Ocean Science
Discussions

Open Access

Interactive
Comment

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

B. Scanlon et al.

bward@nuigalway.ie

Received and published: 1 July 2013

Response to Referee 2

RC: This paper describes a comparison of very high resolution temperature profile time series with 5 different versions of an ocean mixing model. The model is the Kantha- Clayson tke closure model. The original model and various combinations of modified turbulent and radiation absorption profile parameterizations. The observations are truly high resolution (cm scales) in the upper 5 m of the ocean; time

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

resolution is roughly 10 per profiles per hr.

The paper is reasonably well-written. The introduction is good and the model and observation descriptions are mercifully brief but sufficient. The authors have chosen three cases to illustrate three different regimes: mid-day heating, early morning heating, and night-time cooling. I find the analysis somewhat cosmetic -- basically a description of the graphs with little physical insight into what is going on. The approach to the graphics could likely be improved to aid the reader. I am not sure the analysis approach is well-conceived. It would be more informative to me to see an entire 24 hr cycle in one simulation for several different forcing situations. However, I presume this was not observationally practical.

AC: We thank the reviewer for their positive comments. We agree that it would be more informative to see an entire 24-hour cycle, and we have added a new figure presented below. This new figure shows the underway and skin SSTs, as well as the five DW models.

RC: For example, the 3rd case is classified as 'day-night transition', but the models start off too cold by 0.5 C. Presumably this could be due to not producing enough warming during the day? Also, I don't understand how the models can warm 1 C past the data while the sun is down. Since there is not other source of heat, the warming can only be caused by mixing or advective components not accounted for by the model -- yes? The authors incorrectly state this warming occurs after sunrise but it looks to me (a little hard to tell from the poor graphics) the warm occurred well before sunrise. Even if the data are more time limited, it might be amusing to see the entire 24-hr model run.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

AC: The reviewer is correct and we realised that there was an issue with our timestamping on the plots for IO07. Unfortunately the time shift from UTC to local was applied twice, due to a misunderstanding when transferring data. The relevant figures have been corrected and updated.

Specific Points

RC: *P 3854 line 8. It is important to note that this study evaluates the ability of the models to exactly reproduce a specific realization of observations. It does not address a more traditional statistical evaluation of model uncertainty.

AC: This comment is added to the article.

RC: *P 3856 description of the two temperature profilers. The authors could remove some of the un-needed detail such as the sleeve is made of neoprene or the tether is high breaking strain. Suggest reading the section and paring out stuff the reader is not likely to need to know.

AC: The paragraph has been reviewed and trimmed down.

*Page 3857 line 4. The text refers to 'both cruise' but I thought there were 3 cruises.

AC: Corrected.

RC: * Page 3857 line 4. I question the use of the Paulson and Simpson solar flux formula. Wick published a paper previously that suggested it contains highly absorbed bands that do not make it through a humid atmosphere.

AC: One of the objectives of this work is to further evaluate and compare the different solar absorption models of PS81 and OS00 using high resolution measurements in non-idealised situations. While results in some applications have suggested limitations of the PS81 9-band model, it is still in use in other prominent models such as POSH as cited in the text. We felt it was valuable to retain the PS81 model in the comparisons since it is what is normally used in the Kantha-Clayson model in the absence of other changes and we were interested in evaluating the "baseline" configuration of the model. Selection of appropriate turbulence coefficients might be partially "optimized" to function with the embedded absorption model. In the results here in highly stratified conditions (Fig. 3) the combination of the absorption model with this diurnal warming model is found to perform well.

RC: * Page 3859 line 29. The observations used to initialize the
models -- are they CTD? Do they get close to the surface?

AC: The only observation used to initialize the model is the recorded sea surface temperature measurement (thermosalinograph) from the research vessel. The initial model temperature profile is taken as isothermal with this value. The model is run for an adequate period to reach its own vertical profile before comparison with the observations and is not influenced by an initial profile shape. The use of initial isothermal and constant salinity profiles is described in section 2.3.

RC: * Page 3857 line 4. I don't understand this part about 'shifting
to the left'.

AC: We do not understand the reviewer's comment here; can they be more explicit?

RC: *Fig. 2. Is quite interesting but hard to puzzle out. It would be
useful to see the solar envelop on this same figure. Also, would be
nice to see the actual model outputs, perhaps over a longer period.
Perhaps make this 3 separate figures with 2 columns each?

AC: We have added a solar envelope to the figure. We have also made 3 separate figures as suggested.

RC: *Figs3,4, 5. I am confused by the dot on these graphs representing the surface value? Is this the upper layer of the model minus a cool-skin corrections? Does the AERI value play are part in this?

AC: Yes the dots represent the mean of the modeled cool skin correction minus the MAERI skin measurements. The figure captions have been updated.

RC: *Fig. 6. The caption says this profile is 'normalized' to the mean SSTSkin value. Is that from AERI? Also, I think of normalized as divided by; perhaps 'referenced to' is better?

AC: We have updated the caption for this figure.

RC: *Fig. 7. What are these profiles referenced to?

AC: This figure presents the mean temperature difference between the modelled and in-situ measurements for all of the available data for these 3 field experiments. It was an attempt to summarise the model skill over the different in-situ regimes.

Interactive comment on Ocean Sci. Discuss., 9, 3851, 2012.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

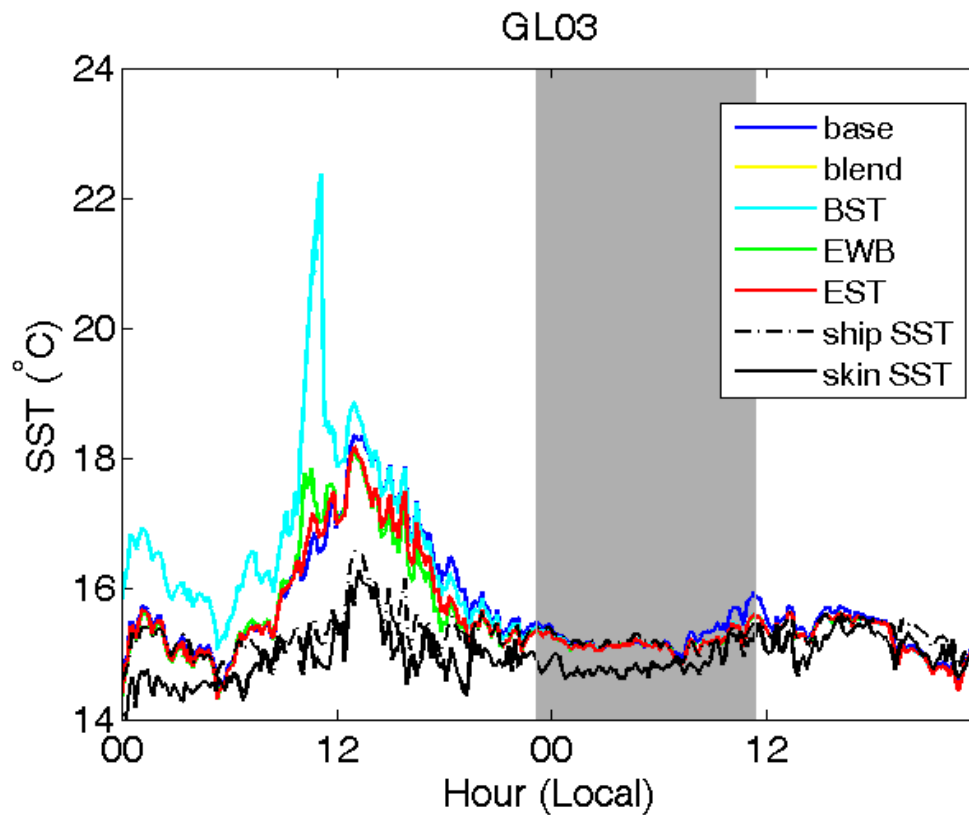**Fig. 1.**