Abstract #74531

A Numerical Model to Assess Soil Fluxes from Meteoric ^{10}Be Data

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Abstract Text:

Meteoric ^{10}Be may be mobile in the soil system. The latter hampers a direct translation of meteoric ^{10}Be inventories into spatial variations in erosion and deposition rates. Here, we present a spatially explicit 2D model that allows us to simulate the behaviour of meteoric ^{10}Be in the soil system. The Be2D model is then used to analyse the potential impact of human-accelerated soil fluxes on meteoric ^{10}Be inventories. The model consists of two parts. A first component deals with advective and diffusive mobility of meteoric ^{10}Be within the soil profile including particle migration, chemical leaching and bioturbation, whereas a second component describes lateral soil (and meteoric ^{10}Be) fluxes over the hillslope. Soil depth is calculated dynamically, accounting for soil production through weathering and lateral soil fluxes from creep, water and tillage erosion. Model simulations show that meteoric 10Be inventories can indeed be related to erosion and deposition, across a wide range of geomorphological and pedological settings. However, quantification of the effects of vertical mobility is essential for a correct interpretation of the observed spatial patterns in ^{10}Be data. Moreover, our simulations suggest that meteoric ^{10}Be can be used as a tracer to unravel human impact on soil fluxes when soils have a high retention capacity for meteoric meteoric ^{10}Be. Application of the Be2D model to existing data sets shows that model parameters can reliably be constrained, resulting in a good agreement between simulated and observed meteoric ^{10}Be concentrations and inventories. This confirms the suitability of the Be2D model as a robust tool to underpin quantitative interpretations of spatial variability in meteoric ^{10}Be data for eroding landscapes.

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