

## ***Interactive comment on “Modal sensitivity of rock glaciers to elastic changes from spectral seismic noise monitoring and modeling” by Antoine Guillemot et al.***

**Antoine Guillemot et al.**

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Received and published: 23 October 2020

Reply to reviews on the manuscript Modal sensitivity of rock glaciers to elastic changes from spectral seismic noise monitoring and modeling

By Antoine Guillemot, Laurent Baillet, Stéphane Garambois, Xavier Bodin, Agnès Helmstetter, Raphaël Mayoraz, Eric Larose

Contact: Antoine GUILLEMOT ISTerre, Université Grenoble Alpes Grenoble (France) antoine.guillemot@univ-grenoble-alpes.fr

Dear reviewer, dear editor,

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We would like to thank you for the constructive review following the submission of our manuscript “Modal sensitivity of rock glaciers to elastic changes from spectral seismic noise monitoring and modeling” to The Cryosphere. We took into account all the comments from the two reviewers and editor. One of the main problems raised concerns the influence of ambient noise sources on resonance frequencies that we picked. Indeed, temporal variability of these frequencies could be related with source variability. To address and discuss this relevant question, we kept the figure showing the spectrograms with frequency picking from earthquakes, in order to show that resonance frequency that we picked are still often visible even for variable earthquake sources. Besides, we added a new figure of spectrograms from a station near the Laurichard rock glacier, settled on a stable site that could be considered as a reference station. Furthermore, you suggested additional figures to demonstrate the feasibility of our method, showing the temporal evolution of modeled resonance frequencies? Unfortunately, this is out of the scope of this publication to our mind, because of the lack of information concerning thermo-mechanical coupling to accurately address this question. We detailed this point further in our response. Nevertheless, we added a new figure in appendix showing the ground surface temperature data, as you requested. As suggested by the reviewers, we also modified some sentences and figures in order to improve both the quality of information that we provide and the readability of the publication. We added also some references to publications about seismic monitoring on permafrost and glaciers, as a completed state of art. Please find below a point-by-point response to all your comments (our answers in red), in complement to the new manuscript with highlighted main changes (text in red as well).

Sincerely yours,

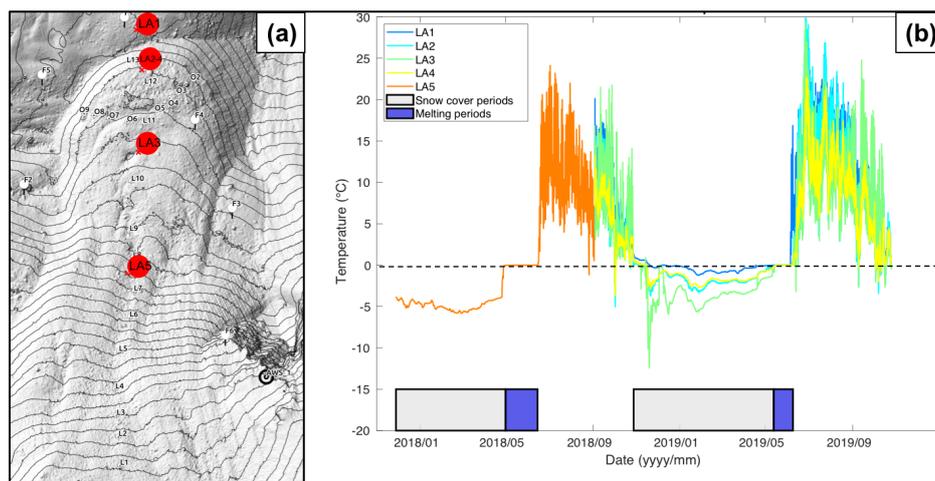
On behalf of the authors,

Antoine Guillemot

Please also note the supplement to this comment:

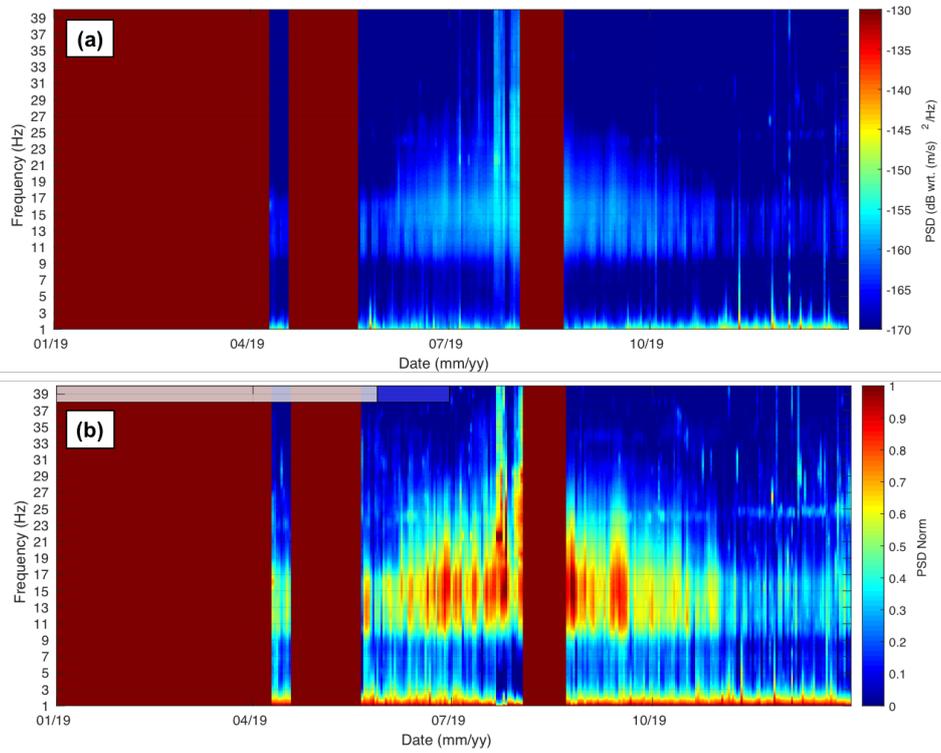
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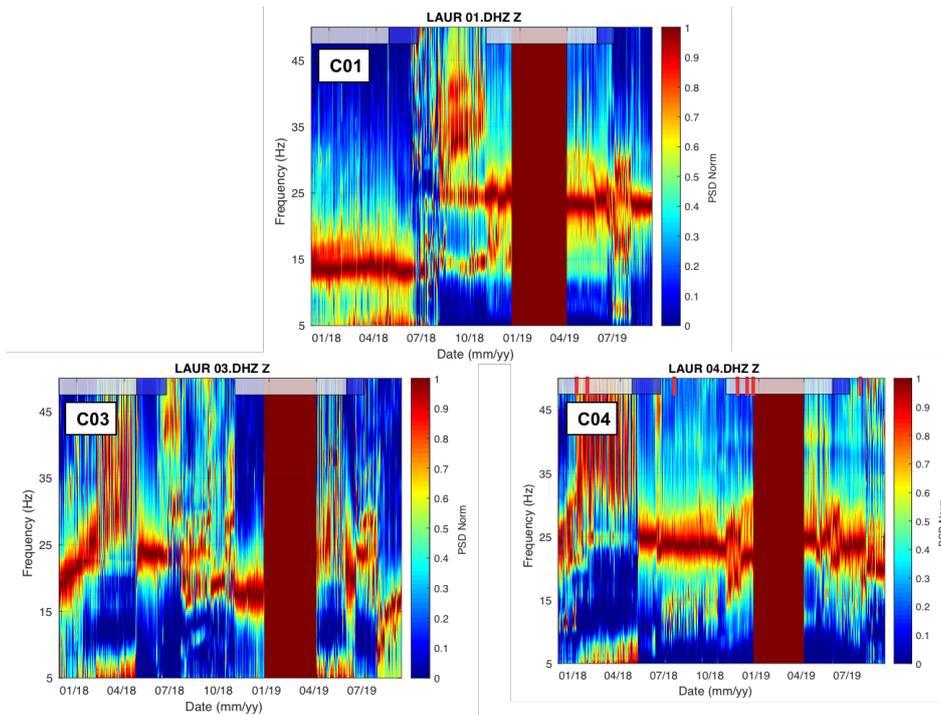
**Fig. 1.** Figure 16 : (a) Location of the five Miniature Temperature Dataloggers (MTD) that record every hour the temperature of the sub-surface (below 2-10 cm of debris), and (b) the corresponding measurements

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**Fig. 2.** Figure 19 : Daily raw (a) and normalized (b) spectrograms of Power Spectral Density (PSD) from OGSA station, located at 2 km from the Laurichard rock glacier, in a stable site, for all the year 2019.

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**Fig. 3.** Figure (in annex ?) showing the normalized spectrograms from the other sensors of Laurichard rock glacier, even if data quality is low.

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