



A new method to estimate the infilling of alluvial sediment of glacial valleys using a sloping local base level

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In the last 20 years, many studies, based mainly on seismic and gravimetric interpretations, were dedicated to the estimation of sediment volumes in the Swiss glacial valleys (Hinderer, 2001). These volume estimations indicate relatively high erosion rates just after the Late Glacial Maximum (LGM), around 1 mm a^{-1} for the Rhine and Rhone valleys, contrasting with the present denudation rates of around 0.2 mm a^{-1} . For such studies we have developed a new method to estimate the volumes of infilling sediment of glacial valleys is tested. This method is based on the concept of sloping local base level and requires only a digital terrain model (DEM) as input data. The area recognized as sediment filling are deepened by an iterative routine up to a fixed second derivative value. To limit the depth of the deepening, a basal surface is used. This surface is calculated using a smoothed topography lowered by the maximum possible known sediment thickness.

The method is tested in the upper Rhone Valley (western Swiss Alps). The infilling of the valley was rapid after the LGM, indicating a rapid erosion within the basin (Hinderer, 2001). The maximum estimated thickness of the quaternary sediment is 900 to 1000 m. The total volume of sediment of the Rhone Valley is estimated to 80 to 100 km^3 by Rosselli & Olivier (2003) and to 106 km^3 by Hinderer (2001).

The results, i.e. the bedrock topography and 118 km^3 for the volume of sediment (obtained using the SRTM DEM $\sim 92 \text{ m}$ resolution), are in good agreement with the previous estimations.

Our results reveal the discrepancy between the gravimetric and seismic interpretations. To conciliate both, the possibility of landslides and rockfalls lying at the base of the filling of the Rhone valley is proposed; the seismic data would not distinguish a mass of loose rock blocks from the other sediments, while the gravimetric data would include it as a higher density material.

References:

Rosselli, A. & Olivier, R. (2003) - Modélisation gravimétrique 2.5D et cartes des isohypses au 1 :100'000 du substratum rocheux de la Vallée du Rhône entre Villeneuve et Brig (Suisse). *Eclogae geol. Helv.*, 96, 399- 423.

Hinderer, M. (2001) - Late Quaternary denudation of the Alps, valley and lake fillings and modern river loads. *Geodinamica Acta*, 14, 231-263.