

Biogeosciences review

Zhao et al. present an interesting study on the effect of soil erosion on carbon sequestration in the Chinese Loess Plateau. The manuscript is generally well written and presents an interesting approach for estimating regional scale assessment of the erosion-induced C sink, and the effect of soil and water conservation practices on the magnitude of the erosion-induced C sink. I had a few questions and comments that I think should be valuable as the authors revise the manuscript.

- Abstract is too long, please revise to make it shorter, and focus on explaining what you did in this study, major findings, and implications.
- Abstract, Statement on lines 17-20 presumes that delivery of eroded sediments into Bohai sea leads to no or little loss of eroded C during or after erosional transport from the CLP. It is hard to take that statement at face value without any supporting data.
- Abstract, Lines 24-27: this statement can have dangerous implications and is wrong. Of course anthropogenically accelerated erosion is a threat to agricultural productivity (and more importantly soil health). Addition of fertilizers to maintain agricultural productivity doesn't eliminate the threat, it just addresses part of the problem.
- Line 26 page 14983 ... here the authors make a statement (also in abstract) that the maximum of the erosion-induced C sink is set by the amount of SOC mobilized. I would argue that this is not necessarily always the case. An exception is a case where erosion of topsoil from hillslopes leads to large increases in net primary productivity and hence C input to soils in depositional sites. The magnitude of the increased input of new carbon to the soil in the depositional site does not necessarily have to be set by the amount of C eroded, but rather by the interaction of a range of soil physico-chemical variables and micro-climate in the depositional sites. This is a major point that the authors highlight in this work, and needs to acknowledge that it is not a universal truth. Please see the work of Berhe et al 2007 (Bioscience) for how changes in input of C to the soil pool AND decomposition rates of eroded and in situ C at the eroding and depositional sites determines the magnitude of the erosion-induced C sink.
- Results and methods: I applaud the authors for compiling such database. But, the justification for up scaling data derived from relatively small plots to an entire region is not well explained. How can we be sure that the extrapolations that are used to arrive at the different estimates are in deed justified? Is it possible that some in the discrepancy of the estimates that they are seeing (discussed in the supplemental files) partly a result of an unjustified up scaling approaches? In addition to presenting better justification for the up scaling approaches the authors are advised to avoid the temptation to over generalize their findings about erosion rates, or contribution of different sediment sources to the regional sediment or carbon budget. Whenever possible, please present limitations of the approaches employed in this study.
- Soil eroded from different landform positions and soil depths not only has different concentration of C, but it also differs in the composition of organic matter, stability and stabilization mechanisms of the eroded organic matter once the sediments arrive at different depositional environments. Moreover, the type of depositional setting that eroded soil organic matter is deposited on has tremendous influence on how erosion

can contribute to carbon sequestration. These considerations didn't receive due consideration in this manuscript. The authors are strongly advised to further discuss the implications of source of eroded C and type of depositional landforms (see works of McCorkle et al. 2016 *Chemical Geology*, Hu et al. 2016 *Biogeochemistry*, Berhe and Kleber 2013 *Earth Surface Processes and Landforms*, Berhe et al. 2012 *JGR-B*)

- The way it is currently presented, the discussion on N and P losses (section 3.5) comes across as an after-thought. If the authors wish to keep this section, they should highlight this issue more in the introduction section.