

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-164

Anonymous Referee #2

Referee comment on "Assessing carbon storage capacity and saturation across six central US grasslands using data-model integration" by Kevin R. Wilcox et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-164-RC2>, 2022

General comments

This is an interesting study and a generally well-written manuscript. The authors provide a quantitative assessment of the C capacity and saturation of 6 US grasslands using both measured and modelled data.

The main weak points of the manuscript are (1) the inconsistent and confusing use of terms (2) the limited discussion around the role of soil biogeochemical processes for the C balance/capacity/saturation and (3) the minimal explanation of the *data assimilation process* i.e. what are the assimilated data about ?

After reading the paper carefully I am not able to explain how many key variables were estimated e.g. potential C. I can understand the key findings due to the very nice graphics. I think this reflects what the manuscript is lacking. All the elements of a good publication are in there but not given to the reader in a clear and coherent manner.

Specific comments

- abstract : C can be lost via leaching also
- abstract : "The proportion of $\delta^{13}C$ currently stored by an ecosystem (i.e., its C saturation – CSAT)" -- this is assuming a grassland ecosystem *is C saturated*, which is almost never the case (can be close to but not *at* Csat)
- Page 2 : C capacity X_c and C content X_p become a source of confusion as there are points in the MS where X_c is presented as present/current C content and X_p as the potential C (e.g. L77)

- L83: *Csat* is presented as "the distance between X_p and X_c " but later referred to as "proportion" and "percentage" which leads to different readers understanding this variable very differently
- L101 : What is the land use history (at least the recent one) of the examined sites? Where they always grasslands?
- Section 2.5 : I believe that all terms used in the MS should be described in one unique section early on. A table and/or schematic would help a lot