Geophysical Research Abstracts
Vol. 16, EGU2014-10372-1, 2014
EGU General Assembly 2014

Impact of land consolidation and field borders on soil erosion and storage within agricultural landscapes

Caroline Chartin (1,2), Sébastien Salvador-Blanes (2), Evrard Olivier (3), Kristof Van Oost (1), Florent Hinschberger (2), and Jean-Jacques Macaire (2)

(1) Université Catholique de Louvain, TECLIM, Earth & Life Institute, Louvain-la-Neuve, Belgium (caroline.chartin@uclouvain.be), (2) EA 6293 GéHCO, Faculté des Sciences et Techniques, Parc de Grandmont, 37200 Tours, France, (3) LSCE (Laboratoire des Sciences du Climat et de l'Environnement), UMR 8212 (CEA-CNRS-UVSQ) Avenue de la Terrasse, 91198 Gif-sur-Yvette, France

Soil erosion plays an important role in sediment and carbon storage within, and exports from, catchments. In cultivated landscapes, field borders can improve the temporary storage of eroded soil particles and associated carbon, by impeding lateral soil fluxes. These local soil accumulations can lead to the development of linear landforms (such as headlands and lynchets) which will keep evolving after field border removal. A recent study performed in a representative cultivated hillslope of the SW Parisian Basin showed that 39% of the area corresponds to landforms resulting from soil accumulation induced by former and present field borders. This study demonstrated that field borders influence greatly the landscape morphology, but also the spatial distribution of soil thickness, and locally the A-horizon thickness, which are essential parameters for the prediction of SOC stocks.
This study aims at characterizing and quantifying the effect of field borders and their removal on medium term topsoil erosion and deposition rates in a cultivated hillslope of the SW Parisian Basin, consolidated in 1967. Here, we used the Cs-137 technique to assess recent patterns of soil redistribution. We measured the Cs-137 inventories of 68 soil cores sampled along transects covering the area and, more specifically, linear landforms identified along present and past field borders (i.e. lynchet and undulation landforms, respectively). Then, we used a spatially-distributed Cs-137 conversion model that simulates and discriminates soil redistribution induced by water and tillage erosion processes over the last fifty years. Finally, observations and model outputs were confronted.
Our results show that tillage erosion dominate the soil redistribution in the study area for the 1954-2009 period and generated about 95% (i.e. 4.50 $Mg.ha^{-1}.yr^{-1}$) of the total gross erosion. Soil redistribution was largely affected by the presence of current and former field borders, where hotspots areas of deposition and erosion (>20 $Mg.ha^{-1}.yr^{-1}$), respectively, were observed. Land consolidation contributed to the local acceleration of topsoil erosion through the conversion of storing areas into sediment generating areas. Though the general patterns of Cs-137 inventories in the area were correctly reproduced by the model, this latter performed weakly with a r2 of 0.20. Important discrepancies were associated with sampling points located along current field borders where data suggests that tillage erosion processes cannot be described as elsewhere, i.e. as a diffusive process. These specific processes implied here should be characterised and implemented into erosion models for simulating rates and patterns of topsoil redistribution in fragmented cultivated landscapes. In addition, the use of a DEM of the present-day morphology leads to the underestimation of soil erosion and storing within linear landforms which morphology seems to have greatly evolved since 1967. This study highlights the importance of present and former field borders on the patterns and intensities of topsoil erosion and deposition processes at landscape scale. This is of particular interest concerning the improvement of our knowledge on soil organic carbon patterns and on estimation of SOC stocks.