

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 #1

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Comparing historical and modern methods of SST measurement - Part 1: Review of methods, field comparisons and dataset adjustments.

General comments

This paper has the potential to be a useful contribution to the literature but will require revision before publication. Some references that are not usually quoted have been identified which is helpful. The review is however presently selective in picking papers, or parts of papers, that support the thesis that bucket measurements are accurate to

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~0.1degC and engine intake measurements are so noisy as to be useless. This leads to a conclusion (in Part 2) that bucket measurements require no adjustment and all engine intake observations should be discarded, which is not supported by the full literature. For example, Ashford (1948) and Roll (1951) made observations of temperature change in wind tunnels for several types of bucket and Brooks (1926) describes "errors closely related to the depression of wet bulb or air temperature below the water temperature". It has long been known that bucket measurements can be accurate, especially if the bucket is well-designed, the exposure time is short and the response time of the thermometers used is short (e.g. Brooks 1926, Saur 1963). However the important question for the adjustment of real data is what the biases are likely to be in the observations actually collected. Folland and Parker (1995) were careful to give more weight to those observing instructions that were likely to have been relevant to a large number of the observations made. In the present review there is more focus on studies where particular care was taken (e.g. Brooks took quick samples with a large bucket, the Saur study used a bucket specially designed by Scripps and Tabata considers observations made at a weather station). It is not clear therefore that the conclusions of this review can be directly applied to the observations in ICOADS or the SST datasets, like HadSST3, derived from them.

However the paper does provide some useful focus on the expected differences between accurate measurements at the surface and at depth. This has not been entirely ignored in the literature, most studies make it very clear that differences are expected between buckets and engine intakes because of the depth (e.g. Brooks, Saur, James and Fox 1972, Folland and Parker, Kennedy et al. 2011b). However the large ship-to-ship differences evident in such studies have precluded the analysis of variations with environmental parameters expected to be important for relating temperature at depth to the surface. It should be noted that most of the evidence for particularly serious problems with engine intakes comes from the 1960s or earlier (although Kent et al. 1993 show some fairly large differences for engine intake measurements from 1988-1990).

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To become suitable for publication two main improvements are required:

- 1) A more balanced and complete review of the available literature
- 2) A more careful consideration of how the different types of studies relate to the historical temperature record as measured

Specific comments

Abstract, line 3: post-industrial period?

Abstract, lines 3-4: Most SST observations have come from the platforms listed at all times

Abstract, lines 8-end: As outlined above I do not believe that the summary presented in the abstract is a fair representation of the literature.

Page 2954, lines 1-3: Kennedy et al. (2011b) describe the difficulty of measuring from large and fast ships. The information reported there is that UK ships were advised to use ERI when the speed is > 15 kt.

Page 2955, lines 1-3: Reference needed for information about dual intakes (Saur?)

Page 2955, lines 16-17: Reference needed for diameter of intake pipes

Page 2956, line 23: usually called Ocean Data Acquisition Systems (ODAS)

Page 2956, line 22-end of paragraph: The information presented here refers to the observations available in ICOADS. There were probably earlier measurements made by these different platforms which are not in ICOADS. The text should make it clear that the start dates are for ICOADS observations.

Page 2958, lines 3-9: SST measurements from AVHRR are adjusted for biases using in situ observations, as described in the Reynolds reference quoted and in many other papers by Reynolds and others. AVHRR cannot be described as accurate, e.g. from Reynolds conclusions "However, because of large potential biases in satellite retrievals,

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accurate bias corrections are needed particularly for climate studies." The SST from ATSR is more suitable for applications requiring higher accuracy (e.g. Merchant et al. 2012, <http://www.agu.org/pubs/crossref/pip/2012JC008400.shtml>)

Page 2957, Section 3.1: As noted in major points above, this review is not adequate to support the conclusions drawn.

Page 2960, Section 3.2: Some of the information presented here is a valuable addition to the literature. It is a shame however that none of the data are presented. I realise that the somewhat unusual method reduces the utility of the observations, but the data may still be useful, especially if there is additional environmental information available. The Mk II bucket was issued to UK observers for many years.

Page 2962, Section 3.3: Ashford (1948) compared several different types of bucket and there are other studies too. Also the comments about likely observing practice are rather sweeping. Yes there is anecdotal evidence of poor observing practice, but equally Meteorological Agencies have invested much effort (since at least 1853) in trying to make mariners understand the importance of the observations and how to take them properly. Some observers will have done as instructed, some will not.

Page 2966, lines 21-23: There are several studies which have tried to separate the contribution of variations with depth from bucket cooling (e.g. James and Fox 1972).

Page 2967, lines 6-7: If observations can be considered independent or only partly dependent then the standard deviation is not the relevant measure. See e.g. <http://www.metoffice.gov.uk/hadobs/hadsst3/faq.html>

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