

Rockwall erosion in high mountain areas Estimation from *in situ*-produced ^{10}Be concentrations measured on supraglacial clasts (Mont Blanc massif, France – Monte Rosa massif, Switzerland)



Mer de Glace – Mont Blanc Massif (France)

Léa Courtial-Manent, Anta-Clarisse Sarr, Arthur Schwing, Toinette Gasnier, Jean-Louis Mugnier,

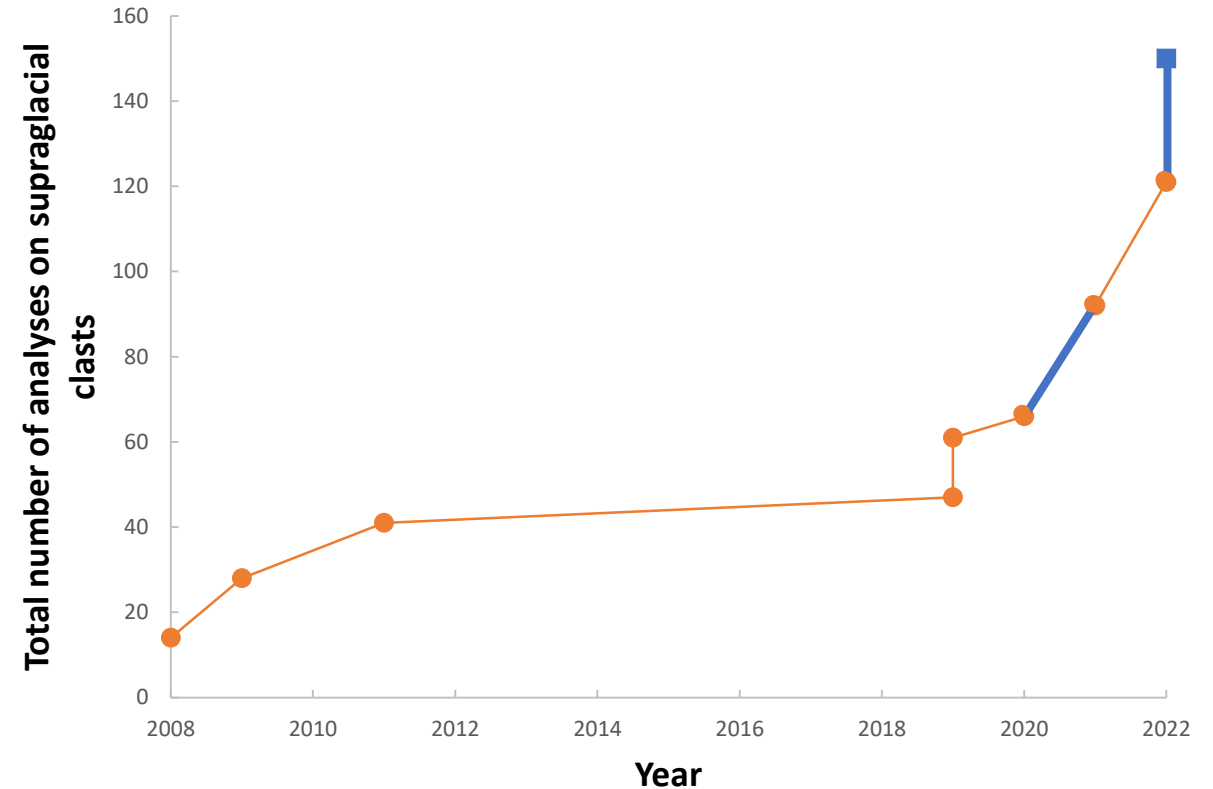
Julien Carcaillet, Ludovic Ravanel, Jean-François Buoncristiani



Supraglacial clasts ^{10}Be analyses

- 8 papers (2008-2022)
- 121 analyses :
 - Heimsath and McGlynn, 2008 (14)
 - Seong *et al.*, 2009 (14)
 - Ward and Anderson, 2011 (13)
 - Orr *et al.*, 2019 (6)
 - Sarr *et al.*, 2019 (14)
 - Scherler and Egholm, 2020 (5)
 - Orr *et al.*, 2021 (26)
 - Wetterauer *et al.*, 2022 (29)
- Studied regions : Himalaya-Karakoram, Alaska, European Alps

Growing number of analyses on supraglacial clasts

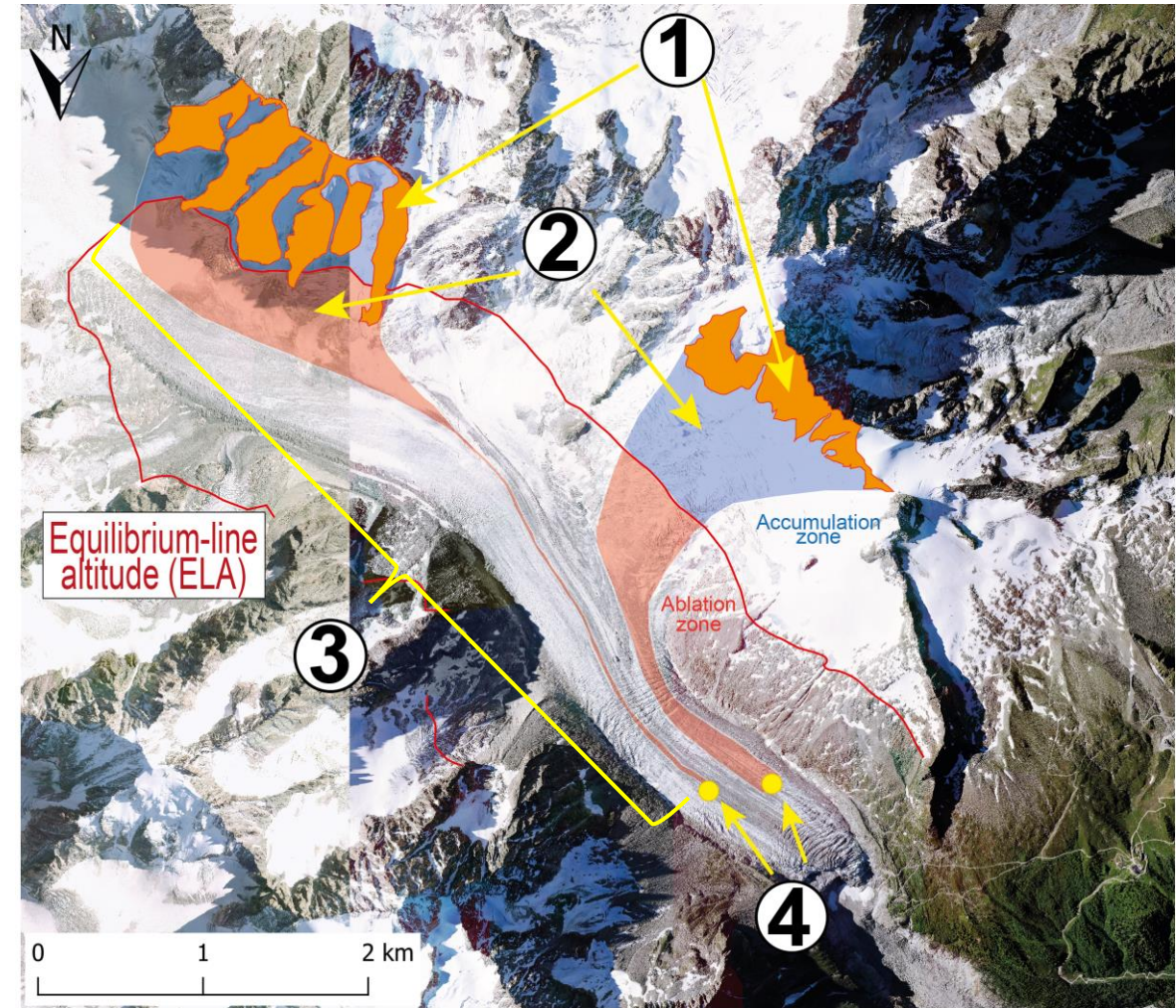


Our work: 23 new ^{10}Be analyses

Focuses: sample robustness + geomorphic parameters

A succession of processes: conceptual framework

- 1) **Source zones**
defined by shielding, median altitude, median slope, aspect, mean production rate
- 2) **Rockfall accumulation area**
morphological mapping from a rockfall catalogue updated since 2003
- 3) **Glacial transport**
transport path and velocity from satellite images correlation
- 4) **Sampling zone**
extent of the zone
granulometry of the supraglacial clasts



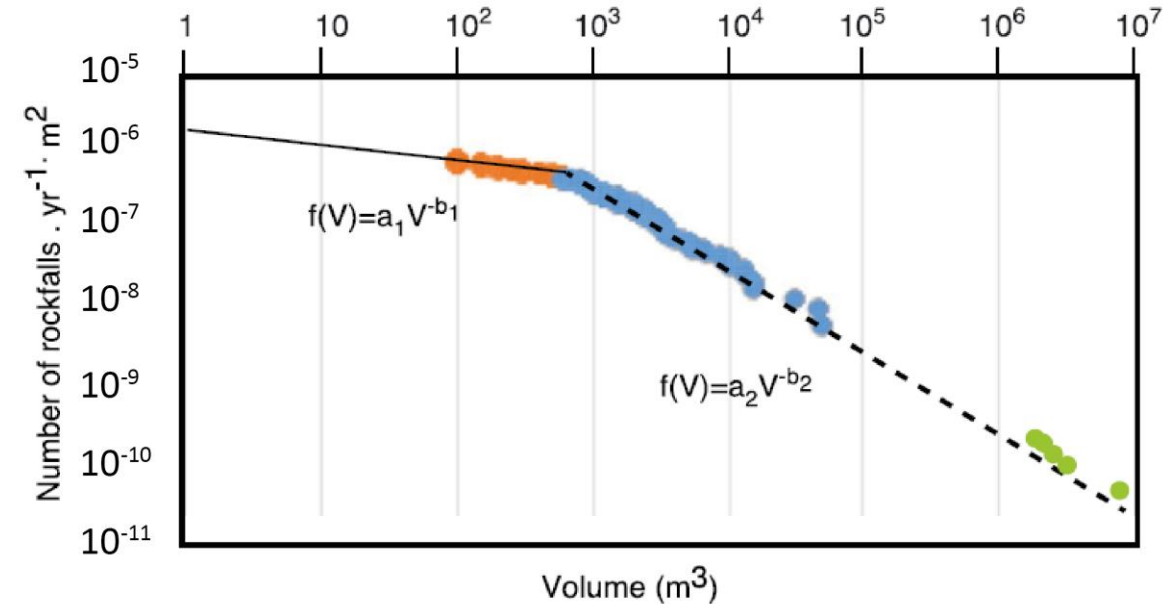
Results robustness

- Rockfall: stochastic events with a power law distribution $F(V) = aV^{-b}$
- Sampling : robust if it amalgamates at least 30 rockfalls (Ward & Anderson, 2011)
- Number of rockfalls (N) probably amalgamated (Sarr *et al.*, 2019)

$$N = \frac{S \times F \times n \times d}{v}$$

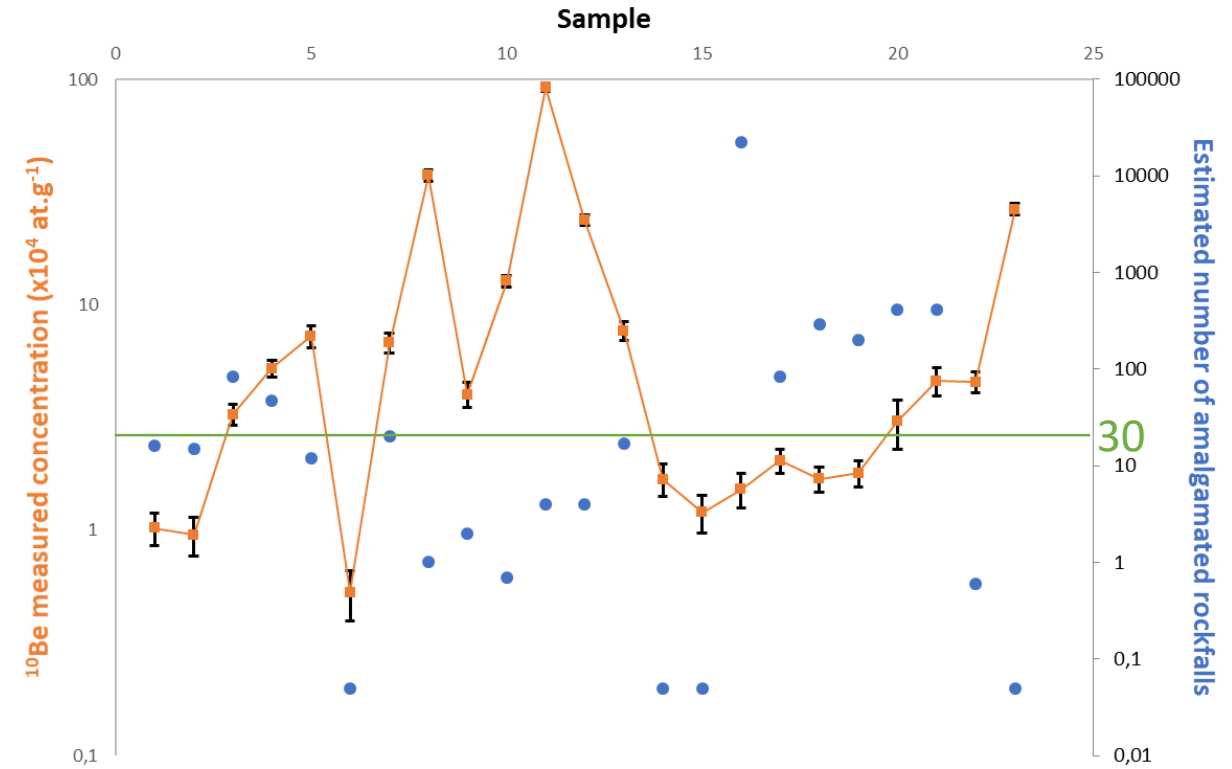
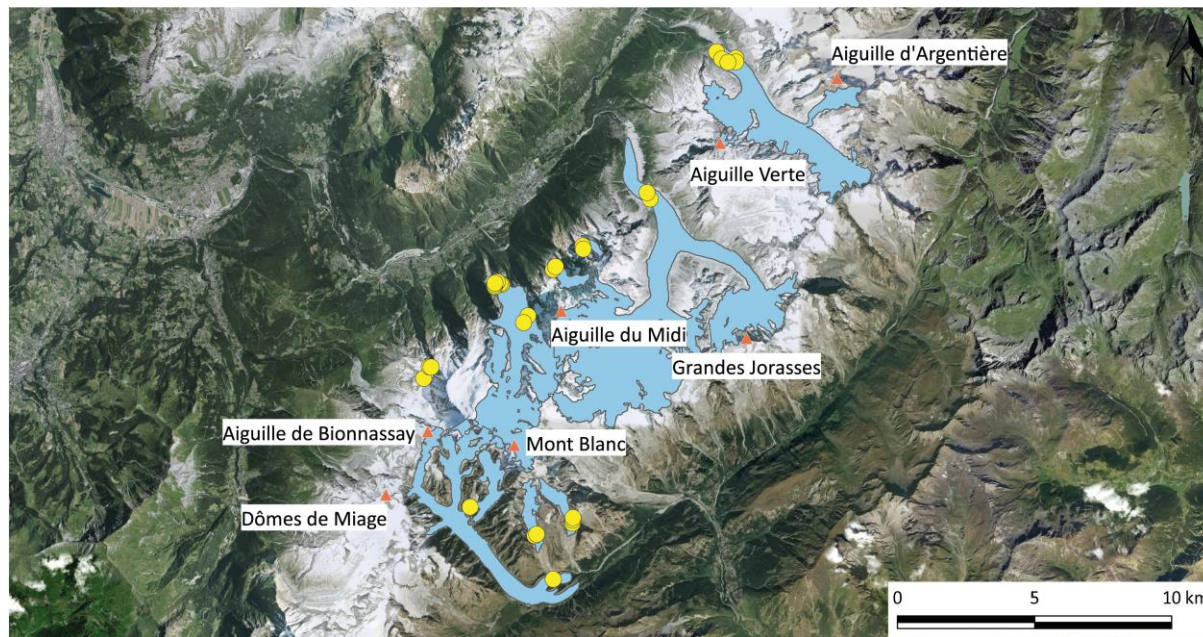
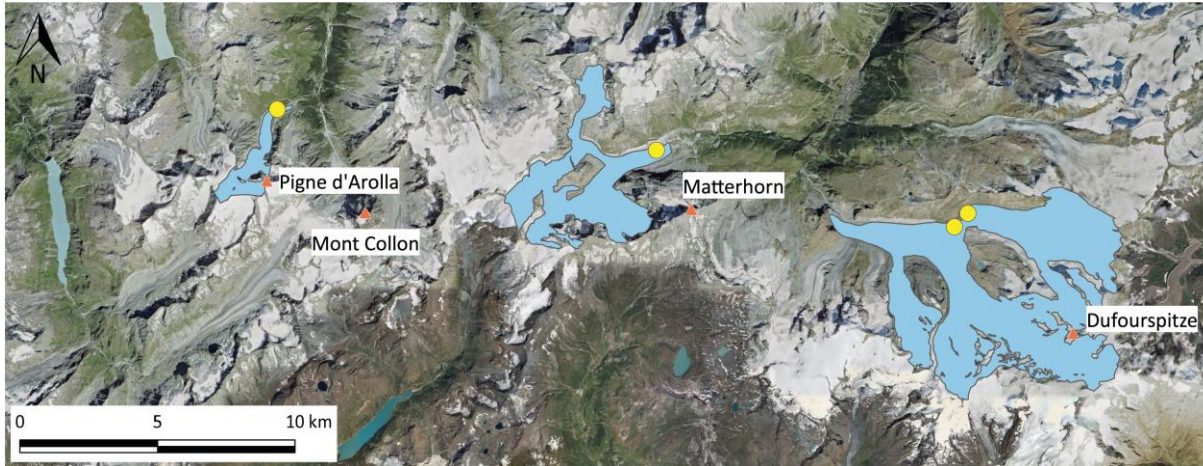
Diagram illustrating the variables in the equation for the number of rockfalls (N):

- S : Source zone surface area
- F : Rock fall frequency
- n : Nb of sample
- d : Sampled length
- v : Glacier velocity



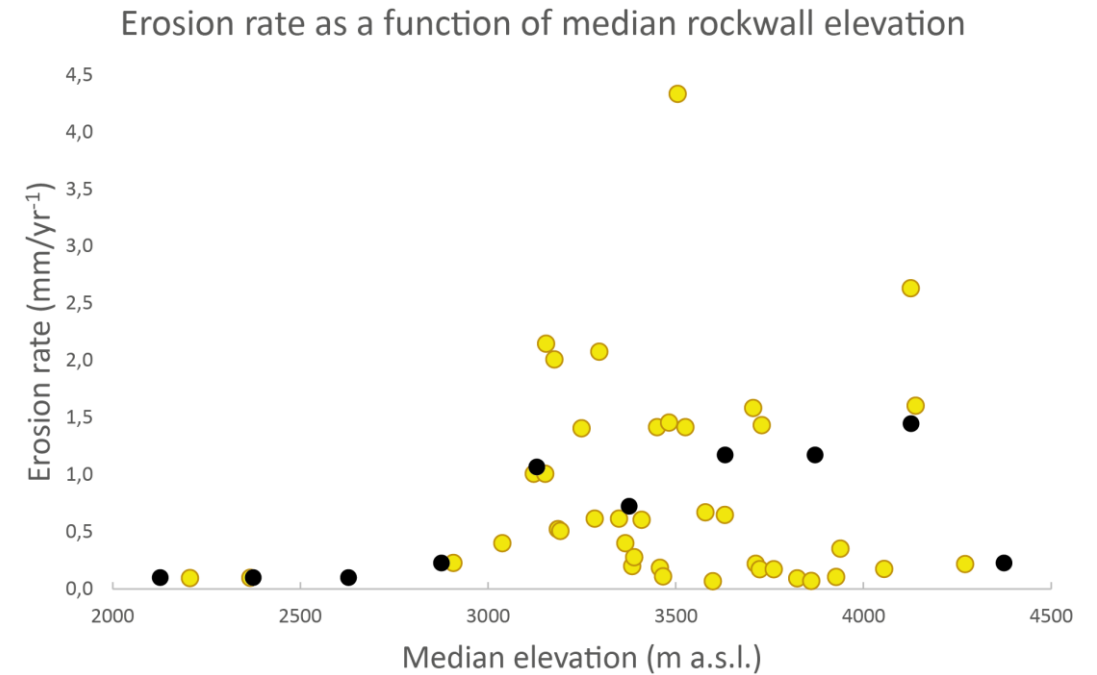
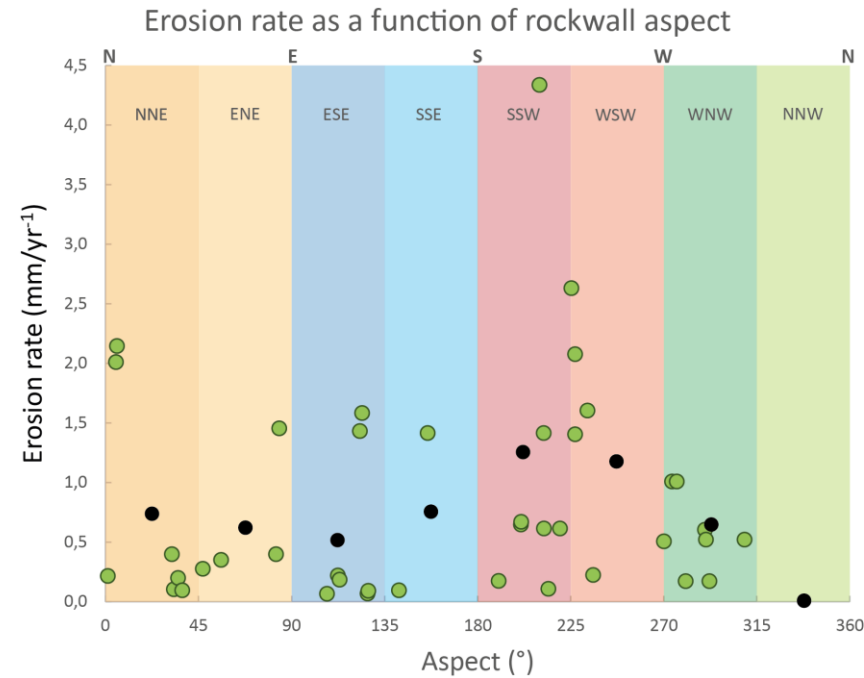
- ● Ravanel *et al.*, 2010, 2011
- Deline *et al.*, 2015
- Akçar *et al.*, 2012

Study sites and database



- ^{10}Be measured concentration (x10⁴ at.g⁻¹)
Min: 0,53 ± 0,13 (Arolla) Max: 95,02 ± 3,16 (Frênay)
- Estimated erosion rate (mm/yr)
Min: 0,07 ± 0,0 (Frênay) Max: 4,34 ± 1,2 (Arolla)

Results and conclusions



Conclusions:

- Higher erosion rates for SSW/WSW-facing rockwalls
- Erosion rates increase with rockwall elevation +/- linearly

Outlooks:

- ^{10}Be concentration dispersion due to insufficient number of amalgamated rockfalls
- Database to be further analyzed



Thank you for listening

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Contact: lea.courtial-manent@univ-smb.fr