

Introduction

Between the 22nd July and 19th August, we travelled to the Kaunertal region of the Austrian Alps to conduct our research on the Gepatschferner and its surrounding catchment. Specifically exploring the glacial dynamics and its influence on the river channel and the biodiversity of the area.

Glaciers around the world have been retreating at unprecedented rates since the Little Ice Age maximum in 1850 (Sommer, et al, 2020). The Gepatschferner, a glacier in Austria, has retreated approximately 2km in length since 1920 (Figure 1) (Hartl, 2010). Collectively, our studies help us understand how glacial retreat is influencing the geographical factors and processes in the surrounding catchment.

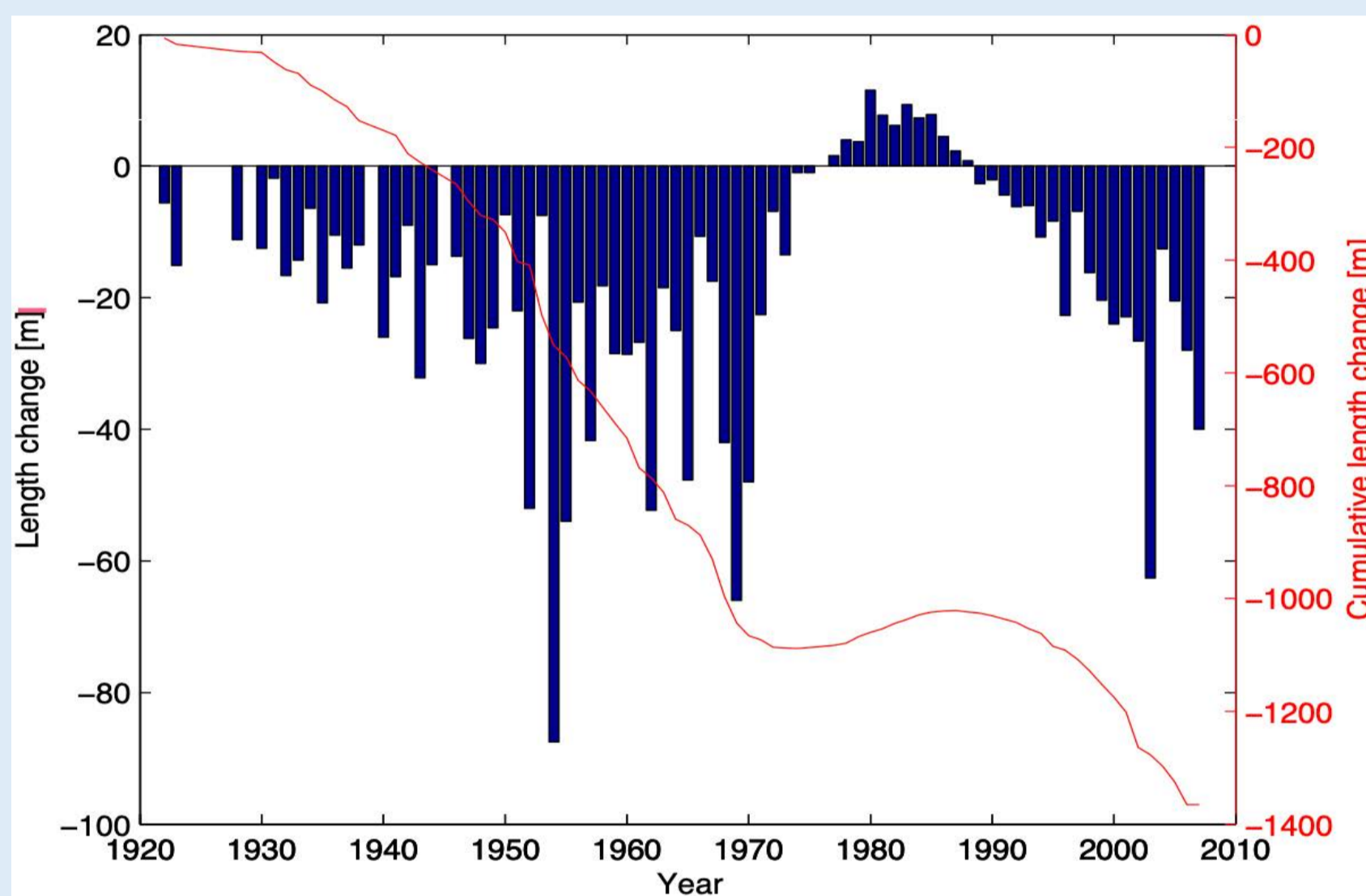


Figure 1: Change of tongue length in metres for the Gepatschferner between 1922-2006, cumulative as red line, net as blue bars (Hartl, 2010).



Figure 2: Comparison of the Gepatschferner's terminus in week 1 (left) and week 2 (right) of the expedition.

References:

- Baewert, H., & Morche, D., (2014) Coarse sediment dynamics in a proglacial fluvial system (Fagge River, Tyrol). *Geomorphology*, 218, pp.88-97.
- Hartl, L. (2010). The Gepatschferner from 1850-2006: Changes in Length, Area and Volume in Relation to Climate. Institute for Meteorology and Geophysics of the University of Innsbruck [Online]. Available at: https://www.uibk.ac.at/acinn/theses/diploma-theses/hartl_lea_2010_dipl.pdf [Accessed 9th March 2023].
- Sommer, C., Malz, P., Seehaus, T. C., Lippl, S., Zemp, M., & Braun, M. H. (2020). Rapid glacier retreat and downwasting throughout the European Alps in the early 21st century. *Nature Communications*, 11, 3209.

Aims

- Project 1:** Investigate the factors determining macroinvertebrate abundance and taxonomic richness in the Gepatschferner's catchment area.
- Project 2:** Investigate the difference of suspended sediment and discharge between rock glacier and ice glacier meltwater streams in the Kaunertal valley.
- Project 3:** An investigation into the presence and implications of heavy metal contamination on Gepatschferner glacier.
- Project 4:** Investigating the relationship between vegetation/soil properties and the river geomorphology of the river Fagge.
- Project 5:** Examine the factors controlling sediment transportation and variation in the River Fagge.
- Project 6:** To research how different variables may affect vegetation succession on Moraines in a glacial environment

Methods

- Project 1:** Measured river profiles (width, depth, velocity), invertebrates kick sampled, assessed channel stability and water quality, and suspended sediment concentration.
- Project 2:** Measured river profiles (width, depth, velocity), clast size and suspended sediment concentration.
- Project 3:** Glacier ice and water samples collected with ultrameter readings. Samples filtered and analysed via ICP-MS for heavy metals.
- Project 4:** Measured river width and depth. Sediment samples collected along transect both sides of river. Vegetation survey conducted along transect.
- Project 5:** Measured river profiles (width, depth, velocity), collected bedload sediment and suspended sediment concentration.
- Project 6:** Transect up moraine, measured humidity, temperature, light, and slope, collected soil samples and conducted vegetation surveys.

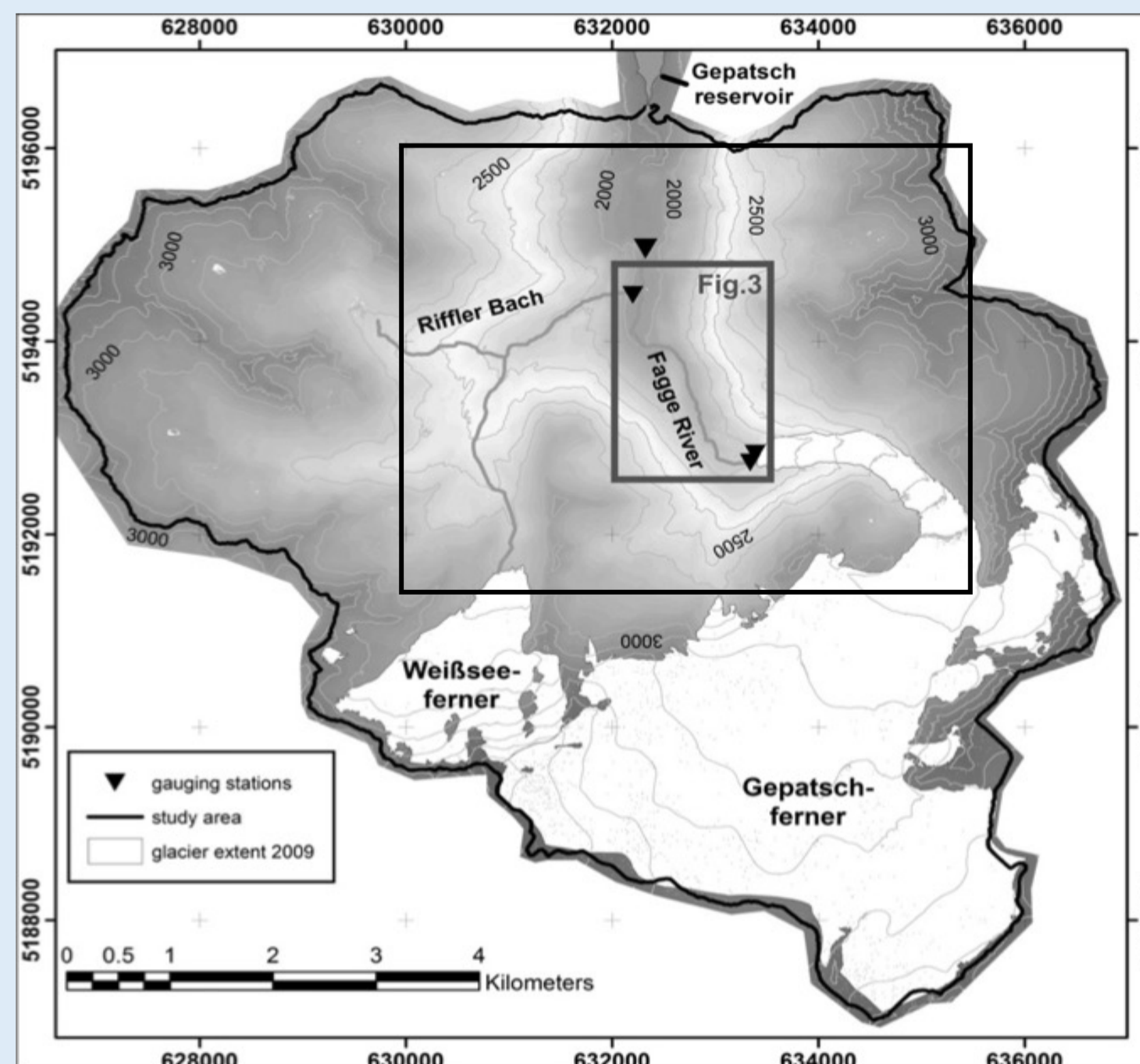


Figure 4: Map of the Gepatschferner and surrounding catchment, Tyrol region, Austria (Baewert and Morche 2014)

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Figure 3: Comparison of the River Fagge downstream of the glacier before and after a flood event.

Key Findings

- Project 1:**
- No macroinvertebrates were found in the upstream regions of the River Fagge where it is largely under the influence of glacial processes.
 - The reservoir alters the rivers flow regime, likely providing a better habitat for invertebrates, as the transect closest to the reservoir had the highest invertebrate abundance and taxonomic richness.
- Project 2:**
- There was a visible difference in suspended sediment load, discharge and water temperature between rock glacier and ice glacier meltwater streams.
 - Temporally, ice glacier meltwater streams displayed a greater change in river velocity compared to rock glacier meltwater streams throughout a day.
- Project 3:**
- Ultrameter readings show spatial and temporal difference between electric conductivity, resistivity and pH for each site over the 4 weeks.
 - Resistivity readings were unexpectedly not recorded at every site due to very low results.
- Project 4:**
- As you move downstream, sediment transitions from gravel/small rocks, to clayish sands, then to vegetated soil.
 - The river Fagge had a more braided river upstream than I had expected, due to the retreat of the glacier causing more unstable riverbanks.
- Project 5:**
- There was a significant change in sediment sizes throughout the river by sieving bedload samples.
 - The higher the discharge, the more suspended sediment that was collected.
- Project 6:**
- Older moraines showed higher vegetation abundance than younger moraines.
 - Vegetation was more abundant at the higher regions of the moraine than at the bottom.

Conclusion

Our studies have provided a deeper insight into the glacial, fluvial and biodiverse dynamics of the Kaunertal catchment. Through our expedition we have gained a comprehensive insight into fieldwork, researching differing geographical processes. Over the next few months, we will continue our data analysis to craft our dissertations and further our understandings of our project aims.

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