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Biogeosciences Discussions

Interactive comment on "Modeling the uncertainty of estimating forest carbon stocks in China" *by* T. X. Yue et al.

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Forest carbon stocks estimation is an import research field. Most studies in this field relied on ground estimations. This study by Yue at al. presents the benefits of fusing ground data with satellite data and vegetation models. Presented is an extensive study analyzing a high number of different methods to estimate forest carbon stocks in China. The five methods were Kriging using forest inventory data, satellite data, global vegetation models (LPJ-DGVM), the fusion of ground plots with remote sensing data and the union of ground plots with vegetation models. Using all methods, the authors produce different carbon density maps for China and validated each with field plots. The method using the fusion of ground plots and satellite data got the best results in terms of reduced uncertainty. Due to these results, the authors showed that forest

carbon stocks of China have increased by 2.24 PG during the period 1984-2008.

In general, it was very difficult to follow the manuscript as there were a lot of different methods, a lot of tables (9) and countless abbreviations. The manuscript begins with a very long introduction and state-of-the-art part (nearly 50% of the whole manuscript) showing and discussing all used methods. In this part are too much examples and explanations. Please reduce the number of example studies to a minimum and just refer to the references. Section 1 and 2 seems at they are a review about methods and results for carbon stock estimations for China. I believe that it was an immense work to collect all these facts. However, it fails the aim of this manuscript. Alternatively, move this review part to the appendix and just show an overview table in the manuscript with the methods and what their results for carbon stocks estimation in China are.

Also the methods part section 3 has some potential for improvement. This section explains very roughly the details of the used methods. I didn't get all methods. Especially, (1) how was the model (LPJ) set up and how was it improved and (2) how works the fusion of satellite data with ground plots? Please spend more effort to explain your methods. In the current version you just spend 1-2 sentences for the data fusion (see section 3.6).

The results part section 4 clearly shows the outcomes of all methods. The authors compare the methods by calculating error values. For this section a validation graphic could help to justify the methods (showing estimated values vs. observed values and indicating r2 and p-value). At the end, a satisfying discussion is missing. Section 5 gives just a summary of the results – there is no discussion. Please refer to you research questions and compare your results with other studies. There are a lot of different Biomass maps for other regions available (Saatchi, Baccini, Mitchard). Please discuss the methods of these maps and compare to your methods. I am missing a lot of references doing the same for China or even other regions. An interesting comparison could be for example this reference: Liu, Yi Y., et al. "Recent reversal in loss of global terrestrial biomass." Nature Climate Change (2015)

In general the manuscript deals with a very interesting topic and the authors have done a lot of work comparing all these methods. However, I was lost in the huge amount of different methods and imprecise description of these methods. I recommend getting a clear focus in the introduction (by shortening) and improve the methods and discussion. Overall, I found the manuscript can be an interesting contribution to the carbon community if the authors spend some effort to improve the content. In the current state of the manuscript it seems not suitable for publication.

R. Fischer

Detailed comments:

Title: I found the title misleading as you do not "model" the uncertainty. My suggestion: "Analyzing the uncertainty of estimating forest carbon stocks in China"

19537, L9-10: "Understanding carbon stocks and the underlying driving forces" – In this manuscript you didn't analyses the underlying processes. You use statistical methods as black box to estimate carbon stocks. Please revise this sentence as you "estimate carbon stocks"

19545, L16: Where is the data of Table 1 from? If it is published in another study it is not necessary to show this data here. Just refer to the publication. The same yields for table 2 and table 3. Please skip table 1-3.

19546, L10-18: How have you created the forest distribution data using the vegetation atlas and the Globcover map?

19546, L22: What is BEF?

19548, L1-L3: What is the difference between CD and BCD?

19551, L6: Suggestion: Additionally to Fig.2 please show the histograms of carbon values for the different methods as a first rough comparison.

19551, L13-14: How was the model combined with forest inventory data using HASM-

LPJ? Explain it in the methods section.

19551, L16: What is "mean annual carbon stocks" as it is no carbon flux. Just name it mean carbon stock.

19551, L21-26: move to methods

Table 4-9: Your abbreviations are wrong. What is AMCS? AMCD? Is it the same like MACS and MACD? I recommend writing in your table what the abbreviations really mean. Sometimes it is not necessary to use abbreviations as Period 1 is not too long compared to P1.

Table 4-9: reduce the number of tables. For example you can join table 4 and table 5 as the information is the same. The same for table 7 and 8 and table 8 and 9.

Figure 4: I can't see differences in these maps. I recommend to show the differences by taking period 1 as baseline map.

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