

## ***Interactive comment on “Efficacy of bedrock erosion by subglacial water flow” by F. Beaud et al.***

**Anonymous Referee #2**

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This manuscript uses numerical modeling to explore role of meltwater in causing fluvial erosion (primarily abrasion) in subglacial channels. Overall, this is a very strong piece of research - the model framework is clearly reasoned and explained, the research questions/goals are clearly outlined and answered, the figures illuminate the results they describe, and the discussion provides thoughtful commentary of how the model results might inform our understanding of real processes and landforms. The supplemental materials keep the manuscript organized and prevents it from getting too long. The authors reference recent literature appropriately, and present the parameterizations of the models they describe clearly. While the results were not surprising, they did provide a framework for future studies in the role of subglacial fluvial erosion. The work is relevant to glaciologists, glacial and fluvial geomorphologists, quaternary geologists as well as governments interested in the role of glaciers in excavating land-

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scapes. I believe only minor revisions are needed to publish the research, and applaud the authors for producing an interesting and well-organized manuscript.

A few more detailed comments: 1. The introduction was my favorite part of the paper - it was one of the best -organized and most thoughtful summaries of a motivation for the research i've read recently. I can't decide if I was hoping to hear more or less about other fluvial erosional mechanisms - we do know that quarrying can be very effective in fluvial systems at times, so I wonder if it is worth explaining this more explicitly. 1a. page 852 line 25: tool and cover effect - i like this phrase, but perhaps explain more for those outside the fluvial erosion community? 2. page 859 line 18/19:  $V_i$  is the volume of bed material removed upon impact, presumably in a uniform fashion across the bed? I guess i was hoping for a bit more detailed explanation of this series of equations (not necessary, but might be helpful in dragging those of us less familiar with the fluvial abrasion equations along). 3. page 861 line 24: any thoughts about testing other grain sizes? 4. page 863 line 15: interesting and diverse range of simulations - i'd like to know more about how these were selected. 5. page 869 line 9: did you mean synthetic forcing of water  $Q$ ? 6. page 879: i wonder a bit about the role of pre-existing bedrock channels in controlling water pressure and meltwater flow at glacier beds for later glaciations - perhaps speculating on this? your results imply quite a bit of channelization can occur during one glacial cycle, but is this a positive feedback process by which fluvial erosion continues to be locally enhanced during subsequent glaciations?

I'm not personally familiar with field examples of the inner gorges that are discussed, so i wonder if including a photograph as an example might actually be very useful for readers. Just a thought!

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Interactive comment on Earth Surf. Dynam. Discuss., 3, 849, 2015.