**Atmospheric
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Comment

Interactive comment on "Error correlation between CO_2 and CO as constraint for CO_2 flux inversions using satellite data" *by* H. Wang et al.

Anonymous Referee #1

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General comments

This manuscript describes the use of both CO and CO2 satellite observations in an inversion study to estimate CO2 fluxes. The idea is to have a stronger constraint by exploiting the model transport error correlations between CO2 and CO. Both the NMC method and a comparison between different models are used to estimate these error correlations. This is in principle a nice idea that could give indeed a stronger handle on the important transport model errors. The manuscript is well written, easy to read, and the figures are clear. The paper provides a nice first look at the use of the proposed method, but will need further research to really show the full potential. However, I recommend publication of the paper in its current stage (after some minor adjustments outlined below). At the same time, I would like to encourage the authors to fully exploit

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the potential benefits of this method by performing a more extensive study.

Specific comments

- Page 11785, lines 2 - 6: The sentence about OCO is not really relevant for the paper. I would recommend to remove it.

- Page 11785, first paragraph: Please, acknowledge some other work as well here: Chahine et al., GRL, 2005, doi:10.1029/2005GL024165 and Engelen et al., JGR, 2009, doi:10.1029/2008JD010739 for AIRS; Frankenberg et al., JGR, 2006, doi:10.1029/2005JD006235 for SCIAMACHY.

- Page 11786, line 3: Please, also cite Clerbaux et al., 2009, ACPD, 9, 8307 for the use of IASI to estimate CO.

- Page 11787, line 22: The references to Engelen et al. seem to be referring to the same paper.

- Page 11787, equation 3: Should the errors not be added quadratically?

- Page 11789, line 1: Can you really assume that the representation errors are independent for CO2 and CO? I would think that these errors depend on things like model grid size and horizontal concentration gradients, which are not that different for CO2 and CO.

- Page 11790, lines 10 - 11: Please mention that the infrared allows observations twice daily, which is one of the main assets of this type of observation.

- Page 11792, lines 3 - 4: This is not an obvious conclusion. Why would the correlations resulting from the differences between 2 models for 2 sets of models be the same? What do the actual model error variances look like for the 2 sets of models? Are the highest CO2-CO error correlations found for areas where

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the variances are small or large? Is there any relationship? The authors should elaborate a bit more on this, i.e., why are the correlation patterns so similar.

- Section 5: I am a bit concerned that everything is done with basically the same model. The estimated error correlations are based on the GEOS-Chem model (although with different meteorological input) and the flux inversion is also done with GEOS-Chem. This means that both S and K are based on the same model, which might make the results a bit optimistic compared to the 'real' world. It would be good if the authors could comment on this in the text and do some more rigorous inversions in a further study.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 11783, 2009.

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