

## ***Interactive comment on “On the use of satellite derived CH<sub>4</sub> / CO<sub>2</sub> columns in CH<sub>4</sub> flux inversions” by S. Pandey et al.***

### **Anonymous Referee #2**

Received and published: 20 April 2015

Authors develop and test surface CH<sub>4</sub> flux inversion scheme designed to ingest the XCH<sub>4</sub>/XCO<sub>2</sub> ratio retrieved from satellite observations. Authors mention that similar method was applied earlier by Fraser et al 2014 using a different transport model and inversion method, thus the new results extend the analysis to the case of grid-scale inversion. The pseudo-data experiment is used to quantify the theoretical performance of the method. The advantage of the developed technique is its ability to use soft constrain on CO<sub>2</sub> fluxes instead of hard constrain applied in a traditional approach when only XCH<sub>4</sub> retrieved with proxy method is used. According to the conclusions, the advantage of the technique is limited to regions of large uncertainties in CO<sub>2</sub> fluxes and simulated XCO<sub>2</sub>.

The manuscript is well written, except for several mistypes, the originality and scientific  
C1709

value of the results justify acceptance for publication. Minor revision addressing the comments below is needed.

Comments:

8807 line 5. Authors suggest that CONGRAD is different from M1QN3 in assuming the cost function as multidimensional parabola, and thus less applicable to nonlinear problems. There are two considerations that do not go along with this discussion. Firstly, Meirink et al, (2008) point that the origin of CONGRAD is a code applied by Fisher and Courtier, (1995) to the nonlinear problem of weather forecast. Secondly, M1QN3 makes estimate of Hessian which is equivalent to approximating the cost function as multidimensional parabola, thus this can not be mentioned as disadvantage of CONGRAD. The actual reason for M1QN3 to perform better in nonlinear case could be ability to rebuild Hessian approximation several times on the course of descent to minimum.

8810 line 24. Authors use both CONGRAD and M1QN3, for consistent comparison single method could be better. So, why single method M1QN3 is not used for all inversions? Need to check if the results are stable with respect to the method applied.

8811 line 4. Sounds better to say “Transcom land regions” instead of “land Transcom regions”

8811 line 8, 10 and below. Should variables cor and bias be written in italics to separate them from the rest of the text?

8812 line 15. Written as “for 100 M1QN3”, it looks incomplete, would be more understandable when text is extended as “for 100 iterations of M1QN3”

Typos:

8807 line 19. assumed -> assumed

8809 line 21. ‘Transport model’ starts with capital T here, could be mistype?

8812 line 16. in-comparioson -> in comparison

References (other than in the manuscript) M Fisher, P Courtier Estimating the covariance matrices of analysis and forecast error in variational data assimilation, ECMWF Tech. Memo 220, 1995

---

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 8801, 2015.

C1711