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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A comparison of different inverse carbon flux estimation approaches for application on a regional domain" *by* L. F. Tolk et al.

L. F. Tolk et al.

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We thank the reviewer for his comments and the constructive review. The questions and remarks raised by the referee are answered below, and the suggestions are included in a new version of the paper.

"One minor issue that I have with the paper is that it is not clear what the primary intention of the inverse estimate is. Is it for estimating regional budgets in the sense of a "reanalysis", or is the focus also on predictive capabilities? This should be clearly stated."

The primal intention of the inversions is providing an estimate in the sense of a reanal-

ysis. This is added to the fourth paragraph of the introduction.

"I find the paper acceptable for publication after addressing this and the more technical issues below. Detailed comments:

P3361 L19 I would suggest to replace "new biosphere model constants" by "new biosphere model parameter values""

This has been done. "P3364 L3 "a" instead of "an" "

"an" is replaced by "a"

"P3364 L24 why was a different model-data mismatch used for control and other inversions? This should be explained."

In the inversions where the biosphere model which is used to generate the priors is different from the biosphere model that provided the 'true' fluxes, the model data mismatch is increased with 1 ppm to account for the possible differences in the biosphere structures. This is added to the text in section 2.4.

"P3365 L19: the term "innovation chi-square" is unkown to the reviewer, probably also to other readers. This term should be introduced."

The Chi-square metric compares the a-priori model performance to the specified error structure by dividing the squared forecast residuals (y-Hx)^2 by the total covariance (HPH+R) of fluxes and measurements. It is thus a measure of the balance between expected skill and achieved skill. An innovation chi-squared of close to 1.0 indicates a correct balance, while smaller chi-squared values suggest that the model performed better than specified in the covariance structure and hence the inversion was conservative in its prescription of covariance. We have added this brief explanation to the text in section 2.5 including a reference to Michalak et al., (2005) for further discussion of chi-squared statistics.

"P3368 L2 the metric RMSD should be introduced (it is introduced a bit late on page

3370)”

We moved the introduction of RMSD from p3370 to p3368.

“P3368 L15 it would be helpful if some additional information on the results of the control inversion would be given, for example the range of RMSDs for the best and worst method.”

We included the results of the control inversion in table 3, so that the full range on RMSDs is visible in the paper.

“P3369 L14 again some more information on the control inversion results would be helpful”

We included the RMSD of the control inversion in table 3 and we extended figure 4 with the results of the control inversion to provide the information about the flux average. This can indeed be very helpful for the reader, we thank the reviewer for these remarks.

“P3371 L6-9 It might not be that simple: the two inversions have an inflated variance, but also more degrees of freedom. It depends on how those different degrees of freedom are “aggregated” when turning fluxes into mixing ratios.”

The reviewer is right that the number of degrees of freedom also play into the X2 calculation as more degrees of freedom allow a better fit to the observations. However, these two particular runs referred to have *fewer* degrees of freedom than the other configurations and not more as stated above. We also confirmed numerically that the smaller X2 in these two inversions was not due to a decrease of the observation term (y-H(x))ˆ2 but to a growth the error term (HPH+R).

“P3371 L17 May be include the control inversion results in Table 4”

The results of the control inversion are included in table 4. The control inversions are in the table referred to with ‘truth fits biosphere model’.

“P3371 L21 move the bracket “(Tables 3 and 4)” to directly after “temporal structure of

NEE” “

This is done.

“P3373 L26 I do not see the necessity to have all three requirements at the same time. A good first guess combined with a small uncertainty could well work in a linearized version”

Indeed applying one of the suggestions could already work well, therefore we replaced ‘and’ by ‘or’.

“P3374 L3 if the authors have some specific “other observation types” in mind, those should be mentioned”

We agree that our description does not really describe our intention here. We have reworded the sentence to “(other observations such as water, energy, and CO2 fluxes and isotopes, more temporal constraints)”

“P3374 L15 add “estimation” after “biosphere model parameter” “

The concerned paragraph has been removed following a suggestion of the second reviewer “P3394 Figure 2: letters for different parts of figure missing”

The letters for the different parts of the figure are added.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 3355, 2011.