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Ocean Science Discussions

Interactive comment on "Comparing historical and modern methods of Sea Surface Temperature measurement – Part 1: Review of methods, field comparisons and dataset adjustments" *by* J. B. R. Matthews

Anonymous Referee #2

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General comments

Whilst this paper is generally well written and revisits some interesting papers from the literature that have lost visibility over the years I don't believe it adds anything new to the literature itself. The author draws conclusions that are at odds with those of the papers reviewed and makes a plethora of statements that are based on personal opinion and without any supporting evidence.

Major comments

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Interactive Discussion

Discussion Paper

Page 2953, line 20 through to 25: This is purely the authors personal opinion based on, I believe, the authors experience in part two of the paper using a pine bucket and not backed up by any of the literature (I'd be happy to be corrected on this point). As such I think it needs to be removed. For example, modern insulated buckets can be heavy, e.g. the bucket issued to German VOS, and have been used from large vessels travelling in excess of 7 knots. It is unclear how this is any less impractical or dangerous than the use of wooden buckets on the early steamships and to me invalidates the authors statement.

Page 2954, lines 19 – 22: The country of recruitment and nationality of the ships making the observations in ICOADS can be estimated from a combination of the country code, deck and source ID in ICOADS. Using this information the majority of the observations in ICOADS prior to WWII come from UK, Netherlands and German ships. Whilst they may have been coal burning ships there is no evidence to suggest that they did not use buckets as instructed. The statement that the proportion using EIT may be significantly underestimated is pure conjecture without any further evidence.

Page 2959, line 6: The statement "these conclusions cannot not be drawn from averages of noisy bucket – intake temperature differences alone" is not true. As an example I'd ask the author to calculate the t statistic for the James and Fox data and state the statistical significance of the result. Similar statements are also made elsewhere that are equally wrong. In addition to this, the conclusions are not only supported by the data but by an understanding of the physics of the upper ocean and off the processes involved.

Page 2960, line 18: Can the author explain the cause of the 0.6°C cooling in the bucket measurements relative to the CTD in this study? Could this be explained by drier (i.e. less humid) conditions and hence greater evaporative cooling from the buckets at the time of observation? A quick look at the dew point temperatures from ERA interim suggest that this may be the case for the SURTROPAC 15 values compared to the others.

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Page 2961, line 7 onwards: Whilst the bucket was not used for collecting the water samples this does not undermine the validity of the experiments. As the author notes, if the bucket were to be used the rates of cooling would be higher due to evaporative cooling through the walls. As a result the cooling rates reported will be a lower limit.

Page 2961, line 15: Why is it unlikely that sailors would have chosen such a location or agitated the water?

Page 2961, line 23 to end of paragraph: This is the only direct comparison between buckets described. Measurements using a canvas bucket were found to be 0.3 cooler than coincident measurements using a tin bucket. This increased to 0.6°C when made by a member of the ships crew. This is strong evidence that the canvas buckets can undergo significant cooling in contrast to the later conclusion of the author of this paper.

Page 2965, section 5 (Synthesis and conclusions) onwards: This is the section I have greatest difficulty with. There is very little new presented and the conclusions drawn appear to be at odds with the rest of the paper. As an example of the former, stating that fast response thermometers respond quickly or that accurate measurements can be made when done so carefully are not exactly new ideas or knowledge.

More seriously, the main conclusion from the author and paper as I read it is that bucket measurements will contain errors of 0.1°C due to evaporative cooling at most. This is based on two minor pieces of information contained within the papers reviewed. Firstly, from B26 - the maximum amount of time to take a sample and temperature reading is 1 minute. Secondly, from FP95 the maximum cooling rate experienced by a bucket is 0.1°C min-1. Neither of these statements is correct, the sampling time from B26 is likely to be a minimum, not a maximum as evidenced in B26 itself when a member of the ships crew made the measurement rather than Brooks, with average cooling of 0.6°C in the canvas bucket sample. As the author of this paper implies, the rates of cooling found by FP95 are also likely to be a minimum due to the buckets not being used to collect the water samples and therefore not experiencing the evaporative

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cooling through the walls of the bucket. FP95 also not the cooling rates in excess of 0.15 °C min-1 were found on a number of occasions.

The author of this paper has made no attempt to explain the various differences found between the results of the different papers. For example, B26 note that fairly large positive values have been found in the bucket – EIT over the Grand Banks when from a naïve (i.e. excluding knowledge of the environmental conditions) we would expect a negative value. B26 goes on to state the differences are largely due to limited cooling of the buckets due to high humidity values and stratification of the ocean surface. Trying to understand the differences in the different papers and explain them would have been more useful than just using them to say everything is too uncertain and that no conclusions can be drawn about the EIT – bucket differences.

Finally, fair conclusions from the evidence presented in this paper would be:

1) both EIT and bucket measurements of the SST are problematic and need careful consideration when being used;

2) that buckets can undergo significant cooling but that this depends on a number of factors, including but not limited to: the environmental conditions (wind humidity, air – sea temperature difference) at time of sampling; the rigorousness with which the measurements; the type of bucket being used etc;

3) and EIT measurements can contain significant biases relative to the surface temperature. These are due to heating of the water in the intake pipes (warm bias) and when there is significant stratification of the surface waters (cold bias).

None of these are new and are already well documented in the literature (including that reviewed by the author).

Interactive comment on Ocean Sci. Discuss., 9, 2951, 2012.