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Interactive comment on "Soils apart from equilibrium – consequences for soil carbon balance modelling" *by* T. Wutzler and M. Reichstein

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In their paper, Thomas Wutzler and Markus Reichstein discuss the consequences of non-equilibrium conditions for the modelling of SOM dynamics. With the conceptual, pool-based SOM model Yasso, they show that relatively small changes in the decomposition rate k of the most stable pool (hum2) in Yasso leads to large changes in calculated equilibrium C-stocks. One problem addressed is the uncertainty in determining khum2 by means of field data, because many sites in Europe are considered to be in non-equilibrium because of their land-use history. In addition, many soils are relatively young (Holocene) and in an early stage of soil formation, exhibiting (from a geologi-

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cal point of view) rapid changes in soil properties, in particular soil mineralogy. These changes might introduce an additional degree of freedom which has to be considered when modelling the long-term fate of soil carbon storage in stable pools. In some contrast to the mechanisms highlighted in chapter 4.5 of Wutzler & Reichstein, not litter quality is the most important constraint to the slow pool of mineral soils, but soil mineralogy (e.g., v.Lützow et al. 2006; Mikutta et al. 2006). The latter is considered exerting important control on stable SOM dynamics. Because of rapid changes in soil properties in young soils, ecosystems with a long track (i.e., more than millennia) of more or less stable climatic conditions and without strong human perturbance should be better candidates to parameterize a model. I suggest applying a study as presented here with comparison to field data to sites of tropical evergreen rainforests. Though their mineralogy is often dominated by Kaolinite and Goethite and thus different to that of many temperate soils and though also tropical soils continue to weather (cf. Richter & Markewitz 1995), they provide relative stability in terms of climate, human perturbance, and mineralogy as compared to temperate soils. Many of them may have ages $>$ 10ˆ6 years. Exclusion of anthropogenic Terra Preta and selection of remote sites should allow for investigating steady-states. A screening of available data on SOC stocks in tropical evergreen forests showed that their carbon storage is higher than that of temperate zones, but still in the same order of magnitude (0-3m: tropical evergreen 27.9 plusminus 8.9 kg m2; temperate deciduous 22.8 plusminus 13.6 kg m2; Jobaggy & Jackson 2000). Keeping in mind the long time tropical soils had to develop, an infinite accumulation of carbon is unlikely and makes equilibrium stocks as shown in Fig. 4b for accumulation rates of $>$0.06 t C ha-1 a-1 (input rates into hum2 0.063 t C ha-1 a-1) unreasonably high. Schlesinger (1990) indicated long-term rates of carbon accumulation of c. 2.4 g C m-2 a-1 due to soil profile development. Global budget considerations suggest, that organic carbon apparently stored in soil is transferred as non-CO2 out of the terrestrial system and that soils have a finite capacity to accumulate new carbon (Hedges et al. 1997).

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BGD

3, S599–S601, 2006

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