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Ocean Science Discussions

Interactive comment on "M3A system (2000–2005) – operation and maintenance" *by* G. Petihakis et al.

G. Petihakis et al.

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The authors would like to thank the anonymous referee for his constructive comments which we believe contribute to the improvement of the manuscript. Having considered each one separately we appose our response below:

Comment 1 In the present form the paper is not more than a technical report. I'm sure this was a deliberate choice of the authors, in order to dedicate to the exploitation of the results other papers. However, this is not a good enough reason. On the other hand, I know very well the costs, in terms of man-time and duty, than a similar system requires. In addition, I recognize that the "dirty work" to produce, to control and to make available the data is too few granted, often limited to some words in the acknowledgements. Several "important" papers result from the utilisation of real-time continuous systems, such the one presented here. In fact, others subjects exploit "scientifically" the effort of

the personnel involved in the observational programmes.

Response 1 We agree we the referee that the high frequency data acquisition is a difficult task involving a lot of “dirty work” as often described in similar papers published for other observing stations. However we don’t think that the present paper is just another technical report because it does not go into deep data analysis. The paper has been written in the framework of a special issue dedicated to MFSTEP project a significant part of which was the M3A setup and operation. Although the analysis of data is always a more fascinating subject we believe that information on how this data was collected is equally important, allowing criticisms on its utility. Additionally we provide quite detailed information on the problem of biofouling, the way it was handled in this particular occasion as well as out future intentions.

Comment 2 So, I think that the paper should be accepted, but I suggest changing some sections of the draft, which could result in an increased scientific relevance of the paper. Some suggestions are in the follow (opened to discussions in the Ocean Science Discussion web-site): 1. The section 2 (M3A design and configuration) could be shortened, mainly referring to other publications for the detailed description of the system. I would indicate here only the changes occurred in the second phase. 2. The description of the periodic maintenance and of the problems encountered (section 4.1 and 4.3) could be shortened too. An idea could be a more extensive use of tables. 3.

Response 2 It is suggested that the section 2 (M3A design and configuration) could be shortened, mainly referring to other publications for the detailed description of the system. However the particular section refers to the design and configuration during the MFSTEP project, information which has never been published. The original setup (MFSPP) which has been published by Nittis et al. (2003) is only briefly mentioned, mainly to describe and explain the changes made. We believe that this helps the readership not familiar with the particular project. The above apply also to the description of the periodic maintenance and of the problems encountered (section 4.1 and 4.3) as we believe that although people experienced in such tasks as the referee obviously

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is, might find it rather extensive, the way it is written is informative for people not very familiar and at the same time allows possible criticisms on the methodology.

Comment 3 The discussion on the bio-fouling problems could be extended, considering the unquestionable experience of the authors on the subject. If, the “hardware” methods are impracticable, is it possible to recuperate the data affected by bio-fouling using some post-processing procedures, as, for example, a re-scaling of the wrong measurements using sample analysis? Did you try it? It is possibly to identify some “external” parameters, which could permit to recognise when an observation is disturbed by bio-fouling (i.e. period of the year, levels of incident light, etc). What’s your feeling about that? Although agree that authors could don’t have the “final” solution, I would appreciate a discussion about that, and, in particular, their opinions on the subject. 4.

Response 3 Following the reviewer suggestions, we have added some more discussion on the subject, describing our experience and the reasons that we converge to the pre-deployment laboratory calibration methods. Furthermore, we describe one potential way to recuperate low-quality optical mooring data, by using concurrent satellite information. However, we are highly skeptical on multiparametric criteria methods to recuperate data, as they involve hypotheses and conceptual models. The application of such models on a time-series may be possible and desirable in the context of research work, however it should not be used for the production of a time series that might be treated as real observation in the future. More detailed, the question of improving the quality of mooring time-series through post-processing or comparison with reference measurements obtained through higher accuracy methods in the field has been addressed through our participation in a series of projects involving moorings, like POSEIDON (Nittis et al., 2001, 2002), MFSTEP (Zervakis et al., 2002), INTERPOL (Tragou et al., 2005). Based on previous experience from field hydrographic measurements, where salinity samples from bottles are routinely used as reference measurements to improve the quality of CTD data, a first approach is to follow a similar

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methodology for mooring measurements. This approach would consist of collecting field samples from the instrument depths during the frequent maintenance visits, and after the retrieval of the complete time series produce a least squares fit between the mooring measurements and the reference values produced from the higher accuracy laboratory methods. This approach was abandoned from the very early stages of our involvement in quality assurance of mooring measurements. The reason is that that measurements made at a single depth usually exhibit small variability when compared to the potential range of the parameter in the area. This problem is rectified by the fact that the periodic maintenance visits provide a few reference samples that, in most cases, cover a very small range of values, even compared to the rage of values of the collected time series. Thus, this approach leads to the application of the calibration exercise over a very small range of values, leading to a bad estimate of the correlation slope instrument and reference values. To overcome this problem, it was decided that for mooring measurements it is imperative to perform pre-deployment and post-retrieval calibrations, if possible in the laboratory, covering thus the whole possible range of parameter under consideration. The argument above applies largely to the referee's suggestion about recuperating the data using sample analysis. In our experience, post-processing can be used as an assessment for the characterization and flagging of measurement, but not really for recuperation of the time-series. Even this process however often presumes some hypotheses (like long-term stationarity) that may not necessarily hold, and it might be unwise to adopt them in the process of just producing a reliable time-series. Some parameters require specific treatment. Transmissometers often exhibit rather linear drifts, which may be easily corrected if such intervention is justified by field measurements and the subsequent deployment of a "clean" sensor. The same holds for conductivity measurements. Fluorometers however, exhibit a less linear behavior. Very often, a shift at a new "base" value follows a recorded bloom, which may influence the effective geometry of the sensor's window. An attempt to recuperate such measurements would involve the use of a combination of removing a linear trend and a step function. However, as mentioned above, in order

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to follow such a procedure in a justified way, while involving as few assumptions and perceptual models as possible, it is imperative to be provided with high-frequency reference measurements, unaffected by biofouling. For near-surface waters it is possible to correlate with time-series provided by biofouling-free satellite measurements in order to remove the drift of moored instruments like fluorometers. And even in this case, the newly produced values should be flagged as "estimated". Summarizing, our experience suggests that while it may be possible to recuperate data of questionable quality, this process involves a series of assumptions and perceptual models, thus reducing the value of the corrected data. We believe that our major efforts should be focused in improving the technologies and methodologies that produce clean and reliable data.

Comment 4 In my opinion, the conclusions section (#6) ignores a crucial aspect, which is potentially the most relevant for the readers: a final budget of the data acquired, of the personnel involved, of the boattime, of the effects of the problems/accidents on the temporal series. Just an example: the authors spent several lines in the text to describe the communication problems affecting the system. I found that's correct. However, not a word is pronounced on the effect of these accidents on the temporal series. These kind of analysis could give an idea of the attention dedicated by the personnel to preserve the data, and also justify the whole supporting and maintenance system.

Response 4 We agree with the reviewer that the inclusion of the final budget of the data acquired, of the personnel involved etc will be an improvement for the manuscript. These will be added once the open discussion processes finishes.

Comment 5 The previous point could introduce some comments on the importance of the continuos monitoring of the ocean allowed by the presented system. The authors correctly highlight this aspect in the introduction and in the conclusions, but I would appreciate some real examples, even very roughly, based on the acquired M3A data. I think about, for instance, the identification of occasional marine or atmospheric events, which could locally modify the oceanic upper layer fields. Such events are very difficult

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to monitor with “classical” platforms, although they have a strong effect on the oceanic dynamic. I suppose that the M3A system is able to detect and to quantify such kind of events.

Response 5 The reviewer brings up a very interesting aspect which we already investigate. Once this analysis is finished the findings will be added in the manuscript soon after the open discussion process.

Interactive comment on Ocean Sci. Discuss., 3, 165, 2006.