

Paper review for Geoscientific Instrumentation

22 August 2012

**Author(s):** L. Girard, J. Beutel, S. Gruber, J. Hunziker, R. Lim, and S. Weber.

**Title:** “A custom acoustic emission monitoring system for harsh environments: application to freezing-induced damage in alpine rock-walls”.

**Manuscript ID:** gi-2012-14

### General comments

This is an interesting paper by the authors, which describes the technical specification and development of a monitoring system that employs the sensing of acoustic emission (AE), temperature and moisture, applied to boreholes in a mountain rock-wall in Switzerland. The future work of the monitoring system attempts to address the correlation of the sensory measurements, with processes that cause damage to occur in mountain rock under cold cyclic conditions. A total of two monitoring systems were deployed, M1 and M2 and are linked via a Wireless Sensor Network (WSN), which is also linked to the Internet for data retrieval. The paper reports the initial deployment and the results produced over a 5 month period of the M1 station only. The reason for only reporting the M1 station data and the short monitoring duration is due to the discovery of a malfunction in the M2 station over this period. It is understood that the M1 station data is complete and that the issue with the M2 station has been resolved allowing full system deployment to date.

The quality of the paper is excellent, written in clear articulate English and is well set out to explain the system development and experiment data. There a few minor typos described in the technical corrections below.

### Specific comments

From an engineer’s perspective, the paper is scientifically sound with no major issues of concern however, I cannot comment on the geological reasoning behind the selection of rock, its location or the meaning of the results. However, based on my own work with AE in rock and concrete, these results do appear valid. It is noted that the system is instrumentally technical and some of the detail is well covered. A good description of the moisture measurement system is given, as well as an overview of the critical AE parameters to be measured. The temperature probe description is short due to its simplicity however, figure 5, which depicts the probe, is not cited in the main text. This would need citing in a revised version so as not to have a non-referenced image. It is clear that the AE detection system (PermaSense board) is bespoke and has been developed by one of the authors and his team in a cited publication (Beutel et al. 2009), so this technical detail is not expanded upon. Although it is mentioned that the temperature and moisture sensors are integrated with the PermaSense board, this is not clear in the block diagram of the AE-node architecture.

### Technical corrections

Please consider making these corrections:

Cite Fig. 5 in main text.

p.269, line 2: as an engineer, I would prefer to see the frequency bandwidth of AE signals quoted with the exponent unit letter, ie. in this case 10 kHz – 1 MHz (however, I think this should be optional).

p.276, line 26: there is an unnecessary hyphen inserted between '30' and 's'.

p.277, line 23: there is an unnecessary space between 'AE-node' and the comma.

p278, line 9: replace 'four-mm' with '4 mm'.

P280, line 10: citation of Fig. 11 should refer to Fig. 6.