Biogeosciences Discuss., 8, C5339–C5341, 2012
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Biogeosciences Discussions

Interactive comment on "Inferring Amazon leaf demography from satellite observations of leaf area index" *by* S. Caldararu et al.

Anonymous Referee #2

Received and published: 13 January 2012

This manuscript describes a Bayesian method for fitting predictive models of forest LAI and leaf demography, using satellite-derived LAI, soil moisture and PAR data. The study was implemented over the Amazon Basin, where ground-based phenology observations are sparse and factors controlling LAI are relatively poorly understood. In the manuscript, the model structure and rules for adjusting LAI according to light and soil water limitations and leaf age are elegant and well explained. The model reproduces general trends in mean LAI, the range of LAI and peak LAI timing over the Basin.

I agree with referee #1 that fitting a 9-parameter model to MODIS LAI data deserves more critical analysis. Is the model "overdetermined"? Also - Figure 5 gives a hint about overall parameter uncertainty, but it would be interesting to see a sensitivity analysis of the individual parameters.

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Interactive Discussion
Discussion Paper

My main question is how the spatial scale of model fitting influences the skill of the resultant model(s). The data, parameters and results are all gridded or re-gridded to 2 x 2.5 degrees, which is the resolution of the PAR data. This is quite coarse compared to the 1-km MODIS LAI and MODIS land cover classification (used to screen out non-forest pixels), and thus each modeled grid cell contains a mixture of forest types, and an unspecified fraction which is "empty". How well can the model be fitted in grid cells with an even distribution of forest types, vs. a dominant type? It would be interesting to see the maps of fitted parameters in Figure 6 (and their uncertainty) compared to the MODIS land cover map. This could indicate whether finer spatial resolution of model fitting is warranted.

The question of spatial scale and model fitting could also be explored by use of plot scale observations such as the auxiliary data from eddy-covariance sites. This data includes LAI, soil moisture and PAR, plus ecological observations and carbon and water fluxes, which could be used for comparison and model validation. There are currently seven such sites in the Amazon Basin. At least, these independent sets of LAI observations (including magnitude and timing of annual min & max) could be compared to modeled LAI, as was done with MODIS data in Fig 4. Observed carbon fluxes could be added to a Figure 8-type analysis, as well.

One final general note: it would be good to compare the modeled outcomes in Figure 3 (mean, range and timing of LAI) to MODIS observations for a time period outside of 2001-2005 (the model fitting period), to test the robustness of the fits.

Specific comments:

P10393 L 23 Alpine areas could be screened using a digital elevation model, such as the one from the ASTER instrument (http://asterweb.jpl.nasa.gov/).

P 10397 L23 With respect to Figure 6d, I don't see the trend of much lower leaf lifespan in the east. Perhaps it would be easier to see if the sub-regions being compared were outlined.

BGD

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Interactive Comment

P. 10398 L3 Figure 7 - comparative leaf age distribution - is very interesting! It would be good to compare it with more detailed info about the distributions of forest types in those areas (e.g. from the MODIS land cover map).

P 10421 Fig. 8 Is this figure for the whole study area? It's hard to tell. It would be helpful to break out a few different forest types, and compare the skill of the phenology-based model for predicting carbon fluxes between the types.

Interactive comment on Biogeosciences Discuss., 8, 10389, 2011.