also a scale is needed for the size of the markers. As it is now they vary in size but the reader has no information about what a big one means vs. a small. Also add labels to the colour bars

so we know which is which.

Fig 7: Please add in bigger numbers and some sort of colourbar label.

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