Processes and Rates of Soil Creep on Hillslopes: Calibration of Diffusivity Using Tephra Stratigraphy and Dispersion. (S05-almond215106-Oral)

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Abstract:

An important challenge for pedologists and modellers in soil science is to shift pedological and soil-landscape models from the qualitative and functional to the quantitative and mechanistic, and from the pedon to the catena and landscape spatial scale. Currently the potential of mechanistic soil-landscape simulations is limited by the lack of field-calibrated process models. In this study we investigate the nature of processes driving soil creep, and determine the rate coefficient for a simple, slope-dependent soil transport model in a temperate and formerly forested landscape in the South Island of New Zealand. The study site is a rectilinear convexo-concave hillslope transect from interfluve to the floor of a gully in a dissected river terrace. Over half of the (8 m) relief is in the 5 m of loess coverbeds. A microscopic primary tephra provides an isochronous (22.6 14 C ka) datum at about 80 cm depth in the loess on the interfluve. The soil transport model was calibrated from: (1) estimates of differential surface lowering (relative to tephra datum) and the associated difference in slope convexity; and (2) simulations of the downslope dispersion and dilution of volcanic glass grains. The downslope pattern of soil profile glass distribution points to tree-overturn as the dominant process driving soil creep, as the depth of tephra disturbance and mixing is coincident with the rooting depth of the tree species (Podocarps and Southern beech) that populated the area during the Holocene.

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Presentation Information:

Presentation Date: Thursday, November 14, 2002
Presentation Time: 8:45 am

Keywords:

Soil creep processes, Diffusivity, Soil-landscape modelling, Tephra