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Cryo-induced cracking in high-alpine rock-wall, evidences from acoustic emissions monitoring

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Ice formation within rock is known to be an important driver of near-surface frost weathering as well as rock damage at the depth of several meters, which may play a crucial role for the slow preconditioning of rock fall in steep permafrost areas. This letter reports results from an experiment where acoustic emission (AE) monitoring was used to investigate rock damage in a high-alpine rock-wall induced by natural thermal cycling and freezing/thawing.
The analysis of the large catalog of events obtained shows (i) robust power-law distributions in the time and energy domains, a footprint of rock micro-fracturing activity induced by stresses arising from thermal variations and associated freezing/thawing of rock; (ii) liquid water availability and rock temperature affect AE activity, suggesting the importance of freezing-induced stresses. These results suggest that the framework of further modeling studies (theoretical and numerical) should include damage, elastic interaction and poro-mechanics in order to describe freezing-related stresses.