

## ***Interactive comment on “Inverse modeling of European CH<sub>4</sub> emissions: sensitivity to the observational network” by M. G. Villani et al.***

**Anonymous Referee #2**

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### General comments

I thought that the paper was well structured and highlights a good method of testing an inversion method. Testing an inversion method is vital and the use of pseudo observations is an obvious first step.

### Specific comments

- 1) P.21078 what was the magnitude of estimated “model representativeness error”? why 50%?
- 2) P.21080 control vector? Please explain.
- 3) P.21082 ‘a typical boundary layer station’ – during the day this will be true (i.e. when

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you take the observations) but during the night this could very easily be above the boundary layer. Therefore can a tower be described as a boundary layer station?

- 4) P.21084 units in ppb/(kg/s) – I assume this is per grid box?
- 5) P.21084 over all of Europe but can be effective on small regions.
- 6) P.21085 All of the values are reported in this page with no uncertainty. E.g. “are 45% lower than” etc. Surely there is not one single value? With all the sensitivity analysis this is shown very clearly. I think ranges would be much more appropriate.
- 7) P.21087 MHD, CB4 and SIL all show reasonable sensitivities in this region so I think it is a bit strong to say “no observational sites”.
- 8) P21088 The inability of the method to find the emissions in the North Sea is a limitation of the need to use a priori constraints.
- 9) P21089 As individual grid cells should not be “over-interpreted” could not the inversion be performed at a coarser scale and produce similarly accurate results?
- 10) Conclusion – this method of testing is good and useful but it should be noted that not all stations can be equally well modelled in reality e.g. mountain stations, coastal station etc.

### Technical corrections

- 1) P21089 “The issue is currently investigated more closely” – please re-word.
- 2) P21090 “to design and optimal” – replace “and” with “an”
- 3) P21090 “In absence” - add a “the”

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