

Interactive comment on “Validation of TES methane with HIPPO aircraft observations: implications for inverse modeling of methane sources” by K. J. Wecht et al.

Anonymous Referee #1

Received and published: 25 November 2011

General comments: The paper utilizes high-density vertical profiles of CH₄ measurements from HIPPO aircraft campaigns to validate the TES retrievals (V004 and V005), and assesses the dependence of TES mean biases and residual standard deviations on the size of the spatio-temporal coincidence windows. In addition, the authors report that the calculated residual standard deviations are larger than theoretical errors. Based on the validation results, the authors have performed an inversion study using pseudo data to evaluate the utility of the TES V004 data in constraining CH₄ sources. This paper, well structured and well written, provides a useful guidance for the application of TES methane retrievals, and should be published after addressing several concerns in the analyses described below.

1)The CH₄ concentrations above the Gulfstream V ceiling (8.5 – 14 km) are extrapolated using the TES a priori profile shape, which introduces an error in the observed profile (Equation 3); however, this is ignored in the analysis. Note that this error could be significant as the CH₄ concentrations are much lower in the stratosphere than in the troposphere. What is the impact of this error on the retrievals y_R, y_U, and y_L?

2)The error on each individual retrieval y_R, y_U, and y_L is not given, and only the mean and standard deviation of the diagonals of the TES observation error covariance matrices are given in Fig. 6. By missing this error, one cannot judge whether each individual bias is significant or not, which could be one of the reasons why the residual standard deviations are independent of the size of the spatio-temporal coincidence window.

3)The residual standard deviations for both TES V004 and V005 validation are significantly larger than the self-reported (or theoretical) errors, and the authors also state that a uniform scaling of the observation error covariance matrix is needed. That is to say the theoretical ones are underestimated. Is there a chance that the residual standard deviations are overestimated, due to inclusion of retrievals with large uncertainties?

4)In the inverse analysis, the authors conclude that V004 is of limited value for constraining methane emissions, based on TES retrievals with standard deviation of 40 ppb. Can the authors say something about the threshold using the existing model setup, i.e. at what error level the retrievals may be useful in constraining regional methane emissions?

Detailed comments: Page 27891 Line 13, change “a priori” to “a priori” or “a-priori”, and to other occurrences Line 15, Bowman et al. (2006) is missing in the References Line 16, Payne et al. (2009) is missing in the References

Page 27892 Line 14, change “V005 DOFS are . . .” to “V005 DOFS is”

Page 27894 Line 2, specify “the nearest profile in space and time”, which has a higher

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

priority? Space or time? Line 3, add a comma after “yL”, before “and yU” Line 20, remove a redundant period after “1.1%” Page 22, Boxe et al. (2010) is missing in the References

Page 27895 Line 10, remove the period in “t.he”

Page 27903 Fig. 1, add annotations to the x-axis on the right panel as well

Page 27904 Fig. 2, pressure values in the right panel are not put at the exact places.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 27887, 2011.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper