We thank you again for your time and your consideration of our work. As a reminder, this research article outlines a new technique for constraining soil carbon models using the radiocarbon signature of heterotrophic respiration (∆14C-CO2) measured in laboratory incubations of archived soils. Our major finding is that measuring ∆14C-CO2 in incubations of archived soils is a promising technique for adding powerful constraints on soil carbon models. However, we found that air-drying and rewetting mobilizes slightly older carbon as compared to what is respired in field-moist soils. The differences in ∆14C-CO2 were significant, but the absolute impact on ∆14C-CO2 is small, indicating limited bias for constraining models.

We have substantially revised the manuscript from the original version. We feel that such substantial revisions were necessary to adequately respond to the comments and suggestions from the reviewers. Specifically, the reviewers recommended that we restructure the introduction and the methods section, as well as cut down the results and clarify the discussion, all of which we have done. The figures are mostly unchanged, but we did adjust the parameterization of the model in Fig. 6, as well as making some minor visual adjustments. The tables have been expanded in response to the reviewer comments, as we did not include all of the data from all three of our experiments initially. Finally, in response to Reviewer 2’s comments, we have redone the statistical analysis. In addition to the updated analysis presented in the main text, we have provided an alternative analysis in the supplemental materials in support of our main findings.

The data and all scripts for generating the figures are available from Zenodo (https://doi.org/10.5281/zenodo.4959705). The authors have no conflicts of interest to declare.