

Interactive comment on “Carbon balance of South Asia constrained by passenger aircraft CO₂ measurements” by P. K. Patra et al.

Anonymous Referee #1

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This study presents a very interesting novel approach for constraining the carbon budget of South Asia. The focus on South Asia is interesting and important, because, as expressed by the authors, it can be considered one of the terra incognita of carbon cycle research despite the fact that it hosts 1.6 billion inhabitants. It is interesting to see how the special atmospheric conditions associated with the Indian monsoon work on favor of constraining carbon fluxes using aircraft measurements at cruise altitude. Despite the validation efforts presented in the manuscript, it remains questionable how realistic the vertical transport is represented in the transport model. It would be interesting to see what flux estimates would be obtained from other models. Also it would be interesting to have more years of measurements to further investigate the relationship between ecosystem functioning and monsoon variability. Below is a list of, mostly minor, issues that the authors should address to make the manuscript suitable for pub-

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lication in ACP.

Page 5384, line 26: I didn't understand the extrapolation of CARIBIC data mentioned here. It doesn't seem to be explained elsewhere. This should be clarified further.

Page 5386, line 6: Add "latitudinal" between "observed" and "profiles".

Figure 1: The purpose of the 1.5 PgC/yr shifted simulation in this figure is not entirely clear. As I understand it this shift is only relevant in the context of the comparisons with CONTRAIL for 2007. Removing this simulation from figure 1 would also solve the problem that it remains unclear to the reader for another couple of pages what this scenario means. Looking at Figure 1 I was surprised to see that the shift didn't seem to significantly deteriorate the CARIBIC fit for 2008. It makes me wonder if the green line really represents the least squares optimal fit to the data. Please verify/explain.

Page 5386, line 20: I don't understand how you can validate model transport if the modeled profiles depend strongly on the quality of the surface fluxes.

Page 5386, line 25: "Asian" instead of "Asia".

Page 5387, line 2: For THE four AsiaN regions.

Page 5387, line 8: I think the authors have to be more careful presenting annual budgets, since the measurements only address part of the year. It could be that enhanced uptake during the wet season is compensated by enhanced release in the dry season. In fact, the authors mention themselves that agricultural waste burning is missing in CASA. The inversion would not likely pick it up either.

Page 5389, line 10: Here I believe the authors are pushing the implications of their results too far. The fact that a time shift in uptake improves the agreement with measurements provides very limited evidence of a conservation of season-integrated uptake. This would require a much better availability of measurements covering several years.

Page 5389, line 18: Given the error bars "unlikely" is better justified than "impossible".

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Page 5389, line 27: The second part of the sentence is incomprehensible. Please revise.

Table 1: A footnote is required explaining the airport codes.

Figure 3: Choose a different color for Caribic modified

Figure 5: Use different lines to distinguish TDI64 and TDI22.

Figure 6: What is the purpose of the top panel. If it is considered important then it should move to a separate figure.

Looking at Figure 7 I thought it might be very instructive to plot the response function for a measurement made in the anticyclone, compared to a response function that is more typical of aircraft measurements at cruise altitude. It would also be interesting to know how the enhanced sensitivity would compare to that of typical sites of GLOB-ALVIEW. How well would the carbon budget of India be constrained by targeted aircraft campaigns during the Monsoon season?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 5379, 2011.

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