Geophysical Research Abstracts
Vol. 12, EGU2010-2464, 2010
EGU General Assembly 2010

Modelling of subsoil C dynamics using simple models

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Soil C dynamics below the plough layer have been little studied, despite a suspected large C stabilization potential of subsurface horizons. The objective of this study was to test two simple models (model A: single compartment for C3- and for C4-derived C; model B: division of C3- and C4-derived C into active and passive compartments) in their ability to simulate the C dynamics in subsoil horizons of a Haplic Phaeozem after conversion from C3- (rye) to C4-cropping (maize). The models were calibrated on an unfertilized maize soil and then validated on a maize soil with NPK-fertilization. Both models simulated well C3-C and C4-C dynamics in the investigated soil depths (20–40 cm and 40–60 cm). In all cases, the model efficiency EF was >0, which indicated that the simulated values described the trend in the measured data better than the mean of the observations. However, we observed some inconsistency in the obtained parameter set (e.g. a higher proportion of passive C for C4-derived than C3-derived C or a very low decomposition rate constant for passive C4-C in 40–60 cm), which we assume to result from data restrictions on the investigated soils. Detailed data, which is needed for the evaluation of complex subsoil models (e.g. pool sizes, turnover rates and C inputs to subsoils) is still limited for most long-term experiments. As even the simple models applied here suffered from a lack of data, we assume more detailed information on subsoil C dynamics is vitally needed – especially for applying more complex models.