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Biogeosciences Discussions

Interactive comment on "Detection of large above ground biomass variability in lowland forest ecosystems by airborne LiDAR" *by* J. Jubanski et al.

Anonymous Referee #2

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"Detection of large above ground biomass variability in lowland forest ecosystems by aibrone LiDAR"

General comments: This paper provides an interesting comparison of biomass stock estimation with different techniques across a broad area of peat swamp forests in Indonesia. Biomass estimates, use of LiDAR and studies on forest degradation are scarce for this region and this paper represent a valuable contribution. However, there are several methodological and sampling design issues that are likely to alter the findings and undermine the conclusions. Despite an interesting error propagation approach, the way LiDAR metrics are then weighed by density remain unclear. More

importantly, the uncertainties in both plot-based biomass stocks and LiDAR heights estimates are not accounted for and are not discussed at all throughout the paper. I am afraid the sampling design will embed to answer the points I am raising. I would be happy to read further comments and clarification from the authors in a revised version though.

Major revision p. 11820 – Acquisition and processing The authors provide in this section a very ideal description of their device and I would have preferred a verification of the accuracy of their device in the real conditions. The authors don't mention here if they used a multi-echo LiDAR (or first/last return). Depending on the type of LiDAR, the penetration might greatly vary and so do height estimates (see (Gaveau and Hill, 2003)). Furthermore, unpublished results (http://www.kalteng.org/dyn/pdf_files/Silvilaser-Boehm-Lieseberg-Frank-ID-113-20.9.2010.pdf) indicate that tree height might be correlated with peat dome slope (i.e. higher trees on top of the domes) and thus changing the H/DBH relationship locally, and subsequently the AGB/CHM relationship. Did the author have the opportunity to investigate H/DBH relation within and among forest types? p. 11820, L15-19: No reference is given on the algorithm used to filter ground points. p. 11821, L. 1-5: 0.13–ha plots sounds very small to accurately quantify biomass stocks especially when using expansions factors. Do the authors have quantified the variability of their estimates and number of plots required per forest type? (Wagner et al., 2010) showed that plots < 0.1 ha had CV > 20 % in an unmanaged forest in French Guiana. I expect even greater variability in degraded forests. An accurate assessment of this variability should be accounted for in the regression models proposed. For instance, (Mascaro et al., 2010) calibrated LiDAR data with plots of 0.33-ha, a size about 3 times bigger than the values reported here and recommended to be cautious with plot sizes below this threshold. p. 11821, L. 26-27: How is Centroid Height computed? This is technique refers generally to large-footprint data. If you were using the distribution of points into vertex of 0.13-ha and removed only the first bin, then why not accounting for trees smaller than 7 cm dbh? I agree that this DBH-class do not account for a large

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fraction of biomass stocks, but might largely affect the height distribution in your plots. Why did you prefer the quadratic mean canopy height (QMCH) to mean canopy height (MCH), as this is a classical LiDAR metric used in several other studies. In the reference you are citing, QMCH does not provide better fit than MCH. Furthermore, in a very similar study (Kronseder et al., 2012) showed that the best predictor of AGB was a tough combination of several metrics (SEM, H65 and H45). Why did the authors not have followed the same methodology here? A more complete analysis of the effect of LiDAR metric on model performances would have been of interest. p. 11822, L. 1-2: What is the bin range used here? As you developed the DTM, you know which points are "ground" and others that are not. So why not more simply remove those points from further analyses? p. 11825, L. 16: Why did you used only peatland values in your comparison? Is the entire region covered by peatland forests? Why did do this? Not clear to me. In Table 1 & 2 is seems that 'peat swamps forest pristine' (would rather used 'undisturbed' or 'unmanaged') only cover 36-39% of the area. . . Table 1 & 2: How do you explain that biomass estimates from LiDAR and those from field plots varies of 20 - 40% and you are concluding (p. 11829, l.19-20) that 'airborne LiDAR data is the most reliable solution'. Compared to what? SMA, field inventories, IPCC? As you biomass stock estimates derived from LiDAR metrics were calibrated on plot inventories, it seems to me that they should be taken as reference and the underestimation of biomass stocks with LiDAR discussed.

Minor revisions: General proofreading is required. p. 11816, L. 17: "overestimation of 46 % ",.. -> table 2 shows 43% p. 11818, L. 2 : "is always inevitably" replace by "is inevitable" p. 11818, L. 3 : "RS data has" replace by "RS data have" p. 11818, L. 21-22 : "due to natural growth condition" sounds odd to me. Do you mean variability in tree growth or environmental heterogeneity? p. 11822 – L. 2 : "from the further processing" replace by "from further processing" p. 11822 – L. 3 : "from LiDAR surveying", do you mean surveys? Table 1 : Why don't you report your figures in Mg ha-1. It would help compare with other publications.

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Reference cited: Gaveau, D.L.A. & Hill, R.A. (2003) Quantifying canopy height underestimation by laser pulse penetration in small-footprint airborne laser scanning data. Canadian Journal of Remote Sensing, 29, 650-657. Kronseder, K., Ballhorn, U., Böhm, V. & Siegert, F. (2012) Above ground biomass estimation across forest types at different degradation levels in Central Kalimantan using LiDAR data. International Journal of Applied Earth Observation and Geoinformation, 18, 37-48. Mascaro, J., Asner, G.P., Muller-Landau, H.C., van Breugel, M., Hall, J. & Dahlin, K. (2010) Controls over aboveground forest carbon density on Barro Colorado Island, Panama. Biogeosciences Discussions, 7, 8817-8852. Wagner, F., Rutishauser, E., Blanc, L. & Herault, B. (2010) Assessing effects of plot size and census interval on estimates of tropical forest structure and dynamics. Biotropica, 42, 664-671.

Interactive comment on Biogeosciences Discuss., 9, 11815, 2012.