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Interactive comment on “The carbon budget of terrestrial ecosystems in East Asia over the last two decades” by S. Piao et al.

Anonymous Referee #1

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This is a nice synthesis paper on the carbon budget analysis of East Asia, a globally important terrestrial carbon sink. The authors employed three different approaches (inventory and satellite approach, ecosystem process modeling, and atmosphere inversion modeling) to investigate the regional carbon budget of East Asia over the last two decades, and found it a carbon sink of about $-0.204 - -0.393$ PgC per year. To my knowledge, this is the first attempt assessing the carbon budget of East Asia utilizing multiple approaches. And the result the authors provide in this manuscript is important contribution to the RECCAP project and constitutes the best knowledge that will be useful in policy making. Therefore, I highly recommend publishing this manuscript in Biogeosciences.

I also provide some suggestions for the authors to consider in revising the manuscript.

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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.

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”.

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.

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.

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.

Sixth, a few citations in the text can not be found in the References list. For example,

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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.

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