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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Evaluations of an ocean bottom electro-magnetometer and preliminary results offshore NE Taiwan" *by* Ching-Ren Lin et al.

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For marine natural resource explorations, the controlled source EM (MCSEM) methods are usually deployed. The natural source EM is used mostly for detecting deep structure of the crust /lithosphere. This manuscript describes a story of evaluations of a natural source marine EM system. I've never seen a paper that gives us so detailed information on how to evaluate an EM instrument. But I'm not sure the work would be published at the moment unless some major revisions be made. Here I'd like to make some suggestions:

Response: Thank you so much for your patient review and valuable comments. We

have tried to improve the manuscript following your comments. Thus, please reconsider the present revision of our manuscript to be published.

1. As I know, some OBEM systems have been developed and deployed in the world (such as SIO-MKIII, LT-OBEM, etc.), I'd like to know what are the new innovations of the OBEM in this MS?

Response: The innovations of the OBEM have been described in the abstract as lines 2-5 (p. 2). The OBEM can be deployed more than 180 days on the seafloor with time drift less than 0.95 ppm. We also compared with Japanese OBEM in table 1 (p. 19).

2. Although the OBEM is a complex integrated system with variety of advanced S&T knowledges, the key units are the data logger, magnetic sensor (fluxgate), electric sensor (electrodes). To evaluate the performance of these delicate units, sophisticated and professional calibrations are needed. The evaluation tools and methods employed in this MS seem like some operational manual step by step which are not enough and unnecessarily described so detailed. For example, the FLUKE726 is an multi-function process calibrator for industrial use, It is not enough for the precise calibration of Geo-EM equipment.

Response: The MS focuses on the calibration of the OBEM, its tested procedures, and methodology. Therefore, we described the detailed procedures for the OBEMs. All the procedures are very important that would greatly affect the recovery rate of the OBEM. It is impossible to develop the high stability of OBEM without detailed procedures. Thus, we would strongly recommend making detailed testing procedures and manufacturers of equipment. The detailed procedures could be referenced as an operation manual developing OBEM. It is never been described in any articles. Thanks for your comment.

3. For OBEM system the most important feature to be calibrated is the frequency responses in the effective frequency band. I do not find any words about this in the MS.

Response: For the fluxgate, the flat responses show below 10 Hz; the datalogger of the sampling frequency is 144 kHz with linear phase digital filter. Therefore, there is no need to calibrate because of the sampling rate of the datalogger is 10 sps. Thanks for your comment.

4. Table 3 to table 7 are really not necessary. Some curved pictures would be better.

Response: We have replaced the tables 1-3 to be figures 4 - 6 (p. 25-30), whereas the tables 4-7 (tables 2- 5 show in recent MS) probably not suitable making curve pictures because of that show different information of the OBEM. Table 2 shows the very low power consumption of all the OBEMs; table 3 shows the evaluating results of the electrodes; tables 4 and 5 show the evaluation of acoustic transceiver and its transducer in the fieldwork, respectively. All the results demonstrate that the integrated system has properly worked.

5. Calibration of fluxgate is one of the most important work for OBEM. What is the result for this evaluation?

Response: The fluxgate response of amplitude and phase shows in figure 1. Frequency of 0 to 1kHz maximally flat, $\pm$5% maximum at 1kHz. The details of the electrode, fluxgate, and amplifier have described in lines 85 - 92.

6. Temperature feature is one of key specifications for fluxgate. Calibration of temperature feature should be done before submitting the MS.

Response: The scaling temperature coefficient is $\pm$15 ppm/$^{\circ}$C, whereas the offset temperature coefficient is $\pm$0.1 nT/$^{\circ}$C. We have added the specifications in lines 87-88 (p.4). The temperature for the deep marine environment should change very small compared with the ground case. Therefore, the temperature coefficients of the fluxgate are suitable for the OBEMs.

7. What does it mean by BBYB and SH1 respectively?

Response: BBYB is an abbreviation of “BroadBand YardBird” called for the Taiwanese

OBS as line 46 (p. 3). The SH1 and SH2 are two horizontal components of the seismic signal. We have described it in lines 501 – 503 and lines 507 – 509 (p. 18). Thanks for your valuable comments.

8. It is really strange for the result of the offshore experiment. Why does only the HY component be affected by the earthquakes?

Response: The Hx, Hy and Hz components are simultaneously affected by earthquakes, but the variation of amplitude appears significantly in the Hy component. It could be related to the orientations of the magnetic sensor and the earthquake. We have described the sentences in lines 351 - 353 (p.12). Thanks for your valuable comments.

9. Figure 10: Names and notes should be clear and mark the English by the Chinese words.

Response: We have modified all the Chinese words to English in figure 10 (p. 32). Thanks for your comment.

10. Figure 11: a small inset figure showing the location of the field work should be added. The main body of the figure can use a detailed seafloor topography as the base map.

Response: The figures 11 (p. 33) have been redrawn in the revised MS. Thanks for your comment.

Please also note the supplement to this comment:
https://www.geosci-instrum-method-data-syst-discuss.net/gi-2019-13/gi-2019-13-AC2-supplement.pdf

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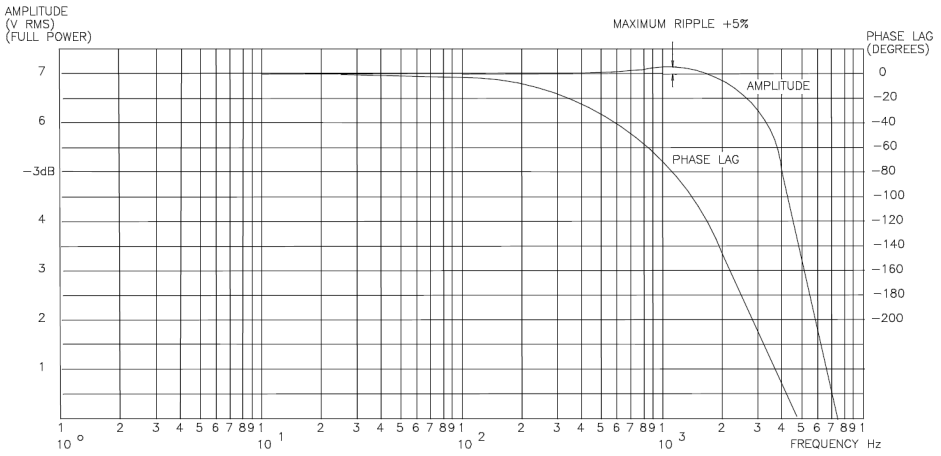

Fig. 1. Response of fluxgate