

Interactive comment on “Changes in alpine plant growth under future climate conditions” by A. Rammig et al.

Anonymous Referee #1

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GENERAL COMMENTS

The work presented in this manuscript is significant, relevant to the journal and useful for various scientific communities. My only concerns regard the use of potentially confusing expressions and the local lack of definitions, justifications, and precisions that would clarify the text (please see specific comments). Some parts of the discussion and conclusion (dealing with biomass, carbon cycling and alpine ecosystem models) seem a little unclear. I would suggest insisting on the added value of quantitative estimates of melt out, onset of growth and maximum plant height and telling more, in the conclusion, about the use of these new regression model results and climate scenario analysis for alpine ecosystem modellers.

SPECIFIC COMMENTS

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Materials and methods

Page 10822 Lines 7-13: I think it should be specified here that “biomass” means “above-ground biomass” and the units given. Are they g/m² of fresh matter, dry matter, carbon? Is this biomass a sum of the daily productivity over the whole growing season? accounting or not for leaf turn-over processes (dead biomass)? or is it representative of vegetation state at a particular date and hence of productivity only over the preceding period (as it seems to be the case in Jonas et al. [2008])? How is the biomass = f(plant height) relationship affected by grazing? I would suggest writing “meadow & pasture” rather than “meadow” Line 11 as it was done in Page 10821 Line 27.

Page 10822 Line 25: Can we still consider the 2001-to-present period as part of a “future” projection?

Page 10823 Line 12-15: Maybe the first years of the “future” simulations could also be compared with observations of the “current period” 1997-2005 since there would be a 5-year overlap.

Page 10824 Line 3: I would suggest writing “accounting for...” rather than “removing the effect of topography” because you actually make use of the effect of topography in the interpolation process described.

Page 10825 Line 11 (resp. Page 10826 Line 1): Is there a justification for the choice of the climate input from HadCM3-A1FI (resp. HadCM3-SRES-A2)?

e.g. Page 10825 Line 23-24 and Page 10826 Line 1 and 8 (and in many other places): I would suggest using the expressions “estimate” or “analyse” rather than “evaluate” or “assess” to avoid the connotation of quality assessment or validation against measurements in the cases where it is not meant.

e.g. Page 10825 Line 9 and 11 and Page 10827 Line 5 (and in many other places): I would suggest using the expressions “simulate” or “predict” rather than “project” to avoid the connotation of future in the cases where it is not meant.

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Discussion

Page 10829 Line 24-26: The sentence is a little confusing and gives the impression that “projections” of melt out (simulation results from the regression models when driven by a future climate scenario) are being compared with observations in the past (different period). Maybe the authors should complete the sentence to make clear that the matter of correspondence is the mechanism “warmer temperature -> earlier melt out” (compared with a colder reference period -> later melt out). This mechanism was i) observed (which period vs. which period?) and described in the literature cited, and ii) simulated (Fig. 4, three future periods vs. 1961-1990 or 1971-2000 depending on the scenario resolution).

Page 10830 Line 17: What is meant exactly by “changes in vegetation patterns”? temporal patterns (phenology)? spatial patterns (migration to new areas of growth)? botanical composition? But these ideas are already expressed line 17, 27 and 28.

Page 10831 Lines 4-13: When talking about productivity and carbon fluxes I would suggest being more precise and use the gross/net plant/ecosystem specifications (GPP, NPP, NEP). How is the productivity integrated over the whole growing season related to the standing above-ground biomass estimated at the dates of plant height measurements? I am not sure to understand the point in the last sentence of this paragraph, especially if the tree line rises. How could land use/management changes influence the source/sink behaviour of alpine ecosystems (e.g. increased grazing intensity)? What is the range of annual mean temperature and precipitation sum covered by the 17 sites? Can summer drought become an issue for these grasslands in the future? Reduced plant productivity or reduced soil moisture could also affect carbon sequestration/loss.

Page 10832 Line 6: It is not clear what the word “comparably” refers to.

Conclusion

Page 10833 Line 26: It is not clear what the word “comparably” refers to. Do the

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authors mean relative to growing season length?

Page 10834 Line 2: Has the biomass production really been projected over the season (cf. previous comments)?

I find it unclear whether the authors refer to the same models or to different ones while saying “mechanistic models” (Page 10832 Line 26 and Page 10834 Line 19), “dynamic vegetation model” (Page 10833 Line 2), “process-based models” (Page 10833 Line 5 and Page 10834 Line 14), “predictive models” (Page 10833 Line 7) and “coupled vegetation-snow pack models”.

TECHNICAL CORRECTIONS

Materials and methods

Page 10822 Line 5: I think “of the current period” should be removed.

Page 10826 Line 1: Shouldn't “SRES” be removed from the scenario name since in Page 10824 Line 5 and in Fig. 5 it is referred to as HadCM3-A2?

Discussion

Page 10831 Lines 6 and 11 (and maybe in other places): I think “tree line” would be correct, rather than “treeline” or “tree-line”.

Page 10831 Lines 20-21: “and allowed quantitative estimates” seems to repeat what was said in the previous sentence Lines 17-18.

Page 10833 Line 10 (and in many other places): I think “melt out” would be correct, rather than “melt-out” or “snowmelt”. I believe there is no need to add the word “date” if melt out is already considered as a date (unit: day of year).

Conclusion

Page 10834 Line 10: There is a repetition of the word “change”.

Figures

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I suppose the following changes since the previous manuscript version were not wanted: i) in Fig. 4, the last two subfigures showing the onset of growth (V_g) and plant height (V_p) seem to be missing, ii) in Fig. 5, the title “melt out” next to the colour legend is missing.

In addition, I would write “onset of growth” rather than “begin of growth” in order to be consistent with the legend and the rest of the text; same comment for “begin of growth” in Fig. 1a and legend and for “beginning-of-growth” Page 10833 Line 20 (and other places).

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