Atmos. Chem. Phys. Discuss., 12, C3652–C3654, 2012
www.atmos-chem-phys-discuss.net/12/C3652/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "CO_2 flux estimation errors associated with moist atmospheric processes" *by* N. C. Parazoo et al.

Anonymous Referee #2

Received and published: 14 June 2012

General:

The paper is about quantifying CO2 flux estimation errors from interpreting satellite observations of CO2 with atmospheric transport models. The focus of this paper is quantifying errors due to the atmospheric transport processes, in particular moist atmospheric processes (e.g., frontal systems). Interesting results with implications for the way we interpret satellite observations of CO2. I do wonder about the realism in the OSSEs (point 7), but on the whole the paper is worth publishing in ACP.

Specifics:

1) Page 9988. An end-to-end OSSE with satellite data would involve atmospheric radiative transfer modelling. The study is a subset of the end-to-end calculations.

2) Page 9989. Why is “better resolved” in speech marks? Are the authors trying to make the point that higher spatial and temporal resolution does not equate to improve accuracy/precision? Cryptic text is unwelcome.

3) Over what lag window does the inversion scheme update fluxes from a particular month? Other studies recognize that measurements a few months after month X can still be useful in constraining flux estimates from that month. There is some text at the bottom of page 9992 and the top of 9993 but it is not completely clear why they have chosen two weeks.

4) The authors note on page 9993 that they do not take into account aerosol effects. Presumably rapid vertical transport of surface emissions over urban areas (that include significant aerosol burden) would also affect the ability of the satellite to observe the frontal system but anything else?

5) Are the humidity fields between GEOS-4 and GEOS-5 products different? I assume they are but how different? How important is this effect in calculation XCO2? How big is this effect for the different spatial resolutions?

6) The eddy and mean flow calculations is described very poorly. Are they simply using Reynolds averaging of the underlying wind fields?

7) How detailed is the calculation of XCO2 along the GOSAT orbit? Did they include changes in AOD, land surface type, surface pressure, etc? This information is not mentioned in the paper. Do they assume access to sun-glint and nadir observations? Have they used GOSAT observations with a high solar zenith angle?

8) I found the concluding remarks a little weak. Joint inversion of column CO2 and surface CO2 would not help fix any of these transport errors or indeed identify them unless with careful analysis. Under extreme conditions the model might not be able to reconcile the column and surface CO2 measurements, with the resulting posterior flux being even more grossly in error. Similarly, running an ensemble of meteorological

ACPD

12, C3652–C3654, 2012

states if the underlying model parameterization is in error will also not help. Only better characterized model parameterizations, developed based on extensive in situ meteorological measurements, will help address transport models. This is an unescapable truth.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 9985, 2012.

ACPD

12, C3652–C3654, 2012