Geophysical Research Abstracts,
Vol. 10, EGU2008-A-08983, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-08983
EGU General Assembly 2008

Coupling agricultural landscape modelling with dynamic modelling of soil organic carbon stock

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Soil organic carbon (SOC) is recognized as a key factor of the chemical, biological and physical quality of soil. Numerous models of soil organic matter turnover have been developed since the 1930ies, most of them dedicated to plot scale applications. More recently, they have been applied to sub-regional scales to better estimate the role of the soil reservoir in global climate issues. However only few studies consider the intermediate landscape scale, where the spatio-temporal pattern of land management practices, its interactions with the physical environment (climate, soil, subsoil,Ě) and its impacts on SOC change can be investigated to provide guidelines for sustainable management of soil in agricultural areas. The purpose of this paper is to present how we combined a landscape modelling approach and a dynamic modelling approach of SOC evolution to elucidate the impacts of farming patterns on SOC patterns. Simulations were based on topography, the field map, and the soil survey of an actual 12-km^2 agricultural landscape located in Brittany (western France). Landscape results from the spatial combination of physical environment, landuse mosaic and land management practices patterns. The physical and agricultural components of the landscape were initialized. Initial soil properties, mainly SOC stocks, were stochastically simulated using spatial structures. Crop rotations and land management practices evolution, known from farmer interviews were simulated. Landscape simulation was integrated as input of RothC model driving soil organic matter dynamics. This preliminary work enabled to identify future needs to improve integrated soil-landscape modelling in agricultural areas.