

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-250

Anonymous Referee #1

Referee comment on "Estimating dry biomass and plant nitrogen concentration in pre-Alpine grasslands with low-cost UAS-borne multispectral data – a comparison of sensors, algorithms, and predictor sets" by Anne Schucknecht et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-250-RC1>, 2021

This study evaluates the potential of low-cost UAS data for estimating biomass dry matter weight (DM) and nitrogen (N) concentration in Alpine grasslands. A combination of 2 UAS (different sensors and UAV), multiple predictors (spectral and ground based) and algorithms (regression and machine learning) are tested and compared showing moderate performance in assessing DM and poor performance in assessing N, with machine learning algorithms better performing than regression.

The topic is of interest and relevant for the Journal and the manuscript is clear and, overall, well written. My main concern is on two main points:

- The study is entirely based on a single field campaign, therefore during one specific stage of grasslands phenological development (presumably early season). This is an important limitation which is not discussed. I would recommend to more explicitly highlight this and discuss the implications.
- The study in the introduction suggests that UAS can bring significant advantages as compared to satellite or airborne data in mountain regions. However, I would argue they have also significant limitations, especially when low-cost sensors are used. By looking at the study results, I have the impression (perhaps wrong) that issues related to data acquisition and quality (e.g. long acquisition time, calibration and incident radiation measurement) might play an important role in explaining the relatively poor model performances. However, this is not mentioned or discussed in a clear way (there are some points, but not really a section discussing the challenges in UAS data acquisition and quality). I would find valuable to see some more discussions on the issues that might be related to UAS use (even better if supported by some analyses).

Minor comments

Introduction:

- There is a bit of mix between Alpine/pre Alpine etc, while most statements are valid for both. Perhaps if the area falls within the Alpine space (geographic region) there is no need to specify Pre. Alpine is sufficient and more details about the sites are given in the methods.
- Perhaps 'often long' is unnecessary
- The sentence is unclear
- 86-89 This might be truth for specific cases, but it is important to keep in mind the limitations of sensors technologies onboard UAS.
- Here and elsewhere it is mentioned canopy height data were not 'available' without explanation. I would suggest avoiding that, as this is explained in the methods. Otherwise, a short justification should be added here too.

Materials and methods

- There is no mentioning of the phenological stage of vegetation during the field campaign. This is an important factor.
- 9.50 to 16.30 is a quite long interval with expected variations in solar angle and, in mountain regions, shadows and possibly cloudiness. This could be quite a relevant factor affecting the data acquisition.
- Is there any indication of the geolocation accuracy?
- An area of 3x3 pixels seem very small considering geolocation errors. Assuming the plot should be somehow representative of a wider area, would not be more prudent to have a larger window?

Results

- It is somewhat surprising the NIR does not follow DM or height, as this should be rather straightforward (unless for very small range). Is there any factor related to the acquisition that might be causing this issue?
- The doubt of a strong influence of acquisition factors is also supported by the very poor performance of regression as compared to machine learning and the improved performances on DM including VI in the validation. Also the important role of ground canopy height may suggest that as this variable is clearly not affected by the UAS data acquisition. I would suggest to run some tests and eventually add some considerations in the discussions.
- The word 'notably' is very often repeated. Sometime is a bit redundant
- Figure 7. It is a bit strange to see many points along a line (i.e. same N content) in

Fig.7b. Is it correct?