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Interactive comment on "Summertime canopy albedo is sensitive to forest thinning" *by* J. Otto et al.

J. Otto et al.

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Reply Reviewer #1:

We thank you for your constructive review.

Main comments:

1. The 2-stream model allows us to simulate the effect of either black-sky-albedo or white-sky albedo. We will introduce extra figures with white-sky albedo where we plot the same shortwave albedo for pure isotropic conditions and show the radiative forcing for both cases.

2. Yes, we use a constant background albedo. To our knowledge, there doesn't exist

a database on background albedos for the temperate zone. Single measurements for specific environmental conditions and solar angle exist, particularly for the boreal and sub-boreal region. Our study, however, focuses on the temperate zone. In addition, the available measurements are BRFs. Converting BRFs into spectral albedo additional assumptions (or measurements) are needed for the sky conditions and spectral weights for converting from spectral (narrow-band) albedo to broadband albedo. While working on this study, we had no access to such data. For consistent reasons, it was decided to model the canopy albedo by applying background albedo and scattering parameters from the same data set (JRCTIP).

3. We will change the title to "Summer albedo is sensitive to species and thinning: how to accounted for in Earth system models?".

4. Previous studies (Bright et al., 2012; Cherubini et al., 2012)âĄă showed that this global transmittance factor works for single sites. A comprehensive modelling study requires the use of an Earth system model. This is outside the scope of this manuscript and at present even outside the capability of Earth system models. We will better stress this issue and discuss how our findings can be used to develop Earth system models towards addressing this type of questions.

5. To improve the readability of the result section, the flow of the results section in the initial manuscript was maintained by adding short statements explaining why certain analysis were performed or why a specific result has been highlighted. While writing the manuscript care was taken to avoid overlap between the results and the discussion. We see these 'discussions' in the result section as a strength rather than a weakness because the reveal our reasoning while analysing the data. The discussion contains our reasoning while interpreting the results. As such we don't think we violated the rules concerning the structure of the manuscript.

Specific comments:

We will consider the specific comments in the revised version but we like to respond to

some issues:

About the uncertainty of albedo: One standard deviation of each simulation is shown in Fig.5, the standard deviation of of 25 simulations of 20 x 20 m forest samples is on average 0.0012.

There was confusion about the calculation of the white-sky albedo and black-sky-albedo. It is possible to calculate both albedos with the 2stream model. The 2stream model runs with state variables, that is, the same state variables are needed to estimate black sky (before of Sun angle) and white sky (after integration over Sun angles). For the validation we use only white-sky albedo, for the analysis we use black-sky and white-sky albedo.

The value 1.55 for the needle-to-shoot area ration was calculated as the mean of the range of values given in Chen 1996. We will specify this in the text.

About the crown volume: Crown volume is calculated as a cylinder using crown radius and crown height. It is the same in summer and winter, and it does not take account of any gaps within the crowns. We will give the definition in the manuscript.

References:

Bright, R. M., Cherubini, F. and Strømman, A. H.: Climate impacts of bioenergy: Inclusion of carbon cycle and albedo dynamics in life cycle impact assessment, Environ. Impact Assess. Rev., 37, 2–11, doi:10.1016/j.eiar.2012.01.002, 2012. Cherubini, F., Bright, R. M. and Strømman, A. H.: Site-specific global warming potentials of biogenic CO 2 for bioenergy: contributions from carbon fluxes and albedo dynamics, Environ. Res. Lett., 7(4), 045902, doi:10.1088/1748-9326/7/4/045902, 2012.

Interactive comment on Biogeosciences Discuss., 10, 15373, 2013.