The growth of a mountain belt is commonly attributed to isostatic balance in response to crustal and lithospheric thickening. However, deeper mantle processes may also affect the topography of the Earth. Here, we discuss the role of these processes in the Eastern Cordillera (EC) of Colombia. The EC is an active fold and thrust belt that formed during the Cenozoic by the inversion of a Mesozoic rift, and topography there has risen up to ~5000 m (Cocuy Sierra). The EC is located ~500 km away from the trench where the Nazca slab subducts below the South American plate. North of 5° N, the belt rises above a flat-slab subduction region. Volcanic arc migration suggests slab shallowing by ~ 10 Ma and flattening to the present configuration at ~6 Ma. The occurrence of a high vP/vS anomaly and clustered seismicity occurring below the belt at
~160 km depth delineate the slab geometry and have been related to dehydration of the slab, suggesting the presence of a hydrated mantle wedge. We compiled available thermochronologic data and estimated the exhumation history of the belt over the last 20 Ma using an inversion method. The results indicate that exhumation rates increased during the Plio-Pleistocene at different wavelengths and amplitudes. Small wavelength and large amplitude signals could be related to shallow crustal deformation whereas long wavelength and moderate amplitude signals need to be addressed. These pulses of fast exhumation are concomitant with surface uplift occurring from ~7 Ma, as previously identified. Combining structural and geophysical constraints for the crust and the mantle, we find that the observed high topography of the chain cannot be achieved solely through isostatic adjustment. Previous studies also suggested that positive residual topography matches the present-day elevation pattern of the belt. We propose that the recent uplift and long wavelength exhumation events were triggered by the transition from a regular to flat-slab subduction, along with the formation of a weak and buoyant wedge. We test the feasibility of our hypothesis with numerical models and conclude that the recent topographic growth of the Eastern Cordillera is linked to slab-related mantle dynamics.