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Dynamic replacement and burial of eroded carbon: quantifying erosion induced soil-atmosphere C exchange at the European scale.

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Recent research has suggested that there exist interactions and feedbacks between terrestrial erosion and sedimentation and carbon cycling, leading to important mismatches in global budgets. This geomorphically-driven carbon exchange depends on dynamic replacement of carbon at eroded sites and reduced mineralization associated with sediment burial. Recent modelling studies at very small scales confirm the hypothesis that erosion and deposition are driving an important sink. However, these results have rarely been verified empirically and are a direct consequence of extending basic concepts of SOC modelling. As a result, the role of geomorphic processes in regional carbon budgets remains highly uncertain. This paper presents a retrospective assessment of rates of dynamic replacement and preservation during burial of C and field-scale C exchange using c. 2000 profile measurements of total carbon and fallout nuclides from various sites across Europe. Application of this approach identifies the major controls and indicates that erosion has driven a significant net carbon sink during the last 50 years for almost all study sites. In a second step, we present a spatially explicit modelling framework that integrates these small-scale observations into models of landscape-scale C budgets; and finally, continental scale observations. This paper presents one of the first regional scale assessments of geomorphic controls on carbon cycling using large-scale GIS databases of land use, topography and soil characteristics and preliminary results are presented. Given the high rates of C exchange, we argue that in order to fully evaluate soil-atmosphere C exchange in a changing environment; a full C account must be made that considers the impact of sediment burial

on mineralization rates and formation of new SOC across the landscape.