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Interactive comment on "Environmental control of natural gap size distribution in tropical forests" *by* Youven Goulamoussène et al.

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General comments : Y. Goulamoussène and collaborators are presenting an original study aiming at characterizing canopy gaps in tropical forests using a novel analytic approach. Generally, this study provides new and interesting insights in key environmental drivers of gap formation at landscape scale. While this study certainly deserves to be published, I have pointed a few issues that should be addressed before publication. The authors have developed an innovative analytic method to define gaps, but the entire analysis relies upon an a priori threshold equal to the 0.001th percentile of the estimated "natural variation of canopy height". While this choice may be well grounded, the rationale beyond it remains unexposed. How sensitive is the definition of gap and all subsequent results to this threshold? What if the authors had chosen the 0.01th percentile? Some kind of sensitivity analysis would make their choice more reliable.

More importantly, while a landscape scale approach seems meaningful to infer gap size distribution, this study highlights the importance of environmental factors on both gap frequency and size. Thus, I wonder if a fixed definition of gap remains meaningful, or if that definition should not adapt to the different forest types and/or main topographical features found at large scale. Doing so would point towards a more "ecological" definition of gaps, instead of a pure remote-sensing approach, and ultimately raises the question of the aim of detecting gaps. For instance, does a 100m2 gap in waterlogged areas dominated by Euterpe oleracea has the same ecological meaning than on hilltops? Certainly not in term of number of trees killed, biomass loss and forest turnover . Depending on the variable of interest (e.g. carbon emission), a fit-them-all definition is questionable. This issue, if not formally addressed, should at least be discussed. The following recent publications may provide additional information (Chambers et al., 2013; Lobo and Dalling, 2014; Schliemann and Bockheim, 2011).

Finally, the manuscript requires additional efforts in editing (loads of typo &citations errors, unclear headers and acronyms) and reviewing recent literature (lots of relevant publications is missing, comparing lambda with other studies). A proof-reading by a native English would also greatly help.

Hope this help. Regards, Ervan Rutishauser

Minor comments : l. 99: For clarity, please define explicitly all the acronyms used, i.e. topographic exposure (TOPEX). l.119: Sub-header should be : "Height above the nearest drainage" to be consistent with previous sub-headers l.193: What is the resolution of the TOPEX variable? Do you have several indices by 5m2? Please clarify how you can get 2 values (min max), or did you standardize TOPEX as: abs((TOPEX – min(TOPEX))/(max(TOPEX)-min(TOPEX))). l. 212: I suggest to change the header here, as Kuo-Mallik refers to a method, but you used it to select the variables. "Variables selection" looks more appropriate. There is also an issue in the way the reference is quoted. l. 216: there is an missing (or extra) parenthesis in your expression l. 226: "Given this height, we retained the surface xmin = 104 m2". What is the link between

the height threshold and the minimal gap area, here? I thought both minimal height and gap size were defined separately. l.254: "Environmental covariates with posterior KM values close to 1 , NAMELY Slope, TOPEX, and HAND . . ." l.260: “Defining the height threshold at which forest gaps may be delineated is a major difficulty faced by foresters. Many times, canopy gaps have been defined in the field, adopting Brokaw’s definition” Is it only the minimal height that is at stake here, or also the minimal area? Many studies define gaps regarding to their size (e.g. Denslow et al., 1998; Hérault et al., 2010; Lima, 2004). This sentence sounds odd, I suggest rephrasing as follow: “Delineating forest gaps is a persistent challenge for foresters and ecologists, among whom Brokaw’s gap definition (1982) has remained very popular/extensively used.” l. 265-269: There are several studies that do not use this 2m-threshold definition of gaps, but 10m (e.g. Hubbell et al., 1999; Meer and Bongers, 1996; Welden et al., 1991). While the authors are extensively referring to the seminal paper of Brokaw, there are way more references defining gaps in complex tropical forests that are lacking here. l.278: Which ones? l.300 (onwards): This paragraph is very confusing. Where does the 75% comes from? What is the remain 25% then? In sloppy areas, does it make a big difference if a tree falls due to breakage, or being uprooted? I don’t think so, and tree size seems to be a more important factor in the cascading effect than mode of death. Yet, the turnover may be more rapid on slopes than bottomland, resulting in fewer large trees (and tree fall gaps). l.338: but WE found

Potentially useful references :

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forest, J. Ecol., 86, 597–609, 1998. Ferry, B., Morneau, F., Bontemps, J. D., Blanc, L. and Freycon, V.: Higher treefall rates on slopes and waterlogged soils result in lower stand biomass and productivity in a tropical rain forest, J. Ecol., 98, 106–116, 2010. Hérault, B., Ouallet, J., Blanc, L., Wagner, F. and Baraloto, C.: Growth responses of neotropical trees to logging gaps, J. Appl. Ecol., 47, 821–831, 2010. Hubbell, S. P., Foster, R. B., O’Brien, S. T., Harms, K. E., Condit, R., Wechsler, B., Wright, S. J. and De Lao, S. L.: Light-gap disturbances, recruitment limitation, and tree diversity in a neotropical forest, Science, 283, 554, 1999. Lima, R. A. F.: Gap size measurement: the proposal of a new field method, For. Ecol. Manag., 214, 413–419, 2004. Lobo, E. and Dalling, J. W.: Spatial scale and sampling resolution affect measures of gap disturbance in a lowland tropical forest: implications for understanding forest regeneration and carbon storage, Proc. R. Soc. Lond. B Biol. Sci., 281(1778), doi:10.1098/rspb.2013.3218, 2014. Meer, P. J. van der and Bongers, F.: Formation and closure of canopy gaps in the rain forest at Nouragues, French Guiana, Vegetatio, 126(2), 167–179, doi:10.1007/BF00045602, 1996. Schliemann, S. A. and Bockheim, J. G.: Methods for studying treefall gaps: A review, For. Ecol. Manag., 261, 1143–1151, doi:10.1016/j.foreco.2011.01.011, 2011. Welden, C. W., Hewett, S. W., Hubbell, S. P. and Foster, R. B.: Sapling Survival, Growth, and Recruitment: Relationship to Canopy Height in a Neotropical Forest, Ecology, 72(1), 35–50, doi:10.2307/1938900, 1991.

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