Ms. Ref. No.: acp-2016-963

Title: Estimating the size of a methane emission point-source at different scales: from local to landscape

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23rd March 2017

Dear Editor,

We would like to thank the referee #2 for their comments. Please find our detailed responses below.

Yours sincerely,

Stuart Riddick (corresponding author)

and co-authors: Sarah Connors, Andrew Robinson, Alistair Manning, Pippa Jones, David Lowry, Euan Nisbet, Robert Skelton, Grant Allen, Joseph Pitt and Neil Harris

Reviewer #2

My main problem in this paper is the conclusion that the landscape inverse modeling approach can be used to identify point sources. The inversion method lacks details and the discussion is somewhat superficial. I think OSSEs would be required to determine the ability of observations at the landscape scale to constrain emission hotspots. We have refocused the paper and made the point that distinct emission sources can be observed within an emission landscape. We suggest that landscape inversion models can be used to identify emission hot-spots within an emission landscape. Page 1 L25 the following has been removed: "is in good agreement with more labour-intensive nearsource approaches and"

Page 1 L26 the following has been removed:

"to provide high-quality emission estimates"

Page 12 L31 the following was removed:

"agreement between the middistance estimates and the" and

"that provide data for regional inversion models"

Page 13 L19 the following was added:

"output from"

Page 12 L32 the following was removed: "the network and even to quantify their emissions hotspots"

		Page 13 L20 the following
		was added "an emission
		landscape"
P6, L9-10: "The standard	The values used can be found	
deviation of the lateral (σy ,	in the Supplementary	
m) and vertical (σz , m)	Material Section 1.	
mixing ratio distribution are		
calculated from the stability		
class of the air (Pasquill,		
1974)." So what are the		
values for the standard		
deviation used in this paper?		
P7, L19: "This allows for any	High methane concentration	
potential bias due to highly	values seen at Haddenham	
uncertain observations to be	are usually short lived and	
accounted for." I don't see	appear as peaks lasting only a	
how the bias would be	few hours (max). They	
accounted for.	usually occur at nighttime	
	and, as the isotopic analysis	
	shows, probably come from a	
	landfill, which is an	
	intermittent of methane.	
	These are therefore more	
	uncertain. The values would	
	have a relatively high cost	
	score at these times. So, by	
	including the hourly SD into	
	the uncertainty calculation	
	this helps to de-weight the	

P9, L14-15: "A statistical See comment above. P9, L14-15: "A statistical See comment above. filtering technique separated See comment above. methane mixing ratios at each site into" What is this statistical filtering? This percentile is used as a percentile"? Why not 10th or result of sensitivity analysis 25th? showing that the resulting InTEM inversion results produced the lowest cost score to the measured observations than any other percentile 5 th to the 45 th . Sensitivity analysis shows this baseline produces emission results with consistently stable emissions with the lowest cost score of all baselines tested. P9, 1.21: "For a more detailed A new paragraph is included Text added at P9 1.12:		large concentrations, which	
Increasing the overall cost score.P9, L14-15: "A statistical filtering technique separated methane mixing ratios at each site into" What is this statistical filtering?See comment above.P9, L16: Why "18th percentile"? Why not 10th or 25th?This percentile is used as a result of sensitivity analysis showing that the resulting InTEM inversion results produced the lowest cost scores and therefore means the emissions produced are closer to the measured observations than any other percentile tested. I tested from the 5 th to the 45 th . Sensitivity analysis shows this baseline produces emission results with consistently stable emissions with the lowest cost score of all baselines tested.		_	
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	month data.		
the lowest emissions month is 1110 kg/hr and has been			
	the lowest emissions month is	1110 kg/hr and has been	

in April (111 kg/hr). I am not	corrected. The response of	
very convinced that	CH ₄ emission from landfill to	
seasonality is due to	temperature is well	
temperature. Does stability	documented and a result of	
class in the Gaussian plume	methanotrophic bacteria	
approach play a role?	becoming more active during	
	the summer months.	
P12, L33-34: I am not		Added at P12 L19:
convinced by this conclusion.		"We suggest that the
See my general comments.		agreement in emissions
		estimates between the near-
		source and middle-distance
		methods indicate that a
		Gaussian plume approach can
		be used to estimate emissions
		up to 7 km from a relatively
		large source. However, this
		may be an upper estimate of
		the distance that this
		approach is effective as the
		fetch between the source and
		detector was relatively flat
		and a more aerodynamically
		complex landscape may
		reduce the model's efficacy."
		At P12 L25:
		"Our results suggest that
		larger emission hot-spots can
		be detected within the

	emission landscape generated
	by an inversion model.
	However, we would suggest
	that future sensitivity studies
	should be conducted to
	estimate the size of emission
	hot-spots within a landscape
	where the source is farther
	from a measurement site used
	as input to the inversion
	model."