Atmos. Chem. Phys. Discuss., 15, C2739–C2741, 2015
www.atmos-chem-phys-discuss.net/15/C2739/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the statistical optimality of CO_2 atmospheric inversions assimilating CO_2 column retrievals" *by* F. Chevallier

Anonymous Referee #2

Received and published: 19 May 2015

Author provides arguments on desirable improvements in overall consistency in a two-step process of estimating CO_2 fluxes using firstly the atmospheric X_{CO2} retrievals from satellite observations, and secondly CO_2 flux inversions. The discussion points at an inflated prior uncertainty for retrievals as a factor contributing to retrieval product deficiencies. It was found that tightening retrieval uncertainties can reduce posterior misfit between concentrations optimized with inversion and retrieved X_{CO2} values. It is also mentioned that possible posterior adjustments to uncertainties are making empirical bias correction inconsistent. The methods and materials applied in the analysis appear valid, and the discussion and conclusions are valuable for those working on concentra-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

tion retrievals and inverse modeling of the surface fluxes. Several minor changes are recommended before publication.

Suggestions on the text

Page 11896 line 19. The derivation of Eq. (4), with elimination of $\check{x}^b$ should be included, to convince the reader that there is no omission or use of simplifying assumptions on the way.

Page 11898 line 3. It is mentioned "if enough intermediate variables were saved by the retrieval schemes, it would be possible to reconstruct the retrievals with a different prior error covariance matrix $\check{B}$" . Reader may get impression that Level 2 products do not carry "enough intermediate variables", while the reality is that a number of products include prior and posterior matrixes, as well as column averaging kernel and prior profile $\check{x}^b$. As author wrote, the information is not sufficient to reconstruct the retrievals with a different prior error covariance matrix $\check{B}$, but it is sufficient for a) getting approximation to $\check{x}^a$ for $\check{B}$ modified by multiplying it by scaling factor, b) replacing the prior profile $\check{x}^b$ with any other. Thus if one wants to have the retrieval with deflated prior uncertainty as suggested in the manuscript, it can be done. For the sake of clarity it is better to mention that although we can not get retrieval result for different prior error covariance matrix $\check{B}$, simple scaling should work.

Page 11898 line 19. The comment that with large prior uncertainties for retrievals, "the retrieval averaging kernel would not peak low enough in the vertical" is not supported by discussion or reference.

Page 11901 line 21. It is mentioned that "boreal forests are covered with needle-leaved trees". It is safer to say "are largely covered". Apart from the widespread light coniferous larch and pine forests, dark coniferous needle-leaved trees can not dominate the landscape and often appear in mosaic patches with broad-leaved trees mostly due to post-fire successional dynamics (eg Shvidenko and Nilsson, Tellus, 2003).

ACPD
15, C2739–C2741, 2015

Page 11903 line 15. The test results introduced on Fig. 6 are most impressive, and show advantage of mixing retrieval with prior X_{CO2}. Here it is worth mentioning that making weighted average of prior and posterior has similar effect with reducing prior uncertainty for retrieval. The result needs more discussion, as long as a) mixing proportion of 1/2 is chosen arbitrarily; b) the prior performed worse than retrievals on Fig.5 so it is not clear why mixing with it would improve the mismatch.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 11889, 2015.