

Coupling a high resolution soil erosion model with an agro-ecosystem model of SOC dynamics. An approach to assess the potential environmental effect of the new Common Agricultural Policy on soil degradation

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At the European Union level, the main mechanisms to promote a more sustainable and environmentally friendly agriculture was introduced by the Common Agricultural Policy (CAP) reform in 2003, through the Cross-compliance. According to this new regulation, the farmer support payments were regulated with respect to environmental, animal welfare and food safety standards. This brought to the Good Agricultural and Environmental Conditions (GAEC), firstly established by Council Regulation No. 1782/2003 and subsequently Council Regulation (EC) No 73/2009. The prevention of soil erosion and maintenance of soil organic matter were two of GAEC requirements, which each Member State was obliged to address through national standards such as: i) minimal soil cover maintenance (GAEC 4); ii) minimum land management reflecting site specific conditions to limit soil loss (GAEC 5) and iii) maintenance of soil organic matter level through appropriate practices including ban on burning arable stubbles (GAEC 6). Although Member States are required to verify whether the farmers are compliant with the regulations (Cross-compliance), the environmental effect of Good Agricultural and Environmental Conditions (GAEC) applications on erosion and carbon budgets are still little known and studied. To investigate the potential impacts of the GAEC, we coupled a high resolution erosion model based on Revised Universal Soil Loss Equation (RUSLE) with the CENTURY biogeochemical model (Land Use Policy, 50, 408-421; 2016). The Italian arable land was selected as a study area, since it is well-known to be highly sensitive to soil erosion. Multi scenario modelling approach was undertaken, i.e. i) a baseline scenario without scenario excluding GAEC (pre 2003 period); ii) a present scenario including the current GAEC standards (post 2003 period), and iii) a technical potential scenario assuming that the GAEC standards were applied to the entire Italian arable land. The results show a 10.8% decrease, from 8.33 Mg ha⁻¹ yr⁻¹ to 7.43 Mg ha⁻¹ yr⁻¹, in soil loss potential due to the adoption of the GAEC conservation practices (with respect to the baseline scenario). The technical potential scenario shows a 50.1% decrease in the soil loss potential (soil loss 4.1 Mg ha⁻¹ yr⁻¹). With regard to the soil organic carbon (SOC), the GAEC application in the current scenario shown an overall soil organic carbon (SOC) gains, with about 17% of the SOC variation related to avoided SOC transport by sediment erosion. The technical potential scenario suggests a potential gain up to 23.3 Mt of C by 2020 with the full GAEC application.