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A simple model for pediment formation.

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Pediments are very flat and smooth erosive surfaces, connected to higher relief by a scarp, that covers up to two thirds of the Earth's surface. A physical mechanism to explain their formation remains elusive. Commonly accepted hypotheses include: (1) the widening of an incised river network (lateral corrasion of Gilbert, 1877), (2) sheetflow erosion, (3) subsurface weathering and exhumation (Strudley et al, 2006) and (4) slope retreat, usually at the base of an escarpment (King, 1949), potentially helped by flexural isostatic rebound (Pelletier, 2010). Here we explore the third hypothesis, which we believe applies mostly in regions characterised by intense rainfall where deep weathering profiles are commonly observed.

In this study, using a new coupled model of groundwater flow and surface erosion, we highlight the critical impact of the geometry of the water table and of the unsaturated zone within a weathering profile to explain its evolution through time. The model is calibrated and used to explain the formation of pediments as the product of a dynamical balance between weathering front propagation and surface erosion. We also explore the effects of abrupt changes in rainfall intensity and base level drop on the geometry of the predicted pediments.