Geosci. Instrum. Method. Data Syst. Discuss., 2, C146–C149, 2012
www.geosci-instrum-method-data-syst-discuss.net/2/C146/2012/


Geoscientific Instrumentation Methods and Data Systems Discussions

# *Interactive comment on* "A custom acoustic emission monitoring system for harsh environments: application to freezing-induced damage in alpine rock-walls" *by* L. Girard et al.

**Anonymous Referee #2**

Received and published: 12 September 2012

Review of the manuscript "A custom acoustic emission monitoring system for harsh environments: application to freezing-induced damage in alpine rock-walls " by L. Girard , J. Beutel , S. Gruber, J. Hunziker, R. Lim and S. Weber, submitted for consideration in GeoscientiïňĄc Instrumentation, Methods and Data Systems This manuscript presents a new experimental setup for monitoring the acoustic emissions generated by rock deformation in the field and in particular in steep rocky terrains concerned by transient permafrost under the supplementary constrains of low energy consuming and wireless connection. This new system aims to cover a range of signal frequency , i.e. around 10-100 kHz, that is not covered by usual micro-seismic monitoring systems in particular when low energy consuming requirement are needed moreover in hard



environmental conditions. To my knowledge this is the first system that successfully records AE at such high frequency and in such hard environmental conditions without external energy supply. The manuscript is well organized separating the specific requirements imposed by the phenomenon the authors want to study and the technical features by which the system achieves the measurement. Validations tests are done both in the laboratory under controlled temperature conditions and in the field under natural conditions and show that the system works with a good level of reliability. My overall impression is that this work is of interest for many researchers involved in field measurement of acoustic emission as it presents a new and original apparatus which is potentially able to provide new insight for understanding the damage process in rock cliffs and the role played by the permafrost on the rock weathering. Without precluding the publication of this manuscript, some points need to be improved, clarified or described with more details: 1) The introduction : In the present form the introduction is focused essentially on the rock weathering related to permafrost and not so much on the systems used in the past. So the progress allowed by their new system does not appear clearly. Previous works should be cited with more detail for showing clearly how the proposed new system covers a field that was not before. In particular, many previous works related to high frequency monitoring of rock masses used systems that need a careful housing to be protected from environmental conditions (e.g. Amitrano et at 2011, Amitrano et al 2012, Senfaute et al 2009; Guglielmi et al 2010, Cheong et al 2011). The systems that works with autonomous energy supply (photovoltaic with battery) and resist to outside conditions are actually restricted to low frequency monitoring, i.e. in the range of seismology monitoring (e.g. Helmstetter and Garambois, 2010; Gaffet et al, 2010; Amitrano et al, 2007; Levy et al, 2010; Gomberg et al, 2011; Lacroix and Helmstetter, 2011; Walter al, 2012). Other systems have previously used waveguide for ensuring an efficient AE monitoring (e.g. Cheong et al, 2011, Dixon et al 2003). I suggest the author enlarge the scope of their introduction to show more clearly that the new system they developed associates features that was not associated before, i.e high frequency monitoring, autonomy for energy supply, resistance to

hard conditions and use of a waveguide to be closer to AE sources. This would help the reader to see how important is the progress done by this system. 2) The tests done in the laboratory are interesting but they need to be more detailed. What are the amplitude, energy, rise time, duration frequency of the signals used for testing the system. Could the author plot the signal used for doing these tests. Moreover, if I understood well, the signals used do not replicate the full range of amplitude energy and temporal distribution as they are of constant amplitude. So it is difficult to extrapolate these results for having an idea of the reliability of the system when it monitors natural signals. Testing the full natural range of these parameters is probably difficult but at least the authors should discuss this point and if possible do some tests with signals of various sizes. Questions rises from the temperature dependence of some AE parameters: Could the authors provide some physical explanation? Is it related to the coupling? How is done the coupling? 3) The results shown here are promising but they are presented in very partial manner restricted only to the AE activity. For example one could be interested in knowing what is the range of signal amplitude or energy that are recorded by the system in natural conditions, what is the maximum rate of event recorded . . . Even if the scope of the paper is the system and not the detailed description of the results, these information's could be interesting for estimating the efficiency of the system Consequently I recommend this manuscript for publication after adressing the minor modification I suggested.

References: I suggest the following references useful for enlarging the scope of the introduction Amitrano, D., M. Arattano, M. Chiarle, G. Mortara, C. Occhiena, M. Pirulli, et C. Scavia (2010), Microseismic activity analysis for the study of the rupture mechanisms in unstable rock masses, Natural Hazard and Earth System Sciences, 10, 831-841. Amitrano, D., S. Gaffet, J.-P. Malet, et O. Maquaire (2007), Understanding mudslides through micro-seismic monitoring: The Super-Sauze (South French Alps) case study., Bulletin de la Société Géologique de France, 178(2), 149-157; doi: 10.2113/gssgfbull.178.2.149. Cheon, D.-S., Y.-B. Jung, E.-S. Park, W.-K. Song, et H.-I. Jang (2011), Evaluation of damage level for rock slopes using acoustic emission technique



with waveguides, Eng. Geol., 121(1-2), 75-88, doi:10.1016/j.enggeo.2011.04.015. Dixon, N., R. Hill, et J. Kavanagh (2003), Acoustic emission monitoring of slope instability: development of an active waveguide system, Geotechnical Engineering, 156(2), 83-95. Gaffet, S., Y. Guglielmi, F. Cappa, C. Pambrun, T. Monfret, et D. Amitrano (2010), Use of the simultaneous seismic, GPS and meteorological monitoring for the characterization of a large unstable mountain slope in the southern French Alps, Geophysical Journal International, 182(3), 1395-1410. Gomberg, J., W. Schulz, P. Bodin, et J. Kean (2011), Seismic and geodetic signatures of fault slip at the Slumgullion Landslide Natural Laboratory, J. Geophys. Res.-Solid Earth, 116, doi:10.1029/2011JB008304. Guglielmi, Y., F. Cappa, et D. Amitrano (2008), High-definition analysis of fluid-induced seismicity related to the mesoscale hydromechanical properties of a fault zone, Geophys. Res. Lett., 35(6), doi:10.1029/2007GL033087. Helmstetter, A., et S. Garambois (2010), Seismic monitoring of Séchilienne rockslide (French Alps): Analysis of seismic signals and their correlation with rainfalls, J. Geophys. Res., 115, 15 PP., doi:201010.1029/2009JF001532. Lacroix, P., et A. Helmstetter (2011), Location of Seismic Signals Associated with Microearthquakes and Rockfalls on the Sechilienne Landslide, French Alps, Bull. Seismol. Soc. Amer., 101(1), 341-353, doi:10.1785/0120100110. Levy, C., D. Jongmans, et L. Baillet (2011), Analysis of seismic signals recorded on a prone-to-fall rock column (Vercors massif, French Alps), Geophys. J. Int., 186(1), 296-310, doi:10.1111/j.1365-246X.2011.05046.x. Senfaute, G., A. Duperret, et J. A. Lawrence (2009), Micro-seismic precursory cracks prior to rock-fall on coastal chalk cliffs: a case study at Mesnil-Val, Normandie, NW France, Natural Hazards and Earth System Sciences, 9(5), 1625-1641. Walter, M., C. Arnhardt, et M. Joswig (2012), Seismic monitoring of rockfalls, slide quakes, and fissure development at the Super-Sauze mudslide, French Alps, Eng. Geol., 128, 12-22, doi:10.1016/j.enggeo.2011.11.002.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 2, 267, 2012.