

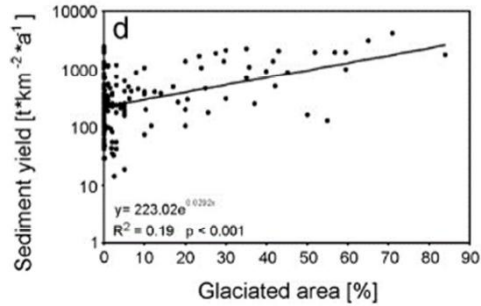
Sediment dynamics in glacierized catchments: a comparison study from two proglacial streams in the Sulden catchment (Eastern Italian Alps)

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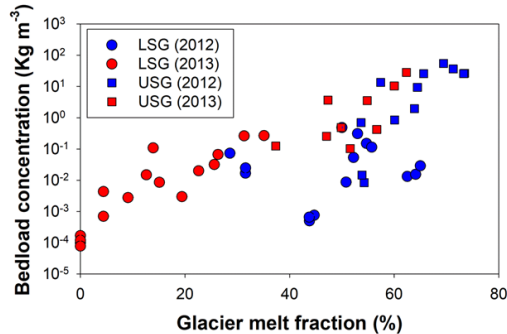


Introduction

- Importance of hydro-sedimentary dynamics and sediment source areas

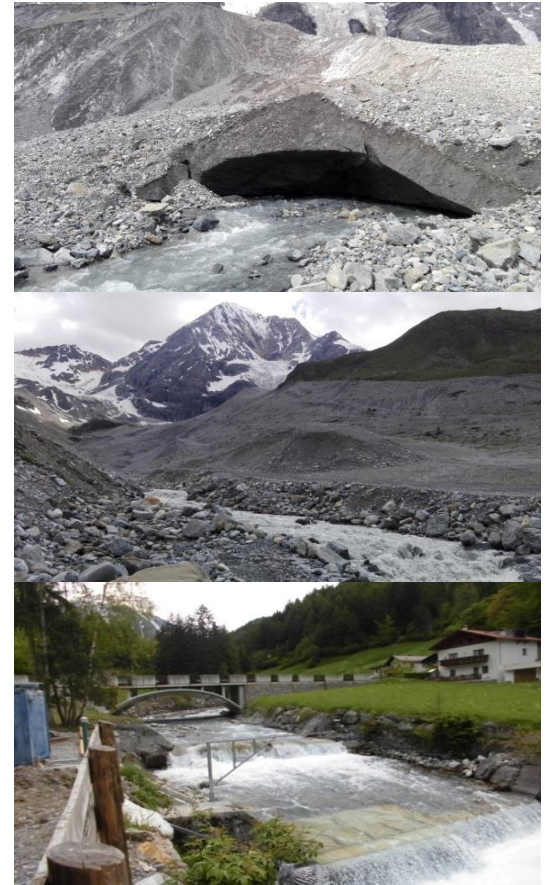
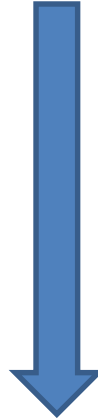


Hinderer et. al. (2013)



Comiti et. al. (2019)

Sediment transport



Research gap and objectives

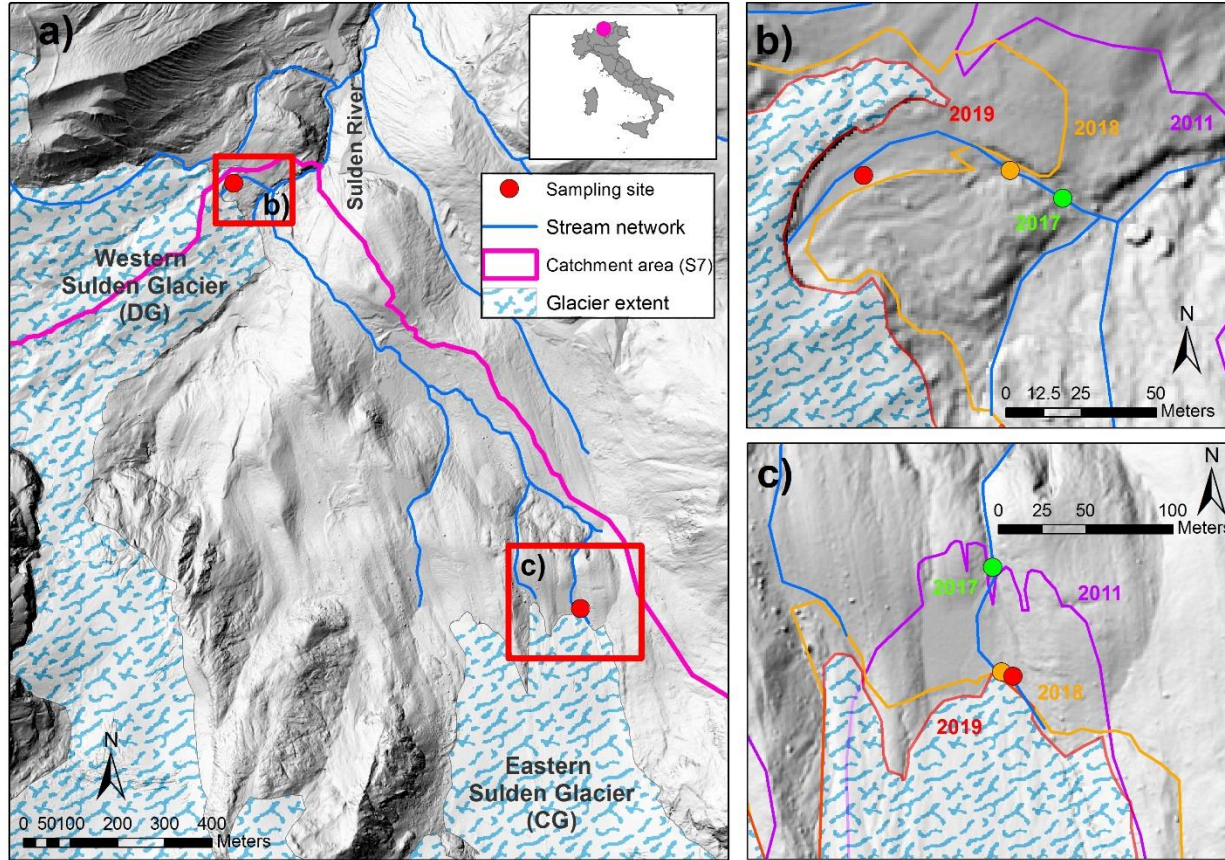
- Only few preliminary studies focus on bedload dynamics in proglacial streams, where different hydrological drivers (i.e., runoff sources) control bedload rate

**Raymond Pralong et al. (2015),
Beaud et al. (2018), Mao et al. (2019)**

The objectives of this study are :

- to analyze the sediment dynamics of two proglacial streams (draining two contrasting glaciers, one clean and one debris-covered) at different temporal scales,
- to use tracer-based analysis to infer the origin of runoff and link this with bedload and SSC data, and
- to identify the main meteorological drivers controlling melt-induced subglacial sediment export.

The Suldén / Solda catchment



CG

Clean or non-debris covered Glacier

- Glacier extent 0.05 km²
- Elevations range 2730 – 3366 m a.s.l.
- Metamorphic rocks (mostly gneiss)



DG

Debris covered Glacier

- Glacier extent 4.3(?) km²
- Elevations range 2430 – 3700 m a.s.l.
- Metamorphic and Sedimentary rocks (mostly Dolomitic)



Methods

- Discharge measurements by salt dilution method
- Bedload sampling by “Bunte” traps
- Suspension (grab) sampling
- Water sampling for EC and stable water isotopes $\delta^2\text{H}$ & $\delta^{18}\text{O}$

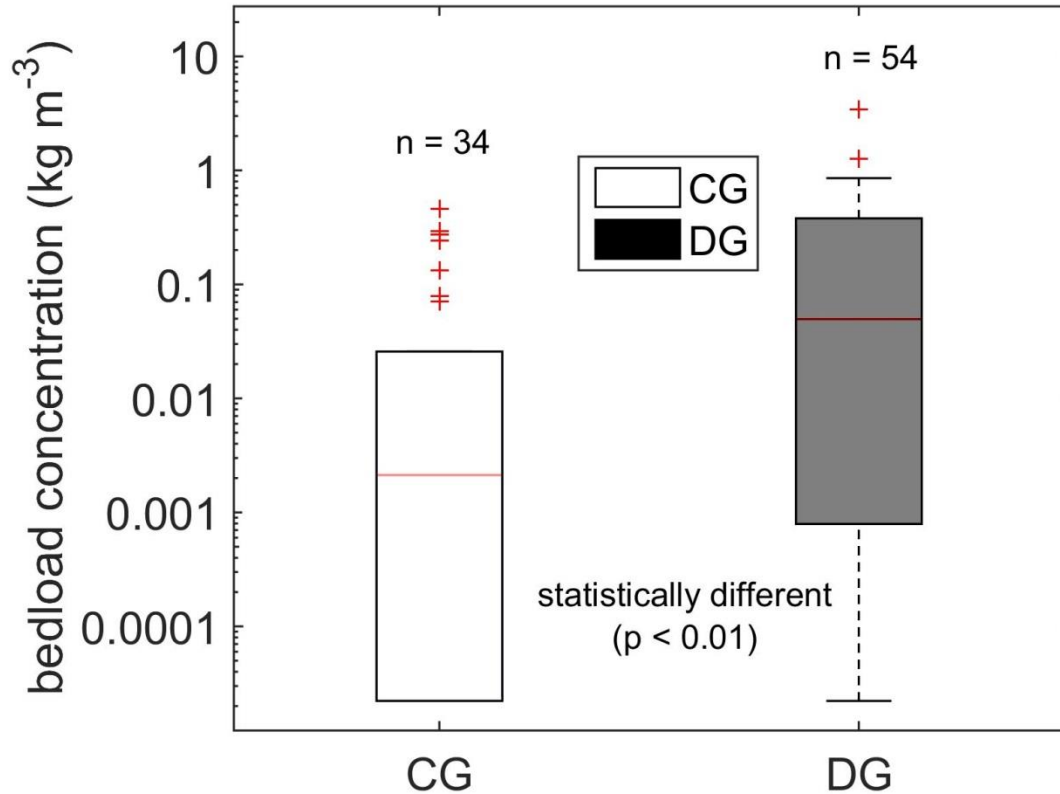


Sampling site at CG



Sampling site at DG

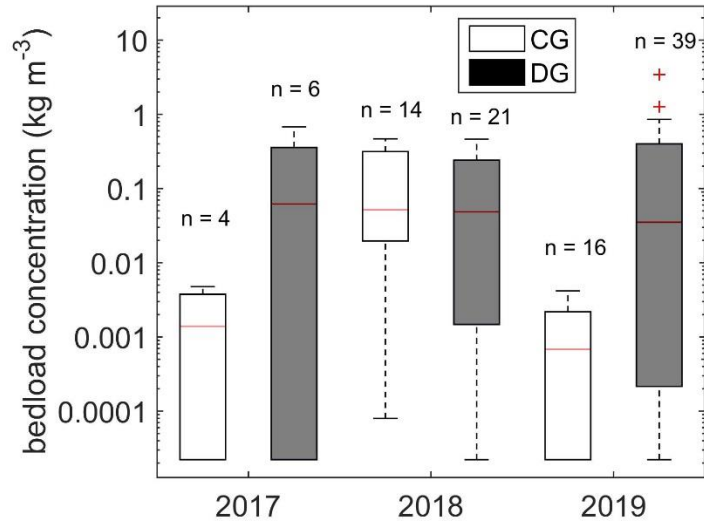
Bedload concentration at CG and DG



Bedload concentrations covered a large range of 5 orders of magnitude and they statistically differ at both sites.

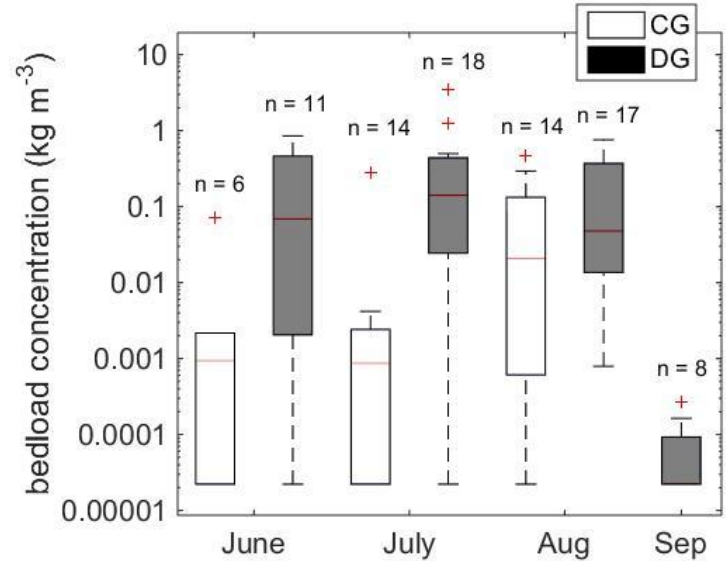
Bedload concentrations ranged from 0 to 0.46 kg m^{-3} at CG and from 0 to 3.42 kg m^{-3} .

Yearly and monthly bedload concentrations



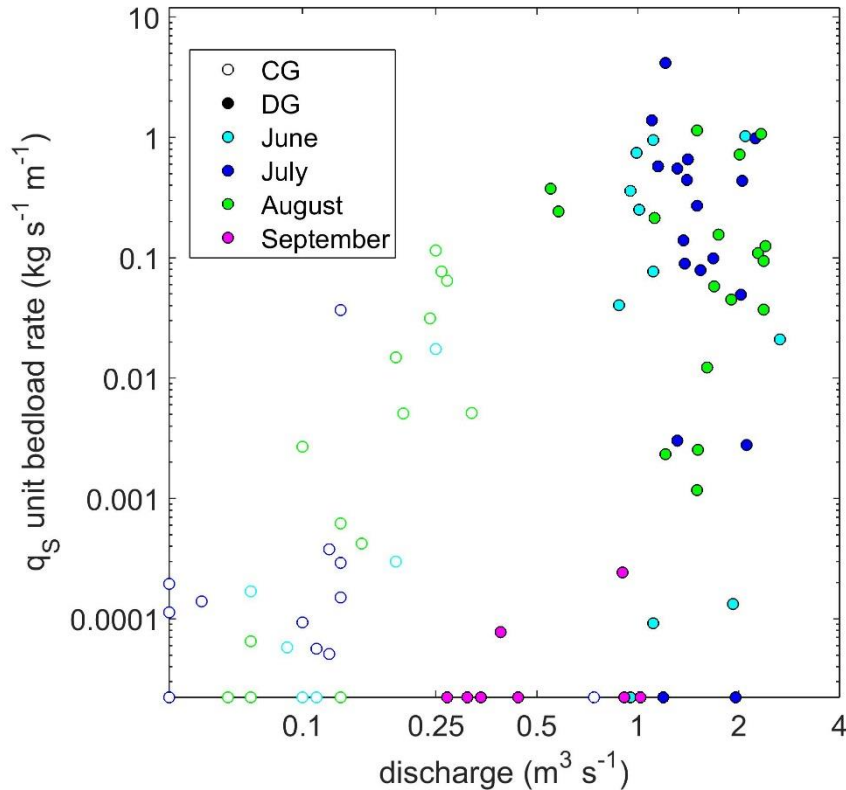
There was a strong contrast between CG and DG in 2017 and 2019 but not in 2018.

At the monthly scale, this contrast occurred in June and July while CG bedload concentrations in August were almost as high as those at DG.



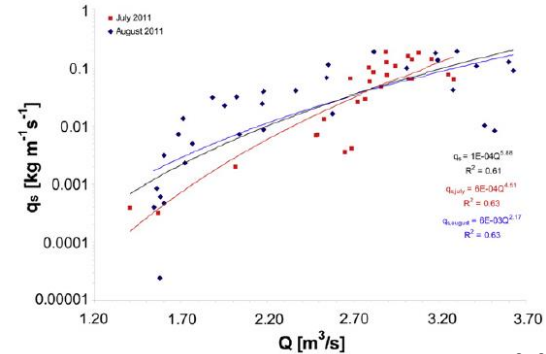
Remark: no bedload data for CG in September.

Discharge vs. bedload rate



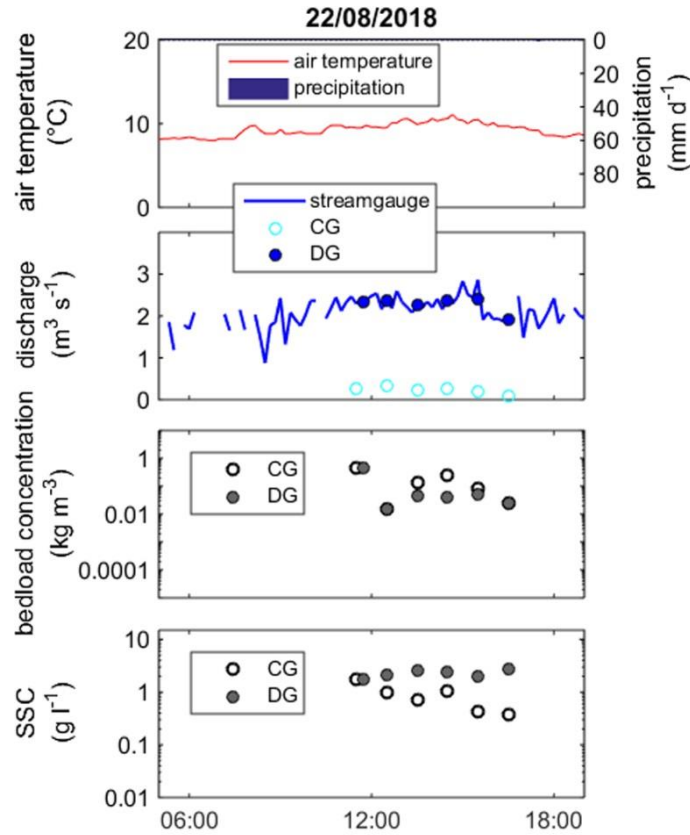
In general, bedload rates increased with increasing discharge and agree with results from a similar study.

However, similar discharges during the melting season result in different bedload rates.



Comiti et. al. (2019)

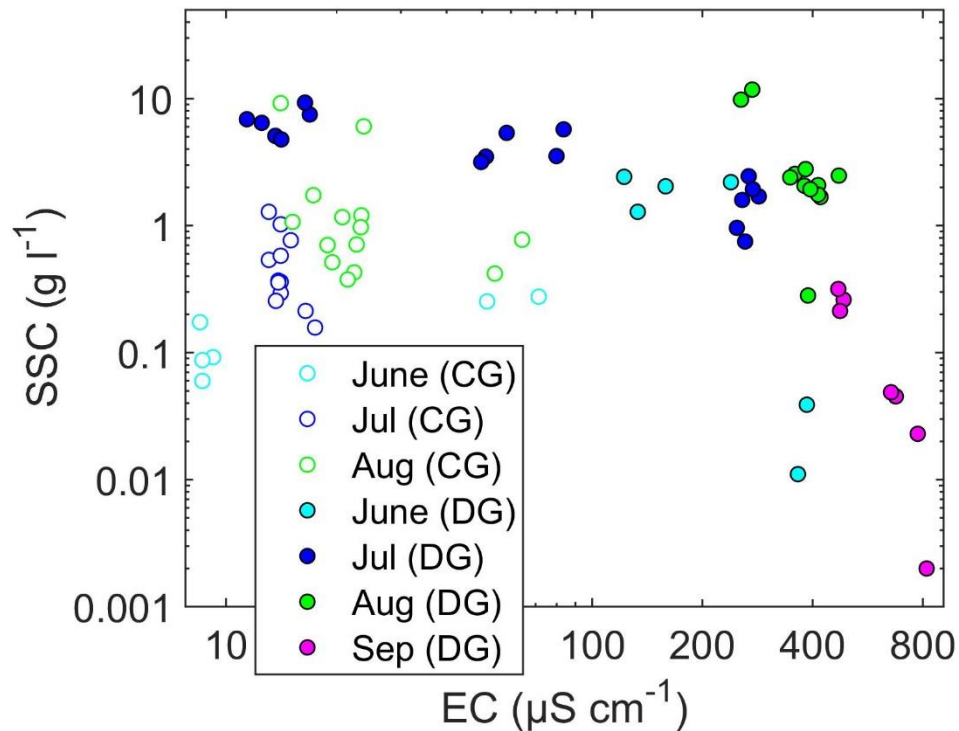
Daily sediment dynamics



During a glacier melt induced runoff event in August 2018, bedload concentrations at both sites were relatively similar and showed a consistent pattern.

However, bedload and SSC may not follow similar dynamics.

Electrical conductivity vs. SSC



Only EC as tracer showed a clear relationship with SSC, reflecting well changes of the monthly stream hydrochemistry.

Interestingly, this relationship of DG was contrasting with the one at CG.

To conclude

- CG and DG contrasted in their yearly and monthly bedload concentrations in 2017 and 2019. However, these bedload concentrations could also be very similar, as observed in August 2018.
- SSC and bedload concentration at DG were at least one order of magnitude higher than those at CG. The debris cover may enhance the sediment supply.
- SSC and bedload concentration quickly responded to changes in discharge controlled by meteorological conditions. Their contrasting hourly dynamics may reveal different sediment sources.
- However, similar discharges during the melting season resulted in different bedload rates.
- With respect to tracers, EC could explain the monthly variations in SSC.

Thank you for your interest!

Acknowledgement:

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