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comment

Interactive comment on "Open-source Arduino-derived data loggers designed for field research" *by* Andrew D. Wickert et al.

Anonymous Referee #2

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General comments:

This article describes the development and technical details of the ALog data logger series, an open-source and low cost data logger that is based on Arduino technology. The article and the described data loggers are a significant contribution to the science community and readers of HESS, as the data loggers may provide a useful technology to many environmental scientists. The article summarizes the substantial development that has gone into the data logger development over many years, and provides detailed background information. The article also includes supplemental material and codes provided online. This helps to make the data logger accessible to the science (and general public) community. The article is well written and well organized throughout, with clear descriptions of the technology. I only have a few minor questions, mostly

regarding field deployment, and minor comments that should be addressed. Apart from these, I recommend this article for publication.

Specific Comments:

1) Please also discuss some of the challenges that you have faced with the ALog data logger in the field, and that a potential user of this data logger may encounter and should be aware of. You mention several field experiments with ALog data loggers in adverse conditions. How long were the data loggers actually in the field, how robust were they found to be? What field issues did you encounter that were specific to the ALog? Were you able to remidify these in the next iterations? I realize the ALogs have been developed over a long period, but a few more examples would be helpful to a potential user of the technology.

2) For instance, did you encounter clock drift? It is referred to a really low clock drift value in the article, but was this value based on 'theoretical lab experiments', or tested in the field?

3) The low power use is impressive. Was this value also experienced in the field? I.e., one data logger actually ran for $\sim$ 2 years on three AA batteries? Or is this a theoretical value based on consumption? Also, what kind of sleep-awake cycling is typically used? A 1 second per minute interval is mentioned, was that typically used? It probably depends on sensor and application, but some examples would be good.

4) In line with the above questions, please also include some more information on how the data loggers were installed in the field. What kind of encasing have you found to work well with these data loggers? Do you typically use batteries or solar panels?

Technical Corrections

Page 1

Line 4 –Alog series: add reference that three data loggers were developed as part of the series.

Line 17 – likely also capacity challenges, especially in developing countries.

Page 2

Line 1 – delete "extreme", and "lightweight"; lightweight is repeated again just below.

Line 2 - "whose" - typically used to refer to humans - better to say: "and has well documented and freely available code and hardware designs."

Line 4- "conventional proprietary data recording systems".

Line 6 – remove dash in data-logger to be consistent. Also check through document for consistent writing of data logger.

Line 11 – First refer to Figure 1, before referring to Figure 2.

Line 17 – Better: "entry barrier".

Line 23 – EAGLE – add reference with link to program.

Line 28 – Mention what doxygen is.

Line 31 – "The ALog series comprises three main data loggers". Mention this sentence earlier (abstract, introduction, and/or start of Methods description). Otherwise it is not clear why sometimes it is talked about the ALog data logger (singular) and sometimes the data logger series (plural). This could also help with referring to Figure 1 before Figure 2.

Line 31/32 – list the ALog data loggers in same sequence as in figure, i.e. first ALog Shield 2.2. Also, better to first discuss the ALog Shield 2.2, then follow with the BottleLoggers, to avoid confusion between data loggers.

Page 3

Figure Caption – ensure consistent naming of the three data loggers. E.g., (a) The ALog Shield 2.2

Line 1 – What are these performance upgrades? Please elaborate more.

Line 6 - First the ALog Shield 2.2 is described in detail, but then no further details are provided right away for the following models. I assume much of what comes below refers mostly to the later versions, this should be made clear however through a transition sentence.

Line 7 – Each of the ALog data loggers? Better: Each data logger of the ALog series contains. . .

Line 9 – Has this been tested in the field? See comments above too, and add reference to field experience here, or later on in field section.

Line 11 - SD cards are also easy to download data from for field assistants / citizen scientists who are not technical experts.

Page 4

Line 1 – Rephrase "While a simple design decision", maybe: "While it is a simple design, using an SD card. . ."

Line 7 – "aggressive sleep cycle" - It should be explained what is meant by 'sleep cycle'. Otherwise readers who are not familiar with Arduinos might not understand. It is explained further below, consider moving the section upward, or referring to it here. Does the 'aggressive sleep cycle' refer to the 1sec per minute awake cycle?

Line 9 – remove 'an'

Page 6

Line 3 and line 8 – are these values theoretical, tested in the lab, or actually experienced in the field?

Line 16 – Remove dash.

Figure 3 – darken shading for low power operations box, not clearly visible on screen.

Page 9

Line 7 –mention in introductory overview or abstract that field deployment is also discussed, and examples are provided.

Line 8 to 12 – could mention some examples of deployment in abstract, this really strengthens the ALog argument.

Line 25 – remove dash

Line 26/27 - Delete this last sentence, this is not relevant to the ALog development and out of context here. Instead, you can highlight the consistent data recording over the period of a year in extreme conditions.

Line 30 – reference to Figure 5b should come at end of sentence, as, if I understand correctly, both sensors are within the solar radiation shield visible in the Figure?

Page 10

Figure caption (e) – Better to remove 'covary' here, and highlight consistency of recording instead. Add start and end date of recording. Refer to paper where these data are discussed.

Page 11

Line 9 – ideally. . .

Line 10 - Could make this point earlier on in introduction already, i.e. that Arduinos were originally developed/are often used for hobby electronics etc by the general public.

Line 11 – delete 'movement'

Page 12

Line 23 – "In doing so"

Page 13

Line 11 – user guides

Line 12 – Supplemental

Page 14

Line 12 – Add University, location and page numbers, also for other theses that are cited.

Line 16 – add publisher and page numbers, link etc.

Line 2 - consistency - the other AGU reference included location and date. Include this here.

Page 16

Line 6 – add reference link

Line 10 – add publisher information.