Atmospheric
Measurement
Techniques
Discussions

Interactive comment on "Quantifying lower tropospheric methane concentrations using near-IR and thermal IR satellite measurements: comparison to the GEOS-Chem model" *by* J. R. Worden et al.

Anonymous Referee #2

Received and published: 19 May 2015

This paper presents an innovative method to derive lower tropospheric concentration of methane with detailed error analysis by combining near-IR product of CH4 total column from GOSAT and thermal-IR product of CH4 (mainly sensitive to CH4 in the free troposphere and stratosphere) from TES. As GOSAT/TES observations are not spatiotemporally collocated, monthly mean lower tropospheric CH4 is derived on 4x5 grid cells in July 2009 with precision of ∼23 ppbv. The accuracy of estimate is mainly determined by the error of XCO2 columns used to quantify XCH4 in the GOSAT retrievals; using two different sources of XCO2 causes mean zonal mean differences of

up to 35 ppb. Evaluation with GEOS-Chem model simulation demonstrates that the derived lower concentrations are more sensitive to the surface methane fluxes than the total column. This paper is generally well written and organized and is suitable for publication on AMT. However, as have been mentioned by the first reviewer, this paper lacks comparison with in-situ measurements as presenting a retrieval method. I also suggest that the authors should add some limited comparison with in-situ data, while presenting more detailed validation in a future paper.

Specific comments

P3855, L25: change CO2 to CH4?

The last term in equation (4) is not the same as the last term in equation (3), it is good to make it consistent

P3858, L18, it is not clear about "the last term"? Do you mean the last term in equation 4 or the third term in equation 3b? Please clarify it.

P3858, L22, change "Sect. 3.1" to "Sect. 3.2"

P3859, L21, it reads as "GEOS-Chem total column minus GOSAT/TES lower-tropospheric methane", which is inconsistent with the figure caption and the context.

P3859, last paragraph, what about the large negative biases in Center Africa, which is worthy of being mentioned.

In Figure 9, it is useful to oveplot the mean and corresponding standard deviation (as error bar) or RMS of the difference at each latitude. Also it is good to over the mean precision as a function of latitude.

P3866, L11-12, remove ". IASI" as there are two "IASI"