

Interactive comment on “The effect of seasonally and spatially varying chlorophyll on Bay of Bengal surface ocean properties and the South Asian Monsoon” by Jack Giddings et al.

Anonymous Referee #2

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This paper is well written, well motivated and timely. Understanding the impact of surface chlorophyll on the SST is a new emerging area of satellite oceanography and a multidisciplinary dynamical issue that needs attention. Application of coupled ocean-atmosphere model is thus a reasonable approach using observed chlorophyll data to force the coupled system and understand the sensitivity of SST response to changes in the chlorophyll behavior.

It would be useful if the authors would comment on the following aspects of their simulation and interpretation.

1. It would be good to quantify the impact of chlorophyll on the changes in SST. Maybe

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the Abstract or the Conclusion could capture this important aspect.

2. Could the authors clarify the errors in their estimates of impact, given that the horizontal resolution of the effective coupled model is actually governed by the 90 km grid spacing of the MetUM-GOML3.0? I understand that the 4km satellite observations have been re-gridded to the 90km model grid. If this is not correct, could the authors specify the horizontal resolution of the ocean model (which is really okay for the vertical – with 100 levels in the upper 1000 m, of which 70 levels are in the top 300m)?

3. Given the 90 km horizontal resolution of the ocean model, how reliable are the inferences for the “coastal chlorophyll impacting the SST” results? Is there really a coast in the ocean model? Should we interpret them as near-coastal? The whole BOB would be a 25 x 25 grid ocean at 90 km resolution. Most of the coastal regions are resolved by such a grid with less than 2 grid points. Maybe the authors could clarify this with care, so that future studies can build upon this limitation.

4. Furthermore, as authors point out in lines 205-212, there are lots of missing values of h2 in coastal regions (not surprisingly) – this again could influence the inferences in lines 384-400. Please also see comment 7 below.

5. The first paragraphs of Section 3.1 and 4.1 are hard to follow. This reader was getting very confused with the increase/decrease and high/low ordering of sentences. Maybe talk about changes focusing on regions first and then the months. A minor issue is the frequent usage of the phrase ‘in reality’ in both paragraphs. This phrase occurs five times in lines (233-239) and another five times in lines (264-271) – almost once in every sentence. Maybe use ‘observed’, ‘satellite’ etc.

6. Lines 245, 257 – the superscripts for units did not come through in my downloaded version. There are other similar occurrences throughout the paper. Please check.

7. It is encouraging to note that the authors have used the Satellite-derived chlorophyll concentrations to h2 using a fifth-order polynomial parameterization. They reported the

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improvement of SST and precipitation in the coastal region. However, the coastal BoB is mostly dominated by river water, where the above algorithm (5th order polynomial to get h2) might not be totally applicable. The authors have actually interpolated and/or extrapolated to fill the data gaps (page 5, 205). This could possibly lead to a positive bias in precipitation in the head BoB in the post-monsoon period (Figure 8). Could the authors please clarify these two aspects or limitations.

8. The BoB is a highly eddy-active region, which has a significant impact on the chlorophyll distribution and on the air-sea interaction (page 13, 570). The authors could expand on how finer resolution ocean models might be helpful in the future for resolving both eddy activities in the open region and mesoscale to sub-mesoscale features in coastal BOB.

9. In the BoB (like in other oceans), Chlorophyll maxima is generally not at the surface level. It varies from 10 m to 80 m (Pramanik et al., 2020). The impact of the deep chlorophyll maxima and its relationship with the surface chlorophyll and SST variations may be explored in a separate future work, but worth a mention.

Reference:

Pramanik, S., Sil, S., Gangopadhyay, A., Singh, M.K. and Behera, N., 2020. Interannual variability of the Chlorophyll-a concentration over Sri Lankan Dome in the Bay of Bengal. *International Journal of Remote Sensing*, pp.1-18.

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