Modeling landscape evolution through space and time

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Project How do landscapes evolve through space and time? Answers to this question have implications for understanding of most geological processes. Landscapes evolve as topography grows and decays, which affects delivery of sediment to resource-bearing basins, and influences oceanic and atmospheric circulation. The successful candidate will develop 4D landscape evolution models that will make testable predictions about geological and geomorphological processes (e.g. incision rates). These models will build on recent work (e.g. 1, 2) to predict sedimentary flux and facies, calculate regional uplift histories and provide constrain on geological processes responsible for landscape evolution. We will test landscape sensitivity to changing uplift (e.g. regional vs. local), climate (discharge), substrate (lithology) and planform. A variety of geochemical, biostratigraphic and geophysical observations, which provide information about evolution of landscapes on geological timescales, will be used to test these models (e.g. thermochronology, sediment velocities, seismic reflection data, U-series dating). The student will be given support as they develop new software and interpret results. We expect that there will be opportunities for the successful candidate to undertake fieldwork to calibrate landscape evolution models.

(a) Incised rivers and low relief regional surfaces in western Arabia, a response to regional uplift and fluvial erosion. (b) Drainage patterns close to Bryce Canyon, western North America. Note erosional hoodoos (`singularities'). (c) Perspective view of Calabria's landscape, Italy, which is responding to regional and local uplift and erosion.

The successful candidate will join, and be supported by, a vibrant and dynamic research group with world-class expertise modelling geophysical flows. They will be trained in state of the art numerical methods for landscape modeling, mesh generation and high performance computing. The candidate will have the opportunity to develop their career and profile by presenting at international conferences and publishing in high impact journals. Candidates for PhD positions should have a good mathematical background and a good degree in an appropriate field such as earth science, geoscience, physics, mathematics, computer science or engineering.

Please contact gareth.roberts@imperial.ac.uk for more information.

[1] Rudge et al. (2015), Uplift histories of Africa and Australia from linear inverse modeling of drainage inventories, J. Geophys. Res. Earth Surf., 120, 1–21, doi:10.1002/2014JF003297.

[2] Stephenson et al. (2014), A Cenozoic uplift history of Mexico and its surroundings from longitudinal river profiles, Geochem. Geophys. Geosyst., 15, 4734–4758, doi:10.1002/2014GC005425.