

## ***Interactive comment on “The Climate Benefit of Carbon Sequestration” by Carlos A. Sierra et al.***

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Received and published: 13 July 2020

Sierra et al. define a new metric—the climate benefit of sequestration (CBS)—for analyzing the carbon-climate system. This metric is roughly analogous to global warming potential (GWP) but for carbon sequestered in the land surface (e.g. vegetation, soil); similarly to GWP, it reflects both the amount and typical lifetime of carbon in these surface pools, with higher CBS for systems that sequester more carbon and/or hold onto that carbon for longer. Sierra et al. then discuss the usage and implications of this metric in several different cases: A simple matrix-based global carbon cycle model of the pre-industrial world; implications of CBS for management; investigation of globally-averaged CBS during the industrial period (1850-present); and global applications of CBS with respect to forests and soils.

The underlying idea of CBS makes sense, and the authors are to be commended for

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describing CBS and how they applied it to their various cases in detail. However, I do not think this manuscript makes a meaningful contribution to the literature on climate or carbon cycling. To justify the development of this metric, the authors would need to make a compelling case for where existing, widely-used related metrics of carbon sequestration (such as carbon residence time and net ecosystem productivity) fall short, and why this new metric is superior (or at least complementary). However, there is hardly any mention of these existing metrics in this manuscript. For that matter, the manuscript’s application of CBS to terrestrial C cycle models focuses only on dated and/or simplistic models and makes no mention of recent syntheses of terrestrial carbon cycling and associated climate feedbacks by modern land surface models—for instance, Friedlingstein et al. 2014 (<https://doi.org/10.1175/JCLI-D-12-00579.1>) or Heinze et al. 2019 (<https://doi.org/10.5194/esd-10-379-2019>)—which makes it difficult to draw meaningful conclusions from those results.

Ultimately, I cannot recommend this manuscript for publication beyond the Discussion format. I would encourage the authors to carefully read a recent review of terrestrial C cycling and its climate implications and consider how CBS fits into that context.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-198>, 2020.

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