

## ***Interactive comment on “Increase in soil organic carbon by agricultural intensification in northern China” by Y. Liao et al.***

### **Anonymous Referee #3**

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This is an interesting study that attempts to document changes in soil carbon storage during the past 29 years in an important agricultural region in China. This paper has potential to improve estimates of terrestrial carbon storage in China.

#### Major Comments:

(1) Soil carbon concentrations were measured using two different methods (pp. 16501-16502) that have shown to differ from each other. Most of the samples were analyzed by the potassium dichromate method and these samples were concentrated near the beginning and middle of the 20 year study period. However, soil samples collected towards the end of the 30 year study period were measured by dry combustion. Dry combustion usually yields higher carbon concentrations than wet chemical digestions, and this is documented in perhaps 20-30 different reports in the literature. For example,

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see Tivet et al. (2012) Soil Sci. Soc. Am. J. 76:1048–1059; and, Islam (2006) Encyclopedia of Soil Science (R. Lal, ed.), pp. 1164-1167. Does this important methodological difference have any bearing on the rise in SOC concentration and density towards the end of the 30 year study period as illustrated in Figure 1 on page 16523 of the manuscript?

(2) The authors indicate that bulk density was "interpolated" for apparently all of the soil samples taken during the 1982-2011 study period (page 16503, lines 8-9). I assume this means that there were either none or very few direct measurements of soil bulk density to accompany the soils that were collected for measurement of carbon concentration. Since bulk density has a very large and important impact on the calculation of soil carbon stocks, this strikes me as an important limitation to the value of this data set. Furthermore, bulk density can vary substantially across a landscape in response to soil physical characteristics, organic matter production and decay, land management practices, and variation in these factors through time. So, trying to simply interpolate this very important number could give rise to large and unknowable errors in the estimate of soil carbon stocks (mass per unit area).

Minor Comments:

Page 16499, Line 7: I'm not sure why there should be a tilde (~) in between the two numbers 1.3 and 21.2. This is also done on Page 16501 Line 14. Should this actually be a dash, or some other symbol?

Page 16499, Line 7: The units "million T C annually" are used in the middle of this line. It might be better to transform this into Teragrams (Tg) of C since you use Tg throughout the remainder of the paper.

Page 16502, Line 4: The term "SOC content" is used here and in many subsequent locations throughout the manuscript. This is a vague term and should be replaced with "SOC concentration".

**BGD**

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