

## ***Interactive comment on “Importance of vertical mixing and barrier layer variation on seasonal mixed layer heat balance in the Bay of Bengal” by Ullala Pathiranage Gayan Pathirana et al.***

### **Anonymous Referee #2**

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The authors used time series data from six RAMA moorings to investigate the importance of vertical mixing and the barrier layer (BL) on the ML heat balance in the Bay of Bengal. Study on the vertical mixing, BL and ML heat balance is always interesting for a region like Bay of Bengal (BoB). The figures are of good quality. However, the manuscript needs a major revision before it gets accepted. Below are my concerns for the manuscript.

1. There are few already published works (Girishkumar et al., 2011; Girishkumar et al., 2013) used the RAMA data at the same locations as this study and discussed about the mixed layer heat budget, mechanism of BLT variation, importance of BLT, temperature

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inversions and vertical processes on the ML heat budget. So, the authors need to be very specific what is new in this study that was not known from the previous studies.

2. In my opinion, “vertical mixing” is not the right representation of  $q_{-h}$  in the title and abstract. The term  $q_{-h}$  in the MLD heat budget equation represents the heat flux through the base of the ML. This represent the vertical mixing at the base of the mixed layer. The way “vertical mixing” used in the title and abstract, it points towards vertical mixing processes in the water column. That’s why, when  $q_{-h}$  is defined as vertical mixing, the statement in line 38 is misleading as the BLT always suppresses vertical mixing. Re-wording “vertical mixing” in the title and the abstract would be useful.

3. The study used data from the RAMA moorings at location 15, 12, 8, 4, 1.5 and 0 N. Then why the figures 3-7 and 9 do not show fields at all the RAMA locations? It is very hard to follow the results comparing the central and southern BoB.

4. A figure or table for the RAMA data coverage will be useful.

5. What is the justification for selecting the averaging months for summer monsoon? In general May is considered as the pre-monsoon because the summer monsoon sets in around the beginning of June.

6. Figure 4: At which RAMA location?

7. Figure 5: Why there is a patch of the higher amplitude of temperature gradient and stability at 40m depth?

8. The poor vertical resolution of the data raises concern about how well the stratification has been resolved from this data. The authors can check the stability profiles computed from nearby other observation data with higher vertical resolution.

9. It is not clear why NCOM fields were used. How accurate are the NCOM fields in this region? 10. Line 118: The MLD criterion is not clear. Is it density change by  $0.125\text{kg/m}^3$  or density change equivalent to  $0.8\text{C}$  temperature change?

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11. Line 165: Section 3.1 discusses about ILD, MLD, BLT, stratification which are not the surface conditions. Then why “surface conditions” in the section title?
12. Line 221-223: Where is the evidence? Any figure or reference?
13. Separating the importance of  $q\{-h\}$  and BLT into two subsections might be useful.
14. Line 325: What is the “missing source”?
15. Table 1: Why correlation is smallest at 4N and higher towards north and south?

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