

# Periglacial area sediment budget of a rapidly retreating glacier inferred from four years of detrital flux monitoring (Bossons stream, Mont-Blanc massif, France)

Guillon H., Godon C., Goupy B., Pohl A., Buoncristiani J.F., and Mugnier J.L.

**Abstract** A better knowledge about present day erosion is needed to understand long-term relief evolution of periglacial areas. Bossons glacier in the Mont Blanc massif is rapidly retreating and its partially glaciated watershed is left in a natural state. Thus, it was chosen to estimate sediment budget, study its variation in relation to climate change and meteorological events and characterize involved processes. 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. The studied area, called Plan des Eaux, is roughly 35 meters wide, 420 meters long and its highest point is located at nearly 500 meters from the ice front. Sediment budget was determined using: i) annual DGPS measurements of elevation evolution; ii) 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. Identifying each sedimentary flux is performed by determining:

1. relationships between the sedimentary flux that enters in the alluvial area, the released one and the stored one;
2. grain size characteristics of each sedimentary source and how they mix in the river and its exported load.

Considering that 60 percents of the alluvial plain particles are coarser than 2 centimeters, it is interesting to study the movement of this grain size fraction. Since 2011, this work was achieved through 20 monitoring campaigns of 185 PIT-tagged pebbles ranging from 2 centimeters to 32 centimeters. Results show that:

1. sedimentation occurs in the plain at a mean rate of  $54.7 \text{ mm}^3 \text{ yr}^{-1}$ ; there is inter-annual and intra-seasonal variations in the sediment budget; 75% of the 4000 t<sub>yr</sub> of exported material are fine particles (i.e. silts and sands), mainly coming from lateral moraines during extreme rainy events; the stored sediment volume corresponds to about 25% of the exported sediments ( $1000 \text{ t yr}^{-1}$ ); within two melt seasons, the maximum travel distance observed is 360 meters; thus, the mean transit time of gravel in the studied area is greater than two year.

This combined methodology applied to the Bossons watershed demonstrates that erosion mainly concerns the recent exposed periglacial surfaces (i.e. moraines), while the Plan des Eaux is globally aggradating. It also provides keys for the analysis of inter-annual and intra-seasonal variations of the sediment budget.

---

Corresponding Author:  
Hervé Guillon  
ISTerre, Le Bourget-du-Lac, France  
e-mail: [herve.guillon@ymail.com](mailto:herve.guillon@ymail.com)