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Interactive comment on "Asynchronism in leaf and wood production in tropical forests: a study combining satellite and ground-based measurements" *by* F. Wagner et al.

F. Wagner et al.

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Dear Reviewer#2, thank you very much for your review. In this new version of the paper, we have considered your comments and suggestions, and made several changes in the text. Now the paper is clearer and more accurate.

"general comments": Interesting study that statistically investigates the temporal synchronism between tropical forest leaf and wood growth. Good literature review. Well written and structured

Not sure if the authors have the means to infer causality such as 'water driven wood production' or irradiance driven leaf production' FW: the relations remained hypothetic

for irradiance and leaf production but for water at our site we showed in a previous work that water availability was the main determinant of wood production (see Wagner et al Plos One, 2012). I change the sentence containing 'irradiance-driven' in a way that it cannot be considered as a causality and remained an open question. In the abstract 'irradiance-driven leaf renewal' changed by 'leaf renewal assumed to be driven by irradiance' and in the conclusion 'their respective drivers' by their 'their respective assumed drivers'.

Good discussion where the links are stated in terms of statistical or site speciïňĄc relations not generic casualties.

What is a 'climate-explicit' model? Maybe a map of the site to show what space is represented by the models?? FW: I remove the expression climate-explicit model. 'a climate-explicit wood production model' was changed to 'a wood production model based on climate data'. The complete typology map is available in the article of Gond et al (2011) the author of this forest classification. I added this sentence in the section satellite data of the methods : 'For a map of the forest typology see Fig. 1 in Gond et al. (2011)."

To what extent may spatial and temporal aggravation of the data be important? I understand this is pioneering research and future work will improve certain points but it may be worthwhile discussing FW: I add a paragraph in discussion 'As this is a pioneer research, we have to acknowledge that spatial and temporal scaling of the data used here are critical to produce general predictions. In this study, we make the strong assumption that an average tree from our sample is representative of an average tree across the forest type of Paracou. As showed in Wagner et al (2010) at Paracou, diameter growth, and hence woody biomass growth, can be estimated with relative small sampling areas. For example the coefficient of variations of diameter growth is < 20 % for a surface of 0.5 ha censused every 2 years. Furthermore, our sample is a mix of trees across seasonally flooded and terra firme habitats, typicals of this forest type (Sabatier et al., 1997). However, we know that 256 trees won't totally reflect the complex forest

structure and biomass. For this reason, we focus in this paper only on the seasonal variations of woody biomass growth. Another potential bias could be use of datasets with different temporal resolution that lead us to use linear approximation. The result of this approximation could slightly influence the value and timing of the peaks and of the lowest points. However, here again, we are not interested by the absolute values of these variables but by the co-variation between EVI and woody growth at a seasonal scale. Additional works are needed to fill the gap between improving knowledge from correlation studies and modeling for prediction.'

Climate grids may or may not predict areas with complex terrain well. I am not sure if this could be important here. FW: Here are the correlation between CRU data and the climate data from the flux tower at Paracou. The variable with a G in the name is from the CRU dataset, the other is from the Guyaflux climate dataset. Precipitation: cor(datacor$pre,datacor$preG)= 0.9357332

Potential evapotranspiration : cor(datacor$pet,datacor$petG)= 0.8345688

Mean temperature : cor(datacor$tmp,datacor$tmpG)= 0.9619317

We do not have enough data to make full comparisons between the gridded data and the field-based meteorological data as the other local meteorological station datasets in the area are used to generate CRU data, but for the forest type of Paracou, the terrain is relatively homogeneous and flat (see the following Figure 1). The mean altitude of this forest type is 128 m with a standard deviation of 69 m.

Figure 1 : Elevation map of French Guiana

How do the authors determine when leafs are fully mature? Maybe this is not of critical importance. FW: From the satellite point of view, the one we used here, leaf are considered fully mature when EVI reached its highest value because it is assumed to represent the highest canopy photosynthetic capacity. From the field point of view, it relies on expert knowledge based generally on the tree crown stages. For example

see the following table in Figure 2 extracted from R. Borchert, 1980, 'Phenology and Ecophysiology of Tropical Trees: Erythrina Poeppigiana O. F. Cook' which is one of the classical reference for classification of leaf phenology in tropical forests. We have some data at Paracou that are congruent with our assumptions but they are yet unpublished and too sparsed to be used in this paper. I add the sentence 'Leaves were considered fully mature when EVI reached its highest value because it is assumed to represent the highest canopy photosynthetic capacity' in the satellite data section of the Methods.

("speciïňĄc comments") Page 8250 line 14: Consider omitting 'obviously'. FW: done

Page 8252: would it be important to state the size and distribution of the plots? FW: I added the sentence 'These 0.5 ha inventory plots are distributed on a typical topographic gradient for this forest type (Sabatier et al, 1997).'

Page 8252 line 7 units are cm? So 39 cm average increase in 4 years? FW: units are days this is the mean and SD of the time between census. Sentence changed to 'mean= 39 and sd= 19.8 in days'.

Page 8253 line 7: I am not sure if the weather stations provide the grids. Consider rephrasing. FW: Sentence change to 'These datasets are calculated on high-resolution grids (0.5°X0.5°) with data from more than 4000 weather stations distributed around the world'.

Line 15: for the graphical representation? FW: changed to 'graphical representation'

Page: 8254 line 12 onwards: so DBH gives height and height and wood gravity gives wood production? Would there be value in starting the uncertainty? The model may be the best available and uncertainty unknown or it may not be a major factor FW: The parameters obtained by Molto et al. are estimated considering every possible sources of error and this is undoubtly a strong point of their paper. They claims that 'Considering our results, a poor knowledge of WSG and the height–diameter relationship does not increase the uncertainty in AGB estimates. However, it could lead to biases. Therefore,

models and databases should be used with care'. Here we use trees with a very good knowledge of the WSG, for 3/5 of the trees WSG had been measured and for the remaining trees we use mainly a local database at the species level. For the tree height-diameter relationship, we assume that for our trees the model is unique because the molto model was developed in the same study site, Paracou. Moreover, in the aim of prediction, here we are more interested by the variation of the mean value of wood production in time than by the temporal variation of uncertainty. The factor that could be the main source uncertainty at our temporal scale, i.e. the swelling and shrinking, is showed to be of little importance in our data and cannot solely explain the intra-annual variation of tree growth.

It may be an option to remove equation 5 as it is almost the same as equation 4. FW: equation 4 is the calibration of the model for the Paracou data that's why there is an error term while equation 5 is the prediction for the ensemble of the pixel of the Paracou forest type, that's why there is an overline on $\triangle$AGB and no error term. This second step relate to the model application at a spatial scale. In our opinion it is clearer for the reader in this way as this represents two different steps in the method.

Page 8257 line2: is this the spatial mean? FW: yes this is a spatial mean with the pixels classified as Paracou forest type that we assumed to be homogenous. I changed the sentence to 'For the construction of the time series, we used the mean of EVI and $\triangle$AGB of the pixels corresponding to the forest type of Paracou at each of the MODIS times, and all the variables were then linearly approximated at a daily scale. '

Page8258 line 7 maybe replace 'heart of the dry season' by middle FW: done

Page8258 line 23: if a strong inter annual variability was only observed for EVI but not for example litter fall this may suggest a noise effect in EVI due to unïňĆagged sub pixel clouds. FW: this is good remark and I agreed this could be a reason for the annual variability but here we do not aim to compare values of EVI to the value of wood production but we aim to analyze how EVI and wood production co-vary in time. It is

why we choose to not discuss this. We think that this is not central for the paper and could add another level of complexity that add nothing very strong to the paper.

Page 8259 line 26: the sza would vary not just during the dry season. Easy to rephrase. FW: The study of Galvão et al. and the other from Moura et al. were conducted only during the dry season. I changed the sentence to 'Recent works have highlighted that during the dry season, EVI was sensitive to view-illumination effects due to the variation of the solar zenith angle in a location close to Xingu Indigenous Park in Brazil'.

Page 8260 line 1: there is still SZA variation even at the equator but for areas with a certain EVI amplitude the SZA bias component tends to be small relative to the seasonal EVI amplitude. Sorry but I am not aware of a citation for this. FW: To our knowledge, the papers from the INPA team (Galvão and Moura and collaborators) are the most recent research on this issue in the tropics. I can add your sentence as a personal communication if you want.

Page 8261 line 14 maybe replace 'seriously' FW: done, sentence 'Finally, wood production slowly decreased during the wet season, while EVI seriously dropped' changed to 'Finally, wood production slowly decreased during the wet season, while EVI dropped to its lowest values'

Page 8279: what is a 'pixel time couple'? Maybe I am misinterpreting the ïňĄgure. EVI amplitude is quite small in what I presume is the average line and the point cloud is noisy. Maybe the point clouds represents x pixel in space? FW: following your comments and the comments of the reviewers #1 the text of the figure was changed to : 'Evolution of EVI values across French Guianan forest types. Each point represent the EVI value for the points of the 0.5 X 0.5° CRU grid. Lines were fitted with a cubic smoothing spline. The forest type 'high forest with regular canopy' correspond to the type of Paracou.'

Please also note the supplement to this comment:

http://www.biogeosciences-discuss.net/10/C4607/2013/bgd-10-C4607-2013-supplement.zip

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Interactive comment on Biogeosciences Discuss., 10, 8247, 2013.

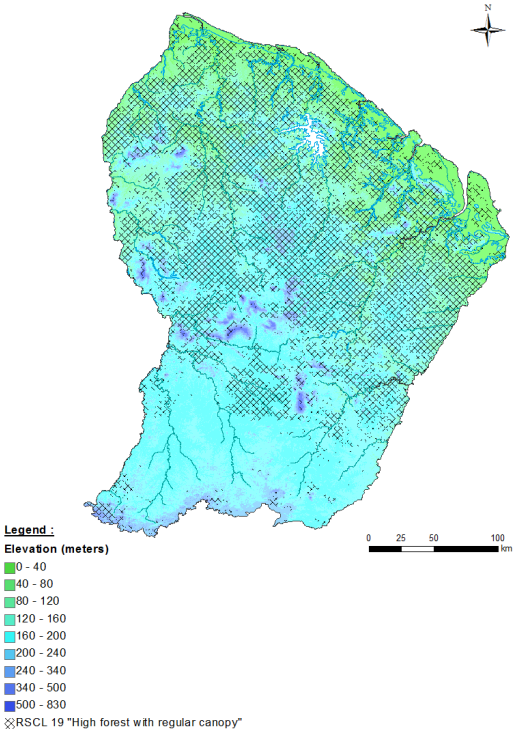

Fig. 1. Elevation map of French Guiana

TABLE 2. Rating scales for phenological observations.

Leaf fall
4—no evidence of leaf fall
3—leaves begin to fall on outermost shoots of crown
2—50% of leaves off
1—no leaves present
Leafing out
0.5—numerous small, light green shoots visible
1—small, light green shoots cover entire crown
2—oldest leaves almost mature, dark green, crown almost filled
3—crown filled with mature, dark green leaves, but numerous green, growing shoots present
4—all leaves mature, crown full
Flowering and fruiting
0—no flowers visible
1—flowers open on lower half of inflorescences
2—flowers open on entire inflorescence; few small fruits
3—few flowers and small fruits, many large, green pods
4—all pods fully grown, either green or already brown and opening

Fig. 2. Rating scales for phenological observations.