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Hillslope sediment and soil carbon transport: can we model their movement?

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Quantifying and predicting the movement of hillslope sediment and soil organic carbon (SOC) is of huge scientific, agronomic and economic benefit. In particular, the movement and fate of SOC has attracted considerable recent attention. However, the reliable modelling and prediction of sediment and SOC movement has proved elusive.
Here we examine the movement of sediment and SOC along a grazing hillslope in south-eastern Australia. The slope is linear, uniformly managed and has consistent vegetation (grassland). We quantify sediment and SOC transport using the environmental tracer 137-Ceasium. However, here we collect field samples using the conventional soil cores but also shallow samples to quantify the dynamics of the near surface. We also model the movement of sediment and SOC using a numerically based soil erosion and landscape evolution model.
Our results show that the hillslope is erosional which is supported by field observation. However, there was no relationship between SOC and 137-Caesium suggesting that SOC and their movement and fate are not related. Significant relationships were observed between soil texture and SOC for the near surface but not for the deeper cores suggesting any movement and fate of SOC is more controlled by soil particle size at the near surface.
The SIBERIA sediment transport model was calibrated and run for the site. Comparing the field derived erosion and SOC data with model prediction found no significant relationship. However, the numerical model was able to predict the cyclic pattern of 137-Ceasium and SOC as well as overall trends. Our findings demonstrate that the movement and fate of sediment and SOC is complex.