Geophysical Research Abstracts
Vol. 15, EGU2013-1201, 2013
EGU General Assembly 2013

Simple pedotransfer functions to initialize reactive carbon pools of the RothC model

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Modelling of carbon turnover is a widely used tool to estimate soil carbon stock changes as a response to climate and land use change. Carbon turnover models are increasingly used not only at the point scale but also on regional and continental scales, whereby the Rothamsted Carbon Model (RothC) is a widely used model due to its simplicity and easy implementation. For the initialization of the RothC model, knowledge about the carbon pool sizes is essential. Their characterization can be either obtained from physical fractionation or equilibrium model runs, but both approaches are time consuming and tedious, especially for larger scale simulations. In this study, a pedotransfer functions (PTF) for the estimation of all active carbon pools of the RothC model is presented. As independent variables only total organic carbon (TOC) and clay content are necessary, which are easily available at most scales. For validation of PTFs the resistant plant material (RPM) stock estimated from physical fractionation of soil originating from a wide range of soil types was predicted with a R^2 of 0.70. In a second step, associated errors induced by the use of PTFs were analysed using simulation runs for a 100 year time period. Therefore, the model was either initialized by the carbon pools extracted from physical fractionation or the PTF. Maximum relative deviation in TOC content were small (< 9 %) and declined to < 4 % after 100 years. Further, absolute errors were in the range of measurement error for soil organic carbon. Therefore, we propose to use PTFs to initialize the RothC model whenever physical fractionation is not feasible or equilibrium runs are considered too tedious.