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Comment

Interactive comment on “Near-surface diurnal warming simulations: validation with high resolution profile measurements” by B. Scanlon et al.

B. Scanlon et al.

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Response to Referee 1

We would like to thank the referee for their useful comments and for the overall improvement of our article.

RC: Major comments: Sections 2–3 First of all, I would re-organize the sections moving section 2.1 first and setting it at the same level as section 2 and 3. All of them might fit as sub-sections of a more general ‘2.Material and Methods’. The sequence would then be ‘2.1

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Instruments' (instead of SST measurements), '2.2 Observations (present section 2), '2.3 Models'.

AC: We have reorganised the structure of the article according to the reviewer's suggestion.

RC: It would be nice to have a brief description of the meteorological/ atmospheric instruments/data and of the methods to estimate fluxes that have been used to force the mixed layer models. These would easily fit in the subsections suggested above, also including more details than those presently reported in section 3.

AC: We have added a paragraph describing the met instruments in section 2.2.

RC: Section 4. It is not clear why the authors have decided to focus only on mean biases between observations and simulations, instead of considering also corresponding rmse. Either this choice should be justified or corresponding analysis should be included in the discussion

AC: The standard deviations of the temperature differences as a function of depth were generally similar for all the different models. Table 3 was added to show the similarity of the standard deviations for the three case studies. Given these similarities, the discussion evaluation was focused on the representation of the profile shape which is best represented through the biases as presented.

RC: Page 3858. Line 4. Question mark should be removed or substituted with proper reference.

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AC: Corrected.

RC: Page 3860. Lines 2–6. This whole sentence is not clear at all. What kind of shift has been applied? What kind of advection effects are being considered?

AC: The sentence has been rewritten: “While the modeled profiles were allowed to evolve freely, the modeled temperature profiles were relaxed to ship-based underway SST measurements at each timestep to minimise advective effects. This involved the entire temperature profile being shifted such that the model temperature agrees with the measured subsurface temperature from the research vessel at the appropriate depth.”

RC: Page 3861. Lines 8–12. See comment above. Limitation of 1D models probably need adequate discussion somewhere (most likely in the Introduction?) Line 28. Remove ‘perhaps’. Last line. Should be GC99.

AC: There are clearly limitations to 1-d models as the reviewer notes, particularly with respect to advection. Explicit acknowledgement of this has been added to the introduction: “Clearly, 1-dimensional models which only consider transport in the vertical direction have limitations and cannot account for advective effects. Advection can introduce errors in modeled temperature gradients from horizontal currents of a different temperature as noted by Kantha and Clayson (1994). The 1-D models, however, can be very informative in evaluating the mixing processes associated with stratification and diurnal warming.” The limitations (with respect to advection) are also reiterated in conjunction with the results at several points throughout the manuscript (see, for example, the previous comment).

We have removed the word ‘perhaps’.

RC: Page 3862. Line 4. Change ‘simulates’ with ‘gives’.

C1759

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AC: Corrected.

RC: Page 3864. Line 23. This sentence is not clear. We are seeing a mean observed temperature profile. What kind of diurnal warming are you talking about? Line 25. Remove 'which are discussed in section 2.1'.

AC: The average diurnal warming, the temperature difference of that from 0.1 to 1 m relative to that of the greatest measured depth at 5 m is 0.7 K and slightly less at the ocean skin.

The sentence was changed to: The mean diurnal warming ($SST - SST_{depth}$) is about 0.7 K for all observations.

RC: Page 3685. Line 6. 'It is', not 'is is'.

AC: Corrected.

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