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Comment on os-2020-125

Anonymous Referee #2

Referee comment on "Spatial and temporal variability of solar penetration depths in the Bay of Bengal and its impact on sea surface temperature (SST) during the summer monsoon" by Jack Giddings et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2020-125-RC2, 2021

Comments on the manuscript entitled Spatial and temporal variability of solar penetration depths in the Bay of Bengal and its impact on SST during the summer monsoon authored by Jack Giddings et al.

General comments:

The study utilizes use observations of downwelling irradiance from a glider and three floats to determine the spatial and temporal variability of solar absorption across the southern Bay of Bengal during the 2016 summer monsoon. The effect of changing scale depths of blue wavelength band on the Chlorophyll-a (Chl-a) concentration and SST are estimated and discussed in terms of the physical processes (e.g. summer monsoon current variability, eddy location, etc). KPP model used with different R and h2 optical parameters to examine the sensitivity of Chl-a (blue band e-folding depth) to SST. The unique measurements from the glider and three profiling floats are well presented in the paper. Overall, the paper is written well and figures are of good quality.

Specific comments:

Section 3.1: The glider measurements are discussed to explain the Chl-a variations in time vs. depth over the region of glider deployment. The BoB is known for having sharp horizontal gradients of properties (T, S, and maybe Chl-a). In the eddy region, these sharp gradients are likely to form. However, the results discussed in this section appear to assuming spatial homogeneity in the area covered by the glider trajectory. One possible solution could be to plot along-track profiles.

In Figure 2, What are causes of the measured (flagged) PAR values departing from the fit. Do we consider PAR values inaccurate in upper few meters or the double exponential fit method is not well-suitable close to surface? How would it affect the calculation of heat terms and SST (change in SST due to Chl-a)?

The glider and float 629 are very close in the first week of July (as seen in Fig 1) but their h2 values differ a lot and appears out of phase between these two measurements. Is it due to different sensors used on glider and float or a calibration issue, or due to any other process?

Line 369-293: The effect of changing h2 depths on the SST is described here. A major concern is that the SST differences among different h2 values prescribed in model shows a progressively increasing differences in SST with the increasing time of simulation. At the beginning of simulation all the SST curves are aligned and by the end of July month, the difference is largest. This points to the possible issue with a drfit in model. The precipitation events after 15th July changes the absolute magnitude of SST in all experiments but the difference in SST remains unaffected by precipitation.

Lines 63-74: Assimilation of satellite-derived Chlorophyll (Chl) concentration would

improve the simulation of Chl on the surface. But, the radiation attenuation occurs in the water column. How these climate models simulate the vertical profiles of the Chl? That would determine their ability to correctly representing radiation attenuation in the mixed layer and, therefore, the SST simulation.

Lines 196-201: Radiation penetration is wavelength dependent and its attenuation is a function of Chl-a concentration and water quality. Red wavelengths are absorbed in top 1-2 m but there are other intermediate wavelengths between red and blue. Only red and blue wavelength bands are referred. What happens to other intermediate wavelengths? How these are treated? Would it affect the overall estimate of SST change?

The water types are determined dynamically in space and time? Can we consider water type (h2 value) to be same for a period of one month?

Line 241: 'The position and velocity of the SMC relative…..south-central BoB'. There could be some contribution to the Chl-a in the south-central BoB from the productive southwest coast of India (apart from the source in the south of Sri Lanka).

In Figure 3(d), Chl-a increases in near-surface layers during 16-17 July. What are possible reasons for this increase? Is it advection-driven to a chance of upwelling (noticing a decrease in Chl-a just below the thermocline in the corresponding period).

Line 360: Apart from the varying h2 values (14 m, 17 m, 19 m, 21 m and 26 m), you also have changing R values in different experiments? Since the two parameters are being changed in each sensitivity expt, one should be careful in checking that it should not affect the inferences drawn from the experiments (i.e. relating to only h2 variations).

In Abstract: Chlorophyll influences regional climate through its effect on solar radiation absorption and thus sea surface temperature (SST) --- Chlorophyll affects climate through other processes as well (e.g. air-sea gas exchange, CO2 uptake).

Mention in figure caption- what do the error bars indicate in figure 4?