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Flexural isostatic response of the Alps to increased Quaternary erosion: constrains from topography, tilted benchmarks and present-day rock uplift.

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Using the so-called Geophysical Relief and global estimated average erosion rate for the Alps, we quantify the spatial distribution of erosion and the volume of eroded rock, respectively. From these, we obtain a synthetic map of rock eroded within a given time span. The calculated isostatic response of the Alpine lithosphere to erosional unloading reaches a maximum rock uplift of $\sim$1km m during the Quaternary in the inner Swiss Alps. Vertical movement extends across the entire belt and surrounding peri-Alpine basins. Two well-exposed Pliocene basin with flat and preserved upper abandonment surfaces (Valensole and Chambaran plateaus) provide natural benchmarks to quantify the overall rebound of the belt associated with Quaternary erosion rates. The difference between present-day slope of the plateau surfaces ($\sim$0.9%) and the initial depositional slopes for these features ($\sim$0.3% and $\sim$0.15%) can be attributed to Quaternary tilting, the magnitude of which is compared to predictions of the numerical model. Results show that half of the surface tilting can be attributed to passive unloading. The observed tilting is unsensitive to the effects of the cyclic processes, such as glacial-interglacial loading / unloading cycles. One can conclude that the post-LGM glacial uloading are not acting anymore to push the Alps up. Half of the deformation need to be explained by (an)other process(es), acting over a long time span ($\sim$2Ma) and over an orogen-scale wavelenght. Deep seated processe(s) seems to fit nicely to this.