Glacial erosion dynamics in a small mountainous watershed (Southern French Alps): A source-to-sink approach

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The hyperpycnal flows triggered during high-magnitude floods of some rivers such as the Var River and the turbidite-like deposits they create, make the changes in sediment supply within headwater region possible to discern in the distal stratigraphic record.

The high-resolution analysis of a 70 kyr-long turbidite deposits in the Var sedimentary system (NW Mediterranean Sea) demonstrated a striking correlation between turbidite frequency and climate records following a cold & dry/high turbidite activity – warm & wet/low turbidite activity pattern [1]. Major element composition, Neodymium isotopes (εNd) and REE concentration were used to track and quantify the sediment routing in the Var sedimentary system from source (Var River sediments) to sink (Var Sedimentary Ridge turbidites) [2].

The results reveal that the changes in the sediment source are coeval with variations of the turbidite frequency on the Var Sedimentary Ridge. High contribution of glaciated areas during Last Gacial Maximum is associated with high turbidite activity, both rapidly decrease thereafter, i.e. during the major alpine glacier retreat (~17.5 ka), and reach minimum values during the Holocene. This show that in contrast to large/buffered systems, sediment export from the Var River to the Mediterranean Sea directly responded to climate-induced perturbations within the watershed over millennial scale. Finally, based on source fingerprinting, we estimated that sediment fluxes in the Var routing system were 2.5 times higher during the Last Glacial Maximum than today.

[1] Bonneau et al. (2014) *Journal of Geology* 122, 687-703.

[2] Bonneau et al. (2016) *Earth and Planetary Science Letters* 458, 366-379.