

Interactive comment on “No change in topsoil carbon levels of Great Britain, 1978–2007” by P. M. Chamberlain et al.

Anonymous Referee #1

Received and published: 8 April 2010

This paper addresses an important issue about which there has been significant debate and contradictory findings reported in the literature. The paper benefits from a very large and carefully designed sampling strategy and this is the main strength of the work. The work certainly needs to be published with too much delay, but there are some important details that need to be addressed. Although the authors' main finding that there is no significant change in topsoil soil C stocks in GB is in line with the emerging consensus, their data are not as secure as the title and conclusion would suggest for the following reasons:

1. As with the previous high profile work in this area (Bellamy et al.), the authors have been forced into using a circular argument to overcome the lack of bulk density measurements from some of the sampling occasions. It is not their fault that bulk

C447

density was not collected earlier, but this is an important short-coming of the work.

2. It is unfortunate (verging on inconceivable) that two different protocols for loss on ignition and two different analytical approaches (LOI and elemental analysis) have been used for the determination of soil organic matter during the course of what is otherwise a well-designed study set up with the purpose of long-term monitoring. The authors make a good attempt to rectify this issue by re-analysis where possible.

3. The authors go to considerable length to describe the sampling design and the re-location of the samples in the X and Y dimensions, but provide little detailed information about the Z (vertical/depth) dimension. They say that samples were taken to 15 cm with a trowel in some case and with a corer in other cases. This difference in method, although apparently trivial, is a very important detail. I have done lots of soil sampling and am well aware of the lack of precision and accuracy that can creep in at that stage. Essentially, the biggest sources of error occurs at the sampling stage because of inaccuracies in volume and depth estimation. So, the questions are:

a. Was 0-15 cm actually measured in each case? b. Were all depths equally represented in the sample, i.e. were the sides of the hole left by the trowel exactly parallel? c. What constitutes 0 cm? This question may seem a silly one but in some classical soil sampling and survey approaches, the top of the soil is considered to be the upper limit of the mineral-rich material. Partially decomposed plant litter which has accumulated above that is either discarded or collected separately. d. How have the authors accounted for shrinking and swelling of soil associated with soil wetness? The authors comment on the effect of wetness on soil volume. They are correct that when volume is not constrained the errors can be large as the soil will expand and contract in all directions. In the field however, expansion in the X and Y dimensions is constrained to some extent, but upward expansion and downward contraction are important considerations. This may mean that the mass of dry soil within a 15 cm depth soil will vary with soil wetness. The authors argue that the sample size is sufficiently large to nullify this effect, but this argument only holds if there was no significant difference in

C448

the antecedent rainfall regime across GB in the years the samples were collected. e. How have the authors corrected for the effect of pouring a core into the soil will have had on soil compression?

All of these questions are important details any one of which can contribute a 5-10% error in the estimate of soil C stock. Given that the differences discussed are of this order, detailed and accurate information is essential.

4. I do not think I saw any comments on how or whether the authors corrected for inorganic C in the soils. Many GB soils were limed in the 1970s and 1980s and others are naturally calcareous. Small amounts of carbonate in the soil will have affected the C analysis in different ways depending on the method. The lower temperature LOI is unlikely to be affected, but the higher one might have been, and the elemental analyser approach will certainly detect inorganic C. Please can the authors clarify and comment.

5. The arguments about how much C could be stored in the soils if they were managed to maximise this attribute is statistically robust, but mechanistically rather naive. Well-established ecological and environmental factors (vegetation, climate, altitude etc) affect total C storage and these seem to have been adequately captured by the stratification. However, for mineral soils, the clay content is the key soil property which influences total C storage and this has not been considered.

6. On a stylistic matter, even though the amount of data is large, the number of tables and figures (7 and 8, respectively) seems excessive for what is a relatively simple message.

Interactive comment on Biogeosciences Discuss., 7, 2267, 2010.