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Interactive comment on "Mapping hydrological environments in central Amazonia: ground validation and surface model based on SRTM DEM data corrected for deforestation" *by* G. M. Moulatlet et al.

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Interactive comment on "Mapping hydrological environments in central Amazonia: ground validation and surface model based on SRTM DEM data corrected for deforestation" by G. M. Moulatlet et al.

Anonymous Referee #1

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-We thank the anonymous Referee for his/her comments. The answers for each comment can be found below.

It is an interesting concept, the opposite of what I would have expected. Typically, the desire is to remove the canopy height from the SRTM DEM to obtain the ground height. Here, the authors are attempting to add back the canopy height to areas that are deforested. While this edited DEM is no longer reflecting the reality that the forest has been removed, it may provide a more uniform DEM for hydrologic analysis, and therefore in some ways makes sense to me, assuming that all areas that have low vegetation stature have been "reforested". This may be a more accurate approach than trying to remove the canopy height from the non-deforested areas. However - there is still a limitation: SRTM is still measuring the canopy height. Some variations in the uncorrected SRTM DEM may very well be due to variations in canopy height rather than variations in ground topography, which is the relevant DEM when considering extraction of drainage networks.

-The study area is important by the fact that is well covered by pristine forest and deforestation has not caused a large impact outside the opening of the BR-319 road on the 70's. For this reason, the chosen method of adding back canopy is appropriate to correct deforestation features rather than remove canopy. The drawback is the one mention by the referee: the ground topography is more relevant than the canopy height when extracting drainage networks. We overcame this condition by walking more than 110 km under the dense canopy of the Amazon forests taking notes of relevant hydrological/topographical information to validate the drainage extractions. These data (also available in this publication) helped on the adjustment of suitable drainage networks for the area. However, as we discussed in the manuscript, the drainages were exaggerated or insufficient in certain areas. Thus we made available eighteen hydrological layers generated from different drainage extractions to help the end user to choose suitable layers according to the need. Details about the drainage extraction can be found in Rennó et al. 2008.

Another limitation, and it is large, is that only a subset of the DEM was apparently corrected (only deforestation along BR-319?). It seems to me that all areas should be corrected (even natural savannas), or the data set will not have much value. One way to solve this problem is to only provide the data where the authors believe that the DEM is consistent with surrounding canopy heights and to eliminate those areas (zero them out?) where the authors are not confident of the consistency of of the dataset (ie - always canopy height). There are many places in this DEM where I see that the topography is varying due to the presence or absence of forest.

-Open areas (absence of forest) may affect drainage extraction since they are interpreted as local depressions by the algorithm processing. As we realized these issues well in advance, we decided by correcting deforestation along the BR-319 and nearby the points we had field observations (also available as shapefile at PPBio repository). Apart from these areas, correction procedures were not made in large open areas by the reason that deforestation features have complex shapes and our correction method would not be efficient there. This can be seen on large deforestation areas that were not corrected on the extreme north and south parts of the DEM. We agree that this is a limitation of the dataset. For this reason we made available a mask of the corrected areas, which can be used as a guide for the use and interpretation of the dataset.

-We decided not correct open savannas areas because they have irregular borders and large dimensions, which would make the correction process long and the results could not be satisfactory. Savannas have lower canopy height and consequently drainage will run to these areas. This results in higher local topographic differences than expected. We cannot measure the general effect of the non-correction of these areas because topographic and hydrological field data are absent. The reviewer's suggestion to zero them out is also interesting but would result in the same local problems on the borders, once the drainages would keep running to the savannas. We are aware of the problems brought up by the savannas and other open areas but we have not seen important impact of these open areas for the hydrological layers we extracted. The road had

a high impact in the data and was, therefore, corrected. We recommend for the end user to take these problems into account when interpret the data near open areas and savannas.

-In addition, following the reviewer's suggestion we provide a mask of the areas where editions were not made and we are not confident about the consistency of the dataset. This mask will also be available as a shapefile in the data repository and the link will be found on the revised version of this manuscript.

Another problem is that the river levels will appear in this edited DEM to be lower than actual relative to the edited elevation (by the canopy height). Perhaps river areas should also have the canopy height added to their values. I am not sure if it important that this DEM was acquired in February 2000 at a particular river level, and how that may impact the analysis of drainage networks.

-As we haven't noticed this problem before, we checked our data again to identify where it could impact the extraction of the drainage network. We realized that the effect of the river level only affects the drainages that run to the large rivers of the DEM, where the SRTM draws a mask over the water bodies. This causes a higher value for the vertical distance to the nearest drainage than expected because the river level is lower than the canopy. We followed the reviewer's suggestion of providing a mask of the areas where editions were not made and we are not confident about the consistency of the dataset. In this mask the large rivers are left out and the problem pointed out by the reviewer loses its importance.

As the authors mention, uneven regrowth of forest can make this correction tricky as well. it is not clear to me from the text how that was addressed. If I were to use this data set, I would want to know more about how this reforestation to the DEM was implemented, so that I would better understand its limitations. The abstract describes this only generally. Is there a publication planned as to how this was implemented? Without a more complete description, I would be hesitant to use the data. However,

I think the concept may be useful for a limited set of uses. I suggest that the authors expand their abstract with more details and examples of the effectiveness of this technique, or include in the abstract a link to a paper or technical report that describes the methodology and results in more detail.

-Large patches of deforestation on the North and South extremities of the DEM were more difficult to correct and we agree that the correction was not as effective as in the middle part of the DEM. For those areas we attempt to homogenized the canopy height variation and, in some of the cases, to flat it. The homogenization was done through the use of elevation profiles from the forested area to the deforested one. When the deforestation patch was too large we opted by not correct it. Two areas on the north extremity of the DEM had field points for validation and had been affected by deforestation. We used, therefore, field observations as guidelines for the corrections where it was possible. The only publication about the deforestation correction and its effectiveness and limitations we are aware of is Rennó et al. 2009. We believe that large deforestation patches cannot have their canopy height totally recovered by correction method like ours and a new method is necessary. For this reason we have been working in a new semi-automatic methodology of correction that can be applied for such complex deforestation cases. This methodology will soon be available in a new publication. As suggested by the referee, a link to a paper that describes the methodology will be included in the abstract.

Please also include in the abstract typical range of height corrections that were made.

-Ok. The range will be added to the revised version of the manuscript.

One other matter is that the 1 arcsecond SRTM has now been released for all of South America. The increase in resolution may be quite valuable for some uses. With a pixel spacing of 3 arcseconds, this data set is now somewhat obsolete.

-Despite the releasing of the 1 arcsecond SRTM, our data are unique and not obsolete. All the processing was made in the 3 arcsecond SRTM and the results can still be

used for different purposes. Our data were intensively worked out to reach the level of correction we did. We are not aware of other available dataset using a deforestation correction method like ours for a large area in Amazonia. Attempts to extract drainages for large forested areas will always be limited by deforestation features and correction methods are needed. A new correction could be done for the 1 arcsecond SRTM, but that would result in a totally different dataset. An evaluation of the drainage extraction and hydrological mapping between the two SRTMs is necessary before assume that this data set is obsolete. Therefore, the data are still valid until new tests are done in the SRTM of 1 arc second.

Interactive comment on Earth Syst. Sci. Data Discuss., 7, 441, 2014.