Biogeosciences Discuss., 10, C6505–C6509, 2013
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Biogeosciences Discussions
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Interactive comment on "Anthropogenic and natural methane fluxes in Switzerland synthesized within a spatially-explicit inventory" *by* R. V. Hiller et al.

Anonymous Referee #1

Received and published: 9 December 2013

General Comments:

The paper by Hiller et al. describes the generation of a national methane (CH_4) emission inventory for Switzerland for the first time at high spatial resolution (500 m x 500 m). Emissions from anthropogenic, natural and semi-natural sources are included. The resulting inventory is then compared with regional and global inventories. Uncertainties in the spatial disaggregation are estimated as these will be needed for some of the intended applications.

Depending on the source sector and data availability, two steps are used to generate the end product: (i) 'aggregation' of bottom-up data by sector/subsector to the national and annual scales; (ii) spatial 'disaggregation', again by sector/subsector, using ap-

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propriate national datasets available at the output spatial resolution. For many of the anthropogenic sources, the first step has effectively been undertaken as part of the Swiss Greenhouse Gas Inventory (SGHGI) programme. Much of the literature cited is to national reports and datasets (e.g., by the Federal Office of for the Environment). The paper is however well written and provides sufficient detail and justification of the approaches used.

The only validation presented in the paper is comparison against other, international;ly-accepted inventory estimates (EDGAR, TNO-MACC and NATAIR, all produced at coarser resolution). The EDGAR and TNO-MACC inventories are widely used in the atmospheric modelling community (for both forward and inverse modelling). One might expect that the detailed inventory generated in this paper is more reliable. Although the comparison is informative, there are a number of limitations, as identified by the authors.

The only real test of the emission estimate is comparison against measurements (atmospheric concentrations or fluxes). I wonder whether there is scope to include some such comparison against independent flux measurements or atmospheric concentrations. The reference to Hiller (2012) in the Introduction is given as the single Swiss attempt to upscale flux measurements to validate its national inventory. The reference is to the lead author's doctoral thesis (and only the abstract is available from the link provided). That said, some of the key measurements or results from the thesis could usefully be included here.

The uncertainty analysis is highly relevant given that one of the stated uses of the inventory is as 'a prior emission estimate' for inverse modelling applications. Although the paper addresses the spatial dimension, the authors correctly note the importance of the temporal variability in the methane emissions. In principle, temporal information for specific sectors is available to the authors and this could be used to generate temporal profiles (and uncertainties).

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Taking a broader view, I have a number of questions about the inventory and methodology: (1) Will the dataset be made available to the research community? (2) How frequently will the inventory be updated? (3) How applicable are the results to other countries?

Specific Comments:

The authors take different approaches for the natural and anthropogenic sources when comparing their emission estimates with existing data. For example, new improved estimates based on in-country measurements are presented for the emissions from rodents, uptake by forests and these are preferred to the older estimates. For the wastewater sector (page 15191), the new emission estimate is ten times higher than the current official estimate (based on a different methodology). The official estimate is preferred for this sector, largely for consistency with the totals reported in the SGHGI (but there is the proviso in the paper that this could be higher). In the absence of atmospheric measurement, we simply do not know which is the more reliable emission estimate (and even here, it would be difficult to fix the emission from this sector).

Figure 2b (methane emissions from energy) gives some sense of where the major population centres are located. I wonder whether a map of population density could usefully have been included (e.g., in the Supplementary Material). The map of methane emissions from waste (i.e., landfills) contains emissions from small areas and can only be seen clearly by zooming in on the screen. I suspect that it would be hard to distinguish these on the paper copy.

The authors correctly note that the EDGAR inventory used its own methodologies for the collection of activity data, application of emission factors, and spatial allocation whereas the TNO-MACC inventory disaggregated the reported country emission totals. The authors ascribe the difference between the EDGAR and the present inventory to the greater dependence on population density for distributing the emissions in the EDGAR inventories. The comparisons reported in the paper were based on the total methane emissions. In principle, spatial inventories are available at the sectoral level

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and this might provide further insight into the reasons for the significant difference between the two inventories.

I draw the authors' attention to the paper by Winiwarter et al. (2003), in which various methods were investigated to compare different gridded emission inventories (linear regrerssion, line comparisons, Moran coefficient). Perhaps, some linear regression plots could be included or the coefficients from such an anaysis could be added to the difference plots.

The derivation of the uncertainty in the spatial emission inventory is not completely clear. The uncertainty in the emission from each grid square was assumed to be a fraction of the absolute emission in that grid square. This fraction was then derived using Gaussian error propagation to match the requirement that the overall uncertainty was equal to the uncertainty in the national inventory (16%). It looks as if the same fractional error was assumed for each grid square. Is this for the total or for the sectoral emission in that grid square? Further, the error co-variances were then derived from the correlation length scale. Two length scales were derived from the analyses of the differences between this inventory and the scaled EDGAR and TNO-MACC inventories. Which one was used or was the average taken?

Technical comments:
There are some minor typographical errors and comments:
Page 15197, line 2: 'row' should be 'roe'
Page 15197, line 7: 'dear' should be 'deer'
Supplementary material, page 5: The entry in Table S2 'gardens in settlements' looks out of place in this table on wetland types.

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References

Winiwarter, W., Dore, C., Hayman, G., Vlachogiannis, D., Gounaris, N., Bartzis, J., Ekstrand, S., Tamponi, M. and Maffeis, G.: Methods for Comparing Gridded Inventories of Atmospheric Emissions – Application for Milan province, Italy, and the Greater Athens Area, Greece, The Science of the Total Environment, 303, 231–243, 2003.

Interactive comment on Biogeosciences Discuss., 10, 15181, 2013.