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Quantifying the coupled geomorphic and geochemical evolution of eroding landscapes

Simon Mudd
University of Edinburgh, GeoSciences, United Kingdom

Both the chemistry and morphology of eroding landscapes are in a state of continual change. This change is forced by both changing climate and tectonics. In recent years we have been able to constrain how long it takes landscape morphology and erosion rates to respond to perturbations to these forcings and have found that the response timescale is typically much greater than the timescale of climate fluctuations. The result is that the steady-state condition is an ever retreating 'finish line' for eroding landscapes. I will explore the nature and timing of how landscapes respond to changing climate and tectonics, and how they affect both geochemistry and production of sediment in such transient landscapes. Both climatic and tectonic changes lead to perturbations in erosion rates that are spatially heterogeneous, and these changing rates alter both the residence time and physical properties of sediment produced from bedrock. These in turn alter chemical weathering rates, which can influence long term climate: chemical weathering of silicate minerals is thought to reduce atmospheric CO_2 concentrations. I explore the connection between the physical and chemical function of such eroding landscapes, and how we might constrain the functional relationship between chemical and physical erosion rates.