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Interactive comment on “Implications of albedo changes following afforestation on the benefits of forests as carbon sinks” by M. U. F. Kirschbaum et al.

M. U. F. Kirschbaum et al.

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We are glad to read the reviewer’s positive assessment of our paper, especially the recognition that our work was based largely on empirical studies which sets it apart from much other work done in this field.

The reviewer correctly noticed that we had to rely on satellite observations to obtain our albedo data for pastures. In that context, the reviewer refers to our Figure 3b to deduce a systematic difference between satellite and ground-based observations. We are puzzled by that comment as Figure 3b only shows satellite-derived pasture albedo and ground-based forest albedo so that no systematic differences could be deduced

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from that Figure. We have changed the legend to explain that more clearly.

Only our Figure 2 gave a direct comparison of satellite and ground-based observations for data obtained on the same days and for exactly the same locations. While the data were tightly correlated for both summer and winter measurements, the ground-based measurements gave on average a 0.4% higher albedo (which had been stated and discussed in the manuscript). The reviewer is therefore correct in pointing out that use of the satellite-derived data for both pasture and forest would have increased the albedo difference from 7 to 7.4% and thus increased the required C removal by forests to attain radiative balance by about 6% (i.e. from 26.5 tC ha⁻¹ to 28.0 tC ha⁻¹). We must concede that this range of possible values is within the uncertainty of our approach, but we would contend that this 6% difference would make little overall difference.

As the reviewer also points out, the more critical assumption relates to the validity of the satellite data to deduce pasture albedo as we had no ground-based measurements on pastures to compare with our satellite data. Our satellite-measured albedo numbers are, however, consistent with values reported overseas, and we provided some references in our paper. The procedure of calculating relevant albedos over the whole day, over all solar angles and all short-wave wavelengths is purely based on physics, geometry and knowledge of the solar cycle. The same underlying principles thus apply to both pastures and forests, and the good agreement for forests lends support and confidence to the pasture data as well.

The reviewer also objected to our statement that “this finding contrasts with the findings of Betts (2000) who concluded that in boreal regions, albedo changes could be quantitatively more important than carbon storage” (Conclusions, paragraph 1). We had not meant to imply that there were any contradiction between our findings and those of Betts (2000). The mentioned “contrast” in findings was meant to refer to the different regions, with Betts mainly referring to boreal regions in contrast to our study from a temperate region. We do, indeed, agree with the reviewer that our findings confirm

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those of Betts (2000). We have, therefore, changed the Section of our text to highlight the agreement between Bett's and our own study more strongly.

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