Geophysical Research Abstracts
Vol. 20, EGU2018-13682, 2018
EGU General Assembly 2018

The impact of acid source location on chemical weathering and erosion processes, and soil profile and hillslope catena development

Garry Willgoose (1), Dimuth Welivitiya (1,2), and Greg Hancock (2)

(1) The University of Newcastle, Discipline of Civil, Surveying and Environmental Engineering, Callaghan, Australia (garry.willgoose@newcastle.edu.au), (2) The University of Newcastle, School of Environmental and Life Sciences, Callaghan, Australia (greg.hancock@newcastle.edu.au)

Recent work using a coupled landform-soilscape evolution model has highlighted unforseen impacts of the source location of acid weathering potential on the in-profile weathering and erosion of soil and how this sensitivity of the soil profile feeds into soil catena, soilscape and landform evolution. This paper focuses on two potential sources of acid potential: (1) at the soil profile surface as a result of rainfall and infiltration saturated with atmospheric carbon dioxide, and (2) within the profile as a result of carbon dioxide generation from plant root respiration and biodegradation of soil organic matter. This sensitivity to source location has been studied by the authors using a coupled soil water infiltration-surface soil erosion-geochemistry model, and the results point to unrecognised complexities in defining the soil production function (typically used for estimating soil depth and age, but also impacting on soil grading changes through the profile and fluvial erosion rate). The paper will first outline the coupled hydrology-erosion-geochemistry model concentrating on the two acid weathering potential source locations: (1) at the soil profile surface, and (2) within the profile. Analytical solutions for the chemical weathering rate with depth can then be derived, and they will be compared and contrasted. For a soil surface source an exponential and/or humped profile with weathering rate declining with depth down the profile typically occurs. For the in-profile source a reversed exponential with maximum weathering rate at the soil-saprolite interface declining exponentially with distance above the interface occurs. Results from using these two analytical solutions in our coupled landform-soilscape model will be shown. We will highlight how the soil profile characteristics are fundamentally different highlighting an experimental hypothesis that potentially can be tested in the field to assist in understanding in-profile chemical weathering dynamics.