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Tectonomorphic evolution of South Island, New Zealand: the effects of strong climatic variations, asymmetric uplift and horizontal advection of landforms

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The tectonic evolution of South Island, New Zealand is intimately linked to its geomorphological evolution. The unusual precipitation rate observed along the west coast of the orogen imposes very high exhumation rates that, in turn, induce a very efficient redistribution of mass at the surface of the orogen. The resulting loading/unloading affect the force balance within the crust and, consequently, the mechanical response of the crust to the present-day convergent tectonic forces.

In recent years, we have investigated the complex interactions between the dynamics of surface evolution and the tectonic forcing, in an environment that is affected by strong cyclic variations in climate and thus in the dominant landforming mechanism. We have used low-temperature thermochronology, field mapping and the analysis of high resolution DEMs to construct a conceptual model of the evolution of the landscape that is not only shaped under varying climatic conditions, but is affected by an asymmetric tectonic uplift rate and a strong component of horizontal landform advection through a relatively stable drainage divide. We present the results of numerical simulations that are an attempt to understand the dynamics of the divide, as well as how the various landforming processes affect different parts of the landscape under changing climatic conditions.