Drainage network over the migrating front of dynamic uplift in Patagonia

Louise Jeandet (1), Xavier Robert (2,3), Laurence Audin (2,3), Laurent Husson (2), and Benjamin Guillaume (1)

(1) Université de Rennes 1, France, (2) Université de Grenoble-Alpes, ISTerre, Grenoble, France, (3) Institut de recherche pour le développement (IRD), ISTerre, Grenoble, France

Dynamic topography disturbs the regional morphology at long wavelength and with very low topographic gradients. Nevertheless, fluvial erosion and the drainage pattern should respond to the spatial and temporal topographic variations. In Patagonia, the mid-Miocene, opening and northward migration of an asthenospheric window beneath the South American plate triggered a northward propagating wave of dynamic topography. Based on a morphometric analysis, we explore the long-wavelength response of the drainage system to the recent dynamics of the continental lithosphere. Our analysis of Patagonian rivers (stream profile analysis) and basins (R/Sr analysis) shows a transient state of the drainage network responding to a likely recent signal that prevails at the latitudes of the Chile Triple Junction in Argentina. Moreover, the distribution of the perturbation signal among the drainage network shows a South-to-North gradient, with the low Strahler order tributaries more affected with increasing latitudes. We interpret this observation as the differential timing of response to a Northward propagating signal of dynamic topography. We further use the geometry of the drainage network combined to numerical model predictions to infer the characteristic response time of the surface processes. While the main tributaries respond within ∼1-3 Ma, the lower order remain disturbed for longer times. This observation is further supported by the persistently high mean elevation where incision is high, which we take as indicative of the fact that erosion has not yet thoroughly achieved its resurfacing action.