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Modelling erosion and its interaction with soil organic carbon.

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Water driven soil erosion removes and relocates a significant quantity of soil organic carbon. In China the quantity of carbon removed from the soil through water erosion has been reported to be 180+/-80 Mt y-1 (Yue et al., 2011). Being able to effectively model the movement of such a large quantity of carbon is important for the assessment of soil quality and carbon storage in the region and further afield. A large selection of erosion models are available and much work has been done on evaluating the performance of these in developed countries (Merritt et al., 2006). Fewer studies have evaluated the application of these models on soils in developing countries. Here we evaluate and compare the performance of two of these models, WEPP (Laflen et al., 1997) and RUSLE (Renard et al., 1991), for simulations of soil erosion and deposition at the slope scale on a Chinese Red Soil under cultivation using measurements taken at the site. We also describe work to dynamically couple the movement of carbon presented in WEPP to a model of soil organic matter and nutrient turnover, ECOSSE (Smith et al., 2010). This aims to improve simulations of both erosion and carbon cycling by using the simulated rates of erosion to alter the distribution of soil carbon, the depth of soil and the clay content across the slopes, changing the simulated rate of carbon turnover. This, in turn, affects the soil carbon available to be eroded in the next timestep, so improving estimates of carbon erosion. We compare the simulations of this coupled modelling approach with those of the unaltered ECOSSE and WEPP models to determine the importance of coupling erosion and turnover models on the simulation of carbon losses at catchment scale.