

Interactive comment on “A method to detect soil carbon degradation during soil erosion” by C. Alewell et al.

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Reply to interactive comment of anonymous referee 1 on “A method to detect soil carbon degradation during soil erosion” by C. Alewell et al.

The main concern of referee 1 is that particle size sorting and simultaneous carbon isotope fractionation during erosion may reflect the differences in stable isotope signature of upland and wetland soils. This is a very valid argument and needs consideration. Baisden et al. (2002; *GlobBioCycles* 16, 117; Figure 6) determined increase in stable isotope signature with increasing density fractions in soils (and parallel increased decomposition and mineral association). Thus, we can assume denser soil particles and particles with an increased degree of mineral association to be heavier in $d^{13}C$ signature. However, during soil erosion lighter fractions and organic material with lower C^{1445}

degrees of mineral associations are most likely to be detached and transported. Thus, the light $d^{13}C$ material would be preferentially transported to the wetlands. In our approach we try to explain the stable isotope mixture in the wetlands affected by erosion with SOC degradation. If particle size fractionation contributes to the isotope signal in the wetland, we would underestimate the degradation of SOC. The conclusion would be that the consideration of particle size fractionation during erosion processes would point to even more SOC degradation than we have considered. We agree with referee 1 that this needs to be discussed in our manuscript and we will include this discussion in a new version of the manuscript. Referee 1 refers us to Balesdent (1996). Balesdent (1996) determined the proportion of new C in different particle size fractions based on calculation with $d^{13}C$ after a shift from C3 to C4 plant cultivation. This approach shows that in the coarser particles (= sand fraction) there is a higher percentage of “new” SOC (= C4 plant SOC) than in smaller size fractions. We can assume from this study, that in the Rothamstead soil the coarse size fractions contain less decomposed SOC with thus lighter $d^{13}C$ signature. However, during soil erosion it is neither the coarse nor the fine material that is preferentially transported but the medium size fraction (fine sand and silt). Thus, from the Balesdent (1996) results we might assume that the net effect of particle size fractionation during soil erosion might be zero. However, this is a very indirect conclusion and we believe that the Balesdent (1996) is not the best example for us to quote. In agreement with our conclusion from the Balesdent (1996) study, Bellanger et al. (2004; *Catena* 58, 125-150) found that stable carbon isotope signature of fine grained particles ($< 50 \mu m$) is surprisingly stable during soil erosion events. They could not detect any trend in $d^{13}C$ of the suspended solids during a nine hour rain event. If particle size fractionation would have a significant effect on $d^{13}C$ in transported material we would expect a trend during erosional events. However, Bellanger et al. (2004) only investigated the suspended fine size fraction $< 50 \mu m$. So it is difficult to really draw conclusions from their study to our approach. The second concern of referee 1 is, that we do not display the Cs-137 reference measurements and the Cs-137 inventory. However, the editor asked us to refrain from presenting data which is

already published in the Schaub and Alewell paper (see Fig. 7, reference value is also given with 143.9 ± 5 Bq/kg). We will include the reference value and a clear quote to the other study in the methods section in a new version of our manuscript.

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