

Response to comments from Anonymous Reviewer #1

[Comment 1] *First, the authors used three different types of approaches and each group of approaches include different methods and data sources etc. Therefore, it is a huge burden to describe the technique details and as the same time organize them in a neat way. I suggest the authors to consider including a sketch figure showing the technique map which I believe will help the readers to understand better what they did.*

[Response] As being pointed out, the technique map of this paper is simply to use three different approaches to constrain the terrestrial ecosystem carbon balance over East Asia. Considering your suggestion, we now provided a table where all flux components could be seen side by side (Table S2). Text S1 was also added to improve the description of the methodology. We hope this could better help the readers understanding what we did. Thanks for your understanding!

[Comment 2] *Second, while the authors used three different approaches in estimating the carbon budget of East Asia, there is little comparative discussion of the results those approaches reproduce. It will be nice to have such a part at the end of the “Results and Discussions”.*

[Response] Following your suggestion, we compared the results estimated from different approaches and provided a best estimate of terrestrial ecosystem carbon balance and its uncertainty based on the three approaches. Descriptions on the major uncertainties of those approaches and perspectives on how to better integrate them were also included in the Summary section. Thanks for your suggestion!

[Comment 3] *Third, in 3.1.1, it is not necessary to describe each individual country's FAO data in the text; a table or figure will be enough.*

[Response] Following your suggestion, a Table with each country's FAO statistics is now supplied as Table S1.

[Comment 4] *Fourth, the inventory and satellite based biomass estimation for grassland and*

shrubs is not clearly described in the methods (like “empirical approach”) and the readers are asked to refer to the group’s early publications. It will be nice to do readers a favor by describing the “empirical approach” with a few more details, something like the empirical relationship between field obtained biomass data and satellite NDVI indices.

[Response] Following your suggestion, we supplied the detail of the empirical approach in estimating biomass for grassland and shrubs in the supplementary materials (Text S1).

[Comment 5] *Fifth, the results from inventory and satellite approach and ecosystem modeling approach matches pretty nicely (-0.208- -0.338 PgC yr⁻¹ vs -0.204- -0.393 PgC yr⁻¹). But the inversion modeling results are highly uncertain from -0.887 PgC yr⁻¹ (carbon sink) to 0.526 PgC yr⁻¹ (carbon source), because of the scarce of CO₂ stations. So before improving the inversion modeling and founding more CO₂ stations, the results from the inversion models are not that useful? Why some models report a carbon source given all other approaches and even the majority of the inversion models report a carbon sink for East Asia during the last two decades? Instead of reporting averaging inversion model result in Fig.7, it’s better to give out the result of each model, considering the large discrepancy among different models.*

[Response] Regarding the inversion model results, we noticed that the average from the inversion models is close to estimates by other approaches. Although the inversion approach produces larger uncertainty than the inventory-satellite based approach and process model based approach, it constrains terrestrial carbon budget from atmospheric observations, rendering it an quasi-independent and indispensable approach in the RECCAP methodology and regional carbon budget studies (e.g. Pacala et al., 2001; Janssens et al., 2003; Piao et al., 2009). Thus, we cannot say that inversion models are not useful. The large range of the inversion approach could come from several sources, including definition of prior uncertainties, errors in model transport (Enting et al., 2012) and the sparse CO₂ observations over East Asia (section 3.3 in our manuscript). Details of the inversion model uncertainty could be found in the RECCAP uncertainty paper (Enting et al., 2012) and the inversion synthesis paper (Peylin et al., in preparation). Following your suggestion, we supplied the estimate of each inverse model in Table 2. Thanks for your understanding.

[Comment 6] *Sixth, a few citations in the text can not be found in the References list. For example, Tao and Zhang 2010; Tan et al. 2010 on page 4033. There are also occasionally some English errors but they can be easily solved with Biogeosciences' new copy-editing service.*

[Response] We have supplied the missing references and correct the English errors in the revised manuscript. Thanks for pointing them out.

References

- Enting, I. G., Rayner, P. J., and Ciais, P.: Reccap uncertainty, *Biogeosciences Discuss.*, 9, 1829-1868, 10.5194/bgd-9-1829-2012, 2012.
- Janssens, I., Freibauer, A., Ciais, P., Smith, P., Nabuurs, G., Folberth, G., Schlamadinger, B., Hutjes, R., Ceulemans, R., and Schulze, E.: Europe's terrestrial biosphere absorbs 7 to 12% of european anthropogenic co2 emissions, *Science*, 300, 1538, 2003.
- Pacala, S., Hurtt, G., Baker, D., Peylin, P., Houghton, R., Birdsey, R., Heath, L., Sundquist, E., Stallard, R., and Ciais, P.: Consistent land-and atmosphere-based us carbon sink estimates, *Science*, 292, 2316, 2001.
- Piao, S., Fang, J., Ciais, P., Peylin, P., Huang, Y., Sitch, S., and Wang, T.: The carbon balance of terrestrial ecosystems in china, *Nature*, 458, 1009-1013, 2009.