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Biogeosciences Discussions

Interactive comment on "Incorporating changes in albedo in estimating the climate mitigation benefits of land use change projects" *by* D. N. Bird et al.

D. N. Bird et al.

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First, thank-you for the constructive criticism. I have found it very useful.

General comments

I agree that the models are simple. The purpose of the research was to build a simple model (i.e. first order approximation) that used readily available information to incorporate changes in surface albedo in the estimation of the greenhouse gas emission reductions from afforestation / reforestation projects.

Currently, estimates are made ignoring changes in albedo. Project developers do not have access to complicated models or measurement, but still need to assess the ben-

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efits of their projects.

I agree completely with your suggestion to confirm the simple model against observed data and more sophisticated models. I realized that Yin’s model was not often cited and was created before the availability of MODIS data.

Specific comments 1. Surface Albedo: Agreed. In the revised version of the paper, I hope to incorporate MODIS data instead of using Yin’s model. A problem is that one needs the monthly averages of albedo for a proper estimate of the climate forcing. I will investigate whether these are available or whether I will need to interpolate between winter and summer albedo measurements.

2. TOA Albedo: Agreed, the model I proposed is relatively simple. I will probably use STREAMER in a revised version of the paper. Again, the purpose was to make a model that did not require a project developer to do too much extra work. My answers are given below in response to your questions may be a moot point if I adopt STREAMER.

a. The multiple scattering transmittance term is included in equation 3, that is why there are two Tc terms (one for coming through the clouds in each direction). What is not included are reflectances from the top and bottom of the cloud layer. These second reflection from the top of the cloud layer would also have a transmission term.

b. % of possible sunshine is a measure that is readily available. I hoped to use it to estimate the amount of clouds.

c. I agree, Kc and Ab are site specific (see attached document on estimation from flat plate radiation estimates). Instead of using site specific estimates, I used a best-fit global estimate and then analyzed the sensitivity to these variables. I agree this is a weak point in the model, which will be corrected using STREAMER

d. What are RT models, please?

3. Change in CO2 Concentration: It was my understanding that if one adds a molecule of CO2 to the atmosphere, it increases the concentration in the atmosphere as long as

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it remains in the atmosphere. CO2 is removed from the atmosphere using the decay curve. So adding the molecule in year 0 means it has a warming effect for numerous years that decreases with time due to the absorption of CO2. Removing a molecule (a negative increase) causes a cooling for a period of time too. The project removes CO2 annually (due to forest growth), but the cooling due to the removal in each year lasts for a period of time.

4. Change in albedo: I can remove the reference to longitude. I used it to derive the equation 23.

5. Case Study: All models shown do not include harvesting, but do include tree mortality and transference of biomass to the dead wood and litter pools. The GORCAM model does that.

6. Technical Corrections: Duly noted. Thanks for your thoroughness.

Interactive comment on Biogeosciences Discuss., 5, 1511, 2008.