



## **Future climate variability impacts on potential erosion and soil organic carbon mobilization in European croplands**

Marijn van der Velde (1), Juraj Balkovič (2), Christian Beer (3), Nikolay Khabarov (2), Matthias Kuhnert (4), Michael Obersteiner (2), Rastislav Skalský (2), Wei Xiong (2), and Pete Smith (4)

(1) European Commission, DG Joint Research Centre, Ispra, Italy, (2) International Institute of Applied Systems Analysis (IIASA), Ecosystem Services and Management Program, Laxenburg, Austria, (3) Department of Applied Environmental Science (ITM) and Bert Bolin Centre for Climate Research, Stockholm University, Sweden, (4) Institute of Biological & Environmental Sciences, University of Aberdeen, Aberdeen, UK

We investigate the impact of future climate variability on the potential vulnerability of soils to erosion and the consequences for soil organic carbon (SOC) mobilization in European croplands. Soil erosion is an important carbon flux not characterized in Earth System Models. We use a European implementation of EPIC, driven by reference climate data (CNTRL), and climate data with reduced variability (REDVAR). Whether erosion regimes will change across European cropland depends on the spatial conjunction of expected changes in climate variability and physiographic conditions conducive to erosion. We isolated the effect of erosion by performing simulations with and without erosion. Median CNTRL and REDVAR erosion rates equalled 14.4 and 9.1 ton ha<sup>-1</sup>, and 19.1 and 9.7, for 1981-2010 and 2071-2100 respectively. The total amount of carbon mobilized in European cropland due to erosion was estimated at 769 Tg C for 1981-2010 (from a total storage of 6197 Tg C without erosion) under CNTRL climate. Climate trend impacts mobilized 578 Tg C if erosion is excluded – and by 683 Tg C if erosion is included, from European croplands during the period 1981 to 2100. Climate variability compounds these impacts with a further mobilization of 170 Tg without erosion, and by 314 Tg C with erosion, by the end of the century. Future climate variability and erosion will thus compound impacts on local SOC stocks arising from gradual climate change alone.