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Interactive comment on "Carbon and greenhouse gas balances in an age-sequence of temperate pine plantations" *by* M. Peichl et al.

Anonymous Referee #1

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The work of M. Peichl and co-authors compiles results from intensive research on ecosystem C cycling and GHG efflux from a pine plantation age-sequence. The intensity of studied parameters (biometric, eddy flux, GHG fluxes. . ..) at the four sites is more than impressive and together, the unique dataset was used to get more detailed insights in the stand age effects on C cycling and the potential role of non-CO2 GHG in the overall GHG balance. On first sight, the fact that younger forest stands grew under more favorable site conditions than older stands might be seen as a limitation. However authors found a way to cope with this and finally came up with conclusions about age and site quality effects on C cycling and the GHG balance. After some modifications, the study should be published in Biogeosciences.

General comments:

Global warming potentials (GWP) for CH4 and N2O are not up to date. Please use the recent IPCC values (28 or 34 for CH4; 265 or 298 for N2O) in the text and for all calculations. You find the values at: http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf

I would avoid the term "cooling effect" throughout the manuscript. You measured uptake of CO2 or C sequestration. Cooling was actually not directly assessed as for instance the effects of changing albedo from agricultural land to forest were not considered; and so forth. . .

I have real problems to understand how the fine root respiration (RA) can be considered as more or less the same (quantitatively) throughout the age sequence (P8238 and Fig 3) if the fine root mass (F) is 15 times higher in the old stand than in the young stand (or even 30 times higher in the middle aged stand.

Presentation and discussion of C cycling is well done but the N2O and CH4 chapter might profit from a bit more detailed literature survey. For instance, you claim that N2O emissions during the cold season can be neglected as they don't add much to the annual budget. However, actually, cold season N2O emission peaks were often observed to account for major parts of the annual N2O efflux from forest soil. E.g.: http://www.biogeosciences.net/9/1741/2012/bg-9-1741-2012.pdf

Also more literature survey regarding the effects of site quality on NEP would be helpful – for instance http://www.nature.com/nclimate/journal/v4/n6/full/nclimate2177.html

There might also be more literature regarding the contribution of N2O and CH4 to the complete GHG balance as the few ones cited.

Specific comments:

Abstract L9-10: "The total ecosystem C pool increased with age from 9 to 160 t ha-1. . .." – there is something wrong with this numbers. Even the soil has approx 30 tha-1 in all four age classes (Fig 3). Please check.

Introduction:

P8230 L11-12: Soil C stocks do not tell much about the current C sink potential. . ..

P8232 L22 onwards: here, more literature, e.g. from the Höglwald experiment could be cited.

Methods:

P8236: N2O cold season issue.

Results:

P8238: fine root issue. . ..

Discussion:

P8240 first chapter: You are talking only about needle litter decomposition? Here however it seems you talk about litter decomposition in general which would include root litter – please clarify.

P8242 chapter 4.2: The first part of this chapter is mentioned in the intro already. The chapter could be improved a bit by more literature research.

Tables and figures are nice (I must confess, I did not check all the numbers in Fig 3)

Interactive comment on Biogeosciences Discuss., 11, 8227, 2014.