Response to editor's comments (ACPD-15-108-2015)

We thank you for your decision and comments and the specific suggestions from two reviewers, which we used to improve our manuscript. Your comments and reviewers' suggestions are italicized and immediately followed by our answers.

Editor's comments
Please incorporate your responses to the reviewers into your revised manuscript (for accuracy and readability since readers will likely not review your responses). Also note and tone down the conclusion/discussions as noted by second reviewer.

A: We incorporated more of our responses to the reviewers into our manuscript and made change in the conclusion/discussions, and details can be found in our specific response for each of the two reviewers.

Anonymous Referee #1
My only remaining qualm with the paper is that, regardless of whether they were included in the prior work, Figures 9 and 10 should include uncertainty bars on the fluxes.

A: We included the monthly uncertainty bars for various regions in Fig. 10. We added 'and their uncertainties' in the caption of this figure. Since we added the uncertainties to the figure, we also added the explanation (page 16, line 18-28) on the relative flux differences that we had provided for the benefit of reviewer in our previous response.

'Because the a posteriori flux uncertainties are largest in the tropics, the differences in the flux estimates can be small relative to the a posteriori uncertainties for the tropical regions. This is particularly the case for tropical Asia. For Northern Africa, the largest absolute flux difference obtained with the tropical source and Arctic sink, compared to the standard inversion, is for July, and that exceeds the flux uncertainty. In contrast, in the extratropics, for Temperate North America, for example, with the Arctic sink the changes are larger than the flux uncertainties for March through June. With the combined source and sink, the temperate North American flux changes are larger than the uncertainties in June, when the sink is at a maximum. Although the relative flux differences are small for some regions, the discrepancies represent significant spatially dependent biases, which have implications for the latitudinal distribution of the estimated sources and sinks.'

Because of the inversion approach that we employ, it is computationally challenging for us to calculate the a posteriori uncertainties for the whole assimilation period for each region (see Deng et al., 2014), so we cannot add error bars to Fig. 9.

Minor Typos:
P. 14, line 18: insert 'compared -to- their a priori…'.
A: Corrected.
P. 15, line 26: Fix punctuation to eliminate fragment.

A: ‘While’ was deleted.
P. 17, line 9: Spelling of ‘latitudes.’
A: Corrected. (line 21)

Anonymous Referee #2
I thank the authors for the efforts that were made to answer my questions. Since I consider myself representative of a typical reader, however, I had expected that the questions were also used to improve the manuscript. In some places I can accept from the answer that this was not done, except for this one:

'A: The reviewer is correct that we are not fixing the underlying problem. It is possible that the flux adjustments obtained here are an upper limit, but in the absence of more data to better characterize the spatio-temporal evolution of the bias we are reluctant to make such a strong statement.'

I disagree that this is a "strong" statement. The reader should be aware that this is probably the case, which deserves a sentence or two of clarification in the discussion.

A: We have added the text in the conclusions (page 19, line 11-14).

‘ Because we have assumed that the adjustments are constant over the assimilation period, the changes in the flux estimates reported here might be an upper limit for the impact of these discrepancies, but we need to better characterize the spatio-temporal evolution of the UTLS biases to properly quantify their impact.’