

Interactive comment on “Tropospheric CH₄ signals as observed by NDACC FTIR at globally distributed sites and comparison to GAW surface in-situ measurements” by E. Sepúlveda et al.

Anonymous Referee #2

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General comment

The paper addresses the problem of defining a tropospheric CH₄ averaged column for NDACC FTIR CH₄ retrieved profiles. Although the paper addresses an interesting problem, it does not provide a clear outline of the scientific methods and assumptions. I was not able to check the validity of equations (5), (6) and (7), nor could I find a mathematical motivation for equations (10), (11) and (12). Perhaps the a posteriori method is introduced elsewhere in the literature, but then the necessary references should be made.

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Specific Comments

- The paper contains statements that are not entirely clear to me:
 - p637,l-1: ‘... the tropospheric signal is much smaller than the boundary layer or the UTLS signal’: what does signal mean?
 - p642,l2: ‘... we calculate the tropospheric column-averaged CH₄ mole fraction directly from the measured spectrum’: do you mean from a retrieved CH₄ profile (‘directly from the measured spectrum’ is confusing)?
 - p645,l-9: Can you describe the temperature uncertainty correlations between the different layers?
 - p648,l3: ‘... that ensures an optimal separation between the retrieved tropospheric and stratospheric amounts’: what does optimal mean? Did you compare to other methods?
 - p648,l19: ‘The a posteriori correction means an a posteriori optimisation of the retrieval constraints. The constraints are modified in order to get a tropospheric product that is optimally independent of the UTLS’: quantify the meaning of optimization and make this statement more precise: show how equation (12) changes the retrieval constraint (which is Tikhonov-Philips matrix).
 - p649,l4: ‘... but it provides the best tropospheric CH₄ data quality’: specify the meaning of best. Did you compare your product with other products?
- p644: Equations (5), (6), (7): I do not understand how these equations have been derived. The smoothing error is obtained from $(A - I)S_a(A - I)^T$ where S_a is the (estimated) covariance of $(x - x_a)$. Indicate how $S_{a,bl}$, $S_{a,tro}$ and $S_{a,url}$ relate to S_a . This should explain why you treat the bl and utls contributions differently in equations (5), (6) and (7).

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- p647: Motivate equations (10), (11) (12). How does this C guarantee an 'optimal separation' between tropospheric and stratospheric amounts? On p648 you mention an optimization of the retrieval constraint. Do you mean that the matrix C optimizes the Tikhonov matrix? This seems to be a strong statement. Provide a more mathematical motivation for this statement.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 633, 2014.