Biogeosciences Discuss., 4, S1994–S1996, 2007
www.biogeosciences-discuss.net/4/S1994/2007/

Biogeosciences
Discussions

Interactive comment on "Relative stability of soil carbon revealed by shifts in δ^{15}N and C:N ratio" *by* F. Conen et al.

F. Conen et al.

Received and published: 27 November 2007

Thank you for the constructive comments and valuable suggestions. We agree, the wider context of the study in terms of climate change should be mentioned. Globally, the upper two metres of the pedosphere contain about three times as much organic carbon (2376-2456 Pg of C; Batjes, 1996) as is currently contained in the atmosphere in form of CO2. The dynamic equilibrium between these two large pools of C is mediated by the biosphere and expected to adjust to a changing climate with the result of a net transfer of C from soils to the atmosphere (Falloon et al., 2007). For predicting these dynamics, it is necessary to have information on the turnover rates, or relative stability, of different soil organic C fractions (Zimmermann et al., 2007).

The central point in our concept is the N-15 enrichment with increasing decomposition of organic matter. A general trend towards N-15 enrichment with depth in undisturbed soil profiles was observed before (e.g. Mariotti et al., 1980) and has lead us into that direction. In a revised version, we will make it easier to understand how we got to Eq. 1 to 3 and explain Eq. 5 in more detail. The explanation of Eq. 5 will then read: "where A(t) is the 14C activity of soil organic C at time t (usually the sampling year; corrected for radioactive decay between sampling and AMS measurement), A(t-1) the 14C activity of soil organic C in the previous year; Ai the input 14C activity of the plant residue (usually equal to the atmospheric time series), k the exchange rate constant of the soil organic C pool (i.e., 1/mean residence time), and lambda the 14C decay constant (1/8268 per year). Mean residence times of soil organic C were calculated according to Eq. 5 by iteratively varying the mean residence time until it matched the measured 14C activity of the sample." The AMS measurements, expressed as percent modern C, provided values between 95.9 % and 115.6 % with a precision (1 standard deviation) of 0.72 %.

We are aware of the critical nature of the enrichment factor epsilon and had tried to expand, to the best of our knowledge, on its value on pages 2921 (line 22 onwards) and 2922 (up to line 14) and in Fig. 2.

Regarding podsolisation in alpine soil, an excellent description can be found in Egli et al. (2006). We agree, the explanation for decreasing C-14 ages with altitude is rather speculative. As it is the only plausible explanation we currently have, we would like to keep it but acknowledge we have to underline its speculative nature.

References

Batjes, N.H.: Total carbon and nitrogen in the soils of the world, European Journal of Soil Science, 47, 151-163, 1996.

Egli, M., Mirabella, A., Sartori, G., Zanelli, R., Bischof, S.: Effect of north and south exposure on weathering rates and clay mineral formation in Alpine soils, Catena, 67, 155-174, 2006.

BGD

4, S1994–S1996, 2007

Interactive Comment

Falloon, P., Jones, C.D., Cerri, C.E., Al-Adamat, R., Kamoni, P., Bhattacharyya, T., Easter, M., Paustian, K., Killian, K., Coleman, K., Milne, E.: Climate change and its impact on soil and vegetation carbon storage in Kenya, Jordan, India and Brazil, Agriculture, Ecosystems & Environment, 122, 114-124, 2007.

Mariotti, A., Pierre, D., Vedy, J.C., Bruckert, S., Guillemot, J.: The abundancee of natural nitrogen 15 in the organic matter of soils along an altitudinal gradiant, Catena, 7, 293-300, 1980.

Zimmermann, M., Leifeld, J., Schmidt, M.W.I., Smith, P., Fuhrer, J.: Measured soil organic matter fractions can be related to pools in the RothC model, European Journal of Soil Science, 58, 658-667, 2007.

Interactive comment on Biogeosciences Discuss., 4, 2915, 2007.