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Interactive comment on "Continuous and discontinuous variation in ecosystem carbon stocks with elevation across a treeline ecotone" *by* J. D. M. Speed et al.

Anonymous Referee #2

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Speed et al measure soil and vegetation C stocks across an altitudinal gradient which includes a treeline ecotone. Within the alpine zone, they also assess the effects of grazing on ecosystem C stocks. The main question driving this research is whether there is continuous or discontinuous variation in ecosystem C stocks across the treeline ecotone. The authors report a minimum in ecosystem C stock at the treeline, with gradually increasing C stocks at both lower and higher elevations. They also report no significant effects of grazing on ecosystem C stocks.

The results are well presented and the manuscript is clearly written. The data shows the complexity of C storage across a mountain birch treeline, with relatively high productivity and stimulated decomposition at lower altitudes and low productivity and de-

composition at higher altitudes. However, I think that the authors should move the focus to the influence of different vegetation on C stocks, rather than interpret the treeline as a 'discontinuum' within an elevational gradient (see. p. 15447, l. 15-17). The fact that vegetation C stock decreases as one goes up to a treeline is trivial, and somewhat implicit in the definition of treeline. What I find relevant in this study is that increased C stored in the soils can outweigh this decrease in vegetation C, with its implications on changing C storage patterns in regions where treelines are moving upwards.

Moreover, I think that changes in vegetation type across the treeline and the elevational gradient itself (obviously) overlap, and that it is difficult to separate the effects of both factors. Data in figs 3-5 show both, an elevational gradient and a change in vegetation and this is well illustrated by the segmented regressions in figs 3 and 5. However, I think that fig. 4 also shows a discontinuity in organic C content. Maybe the authors could also consider to study the effect of elevation on C content and soil depth within the alpine zone (Fig. 4), not with a segmented regression but with a regression excluding the forest data. Would the current relationships still hold? This could be easily added to the current figure. Also in Fig A4, excluding the forest data points, maybe a negative relationship between organic horizon depth and elevation becomes significant? This would probably explain why the increase in organic horizon C stock does not increase at the rate of organic C content (Fig. 4C 4a).

Overall, I think that the focus of the paper could be changed from a rather descriptive treatment of the elevational gradient effect to a discussion of the different mechanisms driving the observed effects (vegetation changes, microclimatic effects on decomposition, etc.).

Specific comments

p. 15438, l. 1-3. Are the reported elevational patterns in SOC largely vegetation-mediated? What is the contribution of temperature/moisture effects on SOC?

Fig 2. Wouldn't a classification based on functional groups (i.e. shrubs, grasses,

sedges...) be more useful?

Fig. 5 caption: 'Field vegetation'? Birch is vegetation as well...

Interactive comment on Biogeosciences Discuss., 11, 15435, 2014.