

Interactive comment on “Examining moisture and temperature sensitivity of soil organic matter decomposition in a temperate coniferous forest soil” by C. E. Gabriel and L. Kellman

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Received and published: 19 May 2011

General

The authors have used an original methodology, involving large undisturbed soil cores to study Soil C fluxes of deep and shallow soil layers in relation to temperature and water content. This paper adds to the fast evolving literature on controls of soil respiration. It is generally straightforward and well written.

Thanks to the referee for these thoughtful comments. Responses to specific concerns will be addressed below.

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I have only a few comments:

Specific

Provide better insights on the controls over deep soil layer CO₂ fluxes. The ms does not make a convincing case that the properties of the soil organic matter in deep layers is different from that of shallow layers. The reason for this is that the low respiration rates and the low sensitivity to temperature are derived from results expressed on a m² basis. Results should be presented on a total C basis to make more credible a discussion on the role of soil organic matter quality and whether it really shows a different dynamics than that of the shallow soil layer. The discussion (l.809-832) about soil organic matter quality as a controlling factor of soil CO₂ efflux (Protection of OM, waxy OM, low C:N,...) is not possible with results expressed on a m² basis. Also if rates are lower, it is possible that detection of changes with increasing temperatures is more difficult to detect.

This is an excellent point and is cause for a re-evaluation of the framing of the discussion, where comparison is made between the shallow and deep soil layers. Although mean C contents are known for the site, individual variability in C content from one soil core to the next (from the triplicate sites) were not measured/assessed, and therefore, a flux on a per mass basis would only be appropriate for a mean value for the whole site.

A “back of the envelope” calculation could be effective at highlighting the overall difference between the shallow and deep layers, however. This exercise would likely yield more valuable information about the controls on organic matter decomposition.

The fluxes from deep soils were within the detection limit of the instrument, so we have confidence in the data.

There is little comment on the role of soil physical properties and a lot of speculation on the role of soil organic matter quality. What is the role of soil aeration? I would suspect

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that there is less macro and micro pores in the deep soil layers. Is this enough to limit rates of decomposition? Perhaps this should be considered.

Although we do not believe that the pore space to be limiting to decomposition in these soils, a discussion of difference in soil pore space through depth would improve the understanding of the relevant controls of soil respiration for the shallow and deep soil layers studied. These ideas will be included in a revised manuscript.

In summary, I think that the discussion on factors controlling soil C effluxes from deep soil layers should consider the results on a total C basis (or organic matter quality basis). They should also consider the role of physical changes to the soil layers. The discussion on the role of soil organic matter quality could be made more convincing in the light of such analysis.

Technical

Terminology: use shallow soil layers instead of shallow soil (e.g. 1.17; but observed throughout the text) to avoid confusion for readers going rapidly through the paper that you are not comparing deep soils with shallow soils but layers of a same soil.

Thanks for pointing this out. This could certainly be a misconception for readers. Changes will be made to make this more clear.

Interactive comment on Biogeosciences Discuss., 8, 1369, 2011.