

Glacial and periglacial erosion rate inferred from five years of detrital flux monitoring (Bossons stream, Mont-Blanc massif, France)

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A better knowledge about present-day erosion is needed to understand the long-term relief evolution in glacial and periglacial context. The rapidly retreating glacier des Bossons was chosen to estimate the sediment budget in its partially glaciated watershed and thus determine the part of glacial erosion versus periglacial denudation.

Sediment budget was determined using: i) three calibrations curves – suspended load/water discharge, suspended load/turbidity and bed-load/water discharge – built through high frequency sampling of water discharge and turbidity since 2009; ii) annual DGPS measurements of elevation evolution; iii) transit time for coarse particles given by radio-frequency monitoring of 185 pebbles.

Sediments come from two reservoirs : the glacier and the lateral moraines. Both interact with a third reservoir: the alluvial area through which the subglacial Bossons stream flows and where hillslope processes provide material. Telling the difference between each sedimentary flux is allowed by determining: i) the hydrologic behaviour of the partly glaciated catchment by using the degree-day GSM-Socont model; ii) relationships between the sedimentary flux that enters in the alluvial area, the released one and the stored one; iii) granulometric and lithologic characteristics of each sedimentary source and how they mix in the river and its exported load.

Results show that i) 75% of the 4000 t/y of exported material are fine particles (silts/sands), mainly coming from lateral moraines during extreme rainy events; ii) the stored sediment volume corresponds to about 25% of the exported sediments (1000 t/y); iii) the subglacial erosion is smaller than 0.8 mm/y beneath the glacial tongue.

This combined methodology applied to the Bossons glacial and periglacial watershed demonstrates that erosion mainly concerns the recent exposed periglacial surfaces (i.e. moraines), and that subglacial erosion contributing weakly to the total exported sediment flux.