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# The Failure Earth Response Model (FERM): a unifying framework to explore dynamic tectonic landscapes

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The landscape serves as a nexus between the solid Earth with its geodynamic processes and the atmosphere. At many spatial and temporal scales, landscape morphology and topography provide a constraint on the tectonics of the deeper Earth and the processes active within it or that have been previously active. To unravel these, we need to understand the complex relationships between surface processes, their drivers and the stressed Earth materials upon which they act.

We will explore recent developments in modelling tectonics and surface processes within a single deformational framework. We focus on collisional settings such as New Zealand's Southern Alps, SE Alaska and the Himalaya where rapid uplift combines with vigorous climate regimes to create dynamic landscapes. Our 3D mechanical models, constrained by field observations, solve for the complete stress tensor, including both geodynamic and geomorphic components (tectonic, dynamic, topography, fluvial, glacial). They also predict where imposed tectonic driving forces result in deformation induced weakening of the rock mass in the form of faults and other structures. The balance between the material strength and 3D stresses acting upon the material determines whether or not rock at the surface experiences failure, which makes it potentially available to be transported by surface processes.