Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-451-SC1, 2020

Biogeosciences
Discussions

Interactive comment on "Landsat NIR band and ELM-FATES sensitivity to forest disturbances and regrowth in the Central Amazon" *by* Robinson I. Negrón-Juárez et al.

Mathew Williams

mat.williams@ed.ac.uk

Received and published: 3 February 2020

This is a very interesting and ambitious paper that links remote sensing and demographic modelling to understand forest disturbance and regrowth in the Amazon. The role of disturbance in forest biomass dynamics and C storage is an important area of research which is challenging to study due to the timescales involved. I think the paper is a valuable contribution but I have some queries about the approach and conclusions.

1. The study is undertaken for one area of the Amazon – are the results (e.g. Fig 3) likely to be extensible across the Amazon, and to other equatorial forests?

2. There are challenges in using LandSat data for tracking forest disturbance and clearance in the Amazon, which lead to biases for smaller magnitude impacts, i.e degradation losses (Milodowksi et al. 2017). These biases are likely to impact the monitoring of forest recovery also. So I suggest extreme caution in interpreting the LandSat time series used here for sensing subtle phenomena like canopy closure and biomass growth. In the results, the statement "The similarity of spectral signatures for the control forests previous to the disturbances suggests comparable structure and species composition" may not be valid. One could equally well conclude that the sensitivity of NIRv is not enough to detect any differences that likely do exist between control old-growth forests. It would help if independent data could show the comparable structure and species composition of the old-growth sites to resolve this issue.

3. The abstract notes that "Statistical methods predict that NIR will return to pre-disturbance values in about 39 years (consistent with observational data of biomass regrowth following windthrows)". I don't find these observational data within the text. It would be very helpful to link the remote sensing directly to ecological time series, so we understand what the NIRv is responding to. I find it hard to understand what "regrowth to old-growth" means in table 3. I think more argumentation is needed to justify the conclusion that "NIR may be used as a proxy in modeling studies aimed at addressing forest regrowth after disturbances." I suggest that more metrics are required to pinpoint 'old-growth' versus 'disturbed' status. Specific ecological metrics would include those that describe biomass stem size distribution, and 3D leaf area density distribution. LiDAR is an obvious candidate for providing such information.

4. It seems to me that the model simulated quicker LAI recovery and slower biomass recovery to steady state than the remote sensing. The transient response of the model in Fig 7a seems to show overshoot of biomass compared to the 'old-growth' baseline – so when is steady state achieved? LAI (fig 7c) seems to equilibrate (within old growth range) after 15-20 years, much shorter than the NIRv estimate of $\sim$ 40 years. It would be useful to discuss how model transient behaviours can be validated against

independent time series, and how robust the comparisons shown here are.

5. For the evaluation of the FATES model it would help to have direct independent comparison to ecological data. Table 3 could be enhanced with observations for comparison against FATES. It's good to see some model-data comparison to data in fig 9, but how does this size distribution mis-match reflect on the modelling of recovery from disturbance?

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-451, 2019.