

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2020-460

Anonymous Referee #2

Referee comment on "MODIS Vegetation Continuous Fields tree cover needs calibrating in tropical savannas" by Rahayu Adzhar et al., Biogeosciences Discuss.,
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This manuscript undertakes an analysis of the accuracy of the MODIS Vegetation Continuous Fields product with particular reference to sparsely wooded ecosystems using tropical forest and savanna field inventory data.

The manuscript is well written and presented. The figures are of high quality and the analysis is clearly described. As the authors related the VCF has been subject to considerable analysis and discussion over some period of time. It could reasonable be postulated that all products from moderate resolution sensors struggle with accurate discrimination along the ecotone between forest and grassland due to non-linearities in the reflectance and VIs applied to derive them, and due to the enormous variation in the morphology, architecture, density and clumping, and phenology of the overstory.

The authors have to work with a limited inventory data set - limited in geographical coverage, and limited in sampling the above mentioned variation. They quite reasonably focus on the issue of clumping of the tree fraction within pixels and undertake a nice analysis based on this. I do wonder why they did not explore the actual representativeness of the field inventory sites versus the VCF pixel resolution in the manner of Roman et al., 2009 and subsequent publications.

[M.O. Román, C.B. Schaaf, C.E. Woodcock, A.H. Strahler, X. Yang, R.H. Braswell, P.S. Curtis, K.J. Davis, D. Dragoni, M.L. Goulden **The MODIS (collection V005) BRDF/albedo product: assessment of spatial representativeness over forested landscapes** Remote Sens. Environ., 113 (2009), pp. 2476-2498, 10.1016/j.rse.2009.07.009]

This is not in any way disqualifying since the analysis here is coherent and valid in itself.

However, I think that there are several issues that the authors need to address more fully especially in their Results and Discussion.

1. The manuscript proposes a correction to VCF for savannas and forests and combined. The authors state in the Results (lines 224-229) that VCF estimates forest tree cover well and greatly under-estimates savanna tree cover. However, based on Figure 1. the performance of VCF at the forest sites looks pretty terrible based on the sites being in a pretty clear blob with very wide variation between Trobit and VCF. This makes me wonder about the representativeness issue for these Trobit sites and VCF pixels and whether clumping issues are the only thing happening here. In any case, Figure 1 does not suggest that VCF is doing well in forest but is this a sampling issue?

2. I am concerned about proposing an overall correction to VCF based on such a limited sampling of the ecotone between grassland and forest. I wonder if it would be better to more clearly identify in the written text, the kind of savanna that is sampled by the Trobit. Figure A1 shows the distribution of sites. Although the sites appear to sample the gradient between the amazon and the cerrado reasonably well (however there is enormous variation within cerrado from wooded to very open short sparse shrubland), they do not sample the variation in savanna structure in Africa and Australia very well. The African sampling is confined to the tree cover gradient in West Africa passing from the Guinean Savana to the Sahel, whilst the sampling in Australia is confined to areas around the small tropical rainforest area and surrounding Einasleigh Uplands. in northern Queensland. There is enormous variation in structure, morphology, and phenology across African and Australian savannas. I would find the study more compelling if it: 1) paid more attention to the actual species, structure, phenology and composition of the sites; 2) constrained the narrative to an analysis of VCF for these particular systems; and 3) suggested a correction approach that is relevant to these kinds of systems and maintains the focus on the issue of sparsely wooded systems. I believe that it is a stretch to propose an overall correction to VCF from this study simply because the available inventory data are limited in coverage of geographical and vegetation diversity.

3. A key issue with VCF and this analysis is the thorny one of the definition of tree cover. Really with VCF and any other remote sensing products it should be about detection of woody cover (of any sort) from the canopy reflectance which is distinguished from the background soil and understory wherein the sensitivity is constrained by pixel resolution and the discriminatory capacity of available reflectance bands. I think that the manuscript gets a bit bogged down in this thorny issue since VCF has a certain definition which is apparently based on height. This is problematic in many ways since although related, height does not have a one to one relationship with canopy extent. However this MODIS product has been around for a long time with clear definition. This rather means that analysis using these Trobit sites needs to provide information on the "tree height" distributions at these sites. This once again returns to representativeness, and maybe explains why the forest data are so scattered for Trobit versus VCF in Figure 1. So again I want more information about what the vegetation is at these Trobit sites.

4. As a result, the Discussion is a bit convoluted. The section between lines 301 and 319 therefore is rather confusing and muddled to read. A whole lot of speculation about where trees are > 5 m or not is included. To make statements about this one needs evidence of

the tree height distribution at the Trobit sites and a matching analysis. I treat VCF as attempting to estimate woody cover. I don't care if it is getting at trees > 5 m or less. So this is kind of a furphy. The results in Figure 1 for savannas are pretty convincing about underestimation of woody cover which is probably unsurprising given the VCF method, but readily corrected based on your analysis at least for these particular savanna systems. If the Trobit data are limited then a whole lot of speculation about tree height really is not relevant and just clouds the Discussion. It damages the message which is best from the savanna analysis. Hence I think that clearer and more simplified findings and discussion points are required.

In summary, the study is well written, the methods are good, and the presentation is excellent. It is an interesting and useful study. However the authors need to address the following major issues before it can be considered for publication.

1. Limit the scope to developing correction to VCF that can be applied in the systems where Trobit inventory is available and representative.
2. Address the issue of representativeness of the Trobit sites, describe them much more fully, provide information of tree heights or tree height distributions or information from the literature on typical structure for these types of savannas and forests.
3. Focus the correction of the savannas for which your analysis is more convincing and explain the variation in the forest tree cover and why you think that VCF is good based on Figure 1.
4. Simplify the issues around definitions and detection of "trees". If you have no height data you can't really comment on this. Make sure that the thrust of the Results and Discussion is clear and clean and does not jump around between phrases about height definition when the imagery is seeing tree canopies not heights. If you can better describe the height distributions and representativeness of the sites, then discussion of the height definition can be useful.