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Interactive comment on "Evaluation of an operational ocean model configuration at $1/12°$ spatial resolution for the Indonesian seas – Part 1: Ocean physics" *by* B. Tranchant et al.

Anonymous Referee #2

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General Comments:

The authors present in this manuscript a specific configuration of a regional model that has been optimized for the Indonesian region (INDO12). A particular focus of this work is improving the diapycnal mixing due to internal tides, which is indeed very important to the accurate reproduction of subsurface stratification and water mass properties in the region. For the most part, the model does quite well in recreating observed transports, and in generating water masses with accurate temperature and salinity characteristics in the interior Indonesian seas. Therefore, the model in this configuration may provide a valuable tool for studying the factors that influence water mass generation in the area, as well as being a potentially useful means of predicting biological productivity

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(the core motivation for the project).

As the authors acknowledge, there are some weaknesses to the model simulation as it currently exists: notably, a Luzon Strait transport that is much weaker than in observations, and a substantial warm and fresh bias in the South China Sea which may affect the transport of water masses through the Indonesian region. To further clarify possible sources of these biases, I have the following general suggestions:

(1) In addition to comparing T-S diagrams from the INDO12 model with in-situ observations and the parent model, it could be illuminating to see comparisons of the upper ocean stratification (as a function of depth). In particular, any biases in the mixed layer depth (MLD) could have an effect on SSS and SST, and also influence water mass characteristics when these surface waters are subducted. The high vertical resolution of this model configuration (1 m near the surface) offers the potential for in-depth analyses of what sets the MLD and stratification in the upper ocean. An in-depth analysis of this is likely beyond the scope of this paper; but as a start, it would be useful to see a validation of the upper ocean stratification. Perhaps the most straightforward way to do this is to show bias and RMSD of temperature and salinity at given depths, for the profiles that are already used to plot Fig. 14 and 15. A similar analysis could also be applied for the INDOMIX measurements.

(2) In a similar vein, it would also be helpful to see how the profiles compare to observations as a function of depth near the Luzon Strait (i.e., the profiles shown in Fig. 14). In this case, it would probably make sense to plot profiles west and east of the strait separately, and perhaps give each individual profile a specific color or identifying marker, given the low number of total profiles.

Specific Comments:

p. 6616, lines 21-23 – It would be helpful to include approximate values of the eddy diffusivity generated from the parameterization here, i.e., 1.5 cm^2/s, or the range 1-2 cm^2/s. I realize these values are mentioned in Koch-Larrouy et al. (2007), but

including them here would allow for easier comparison with other modeling studies in this region (e.g., Jochum and Potemra, 2008).

p. 6623, lines 18-20 – The weak to moderate El Niño in 2006 would have likely acted to decrease the total transport in INSTANT, therefore it does not help explain the discrepancy between INSTANT and INDO12. On the other hand, the strong positive IOD in 2006 certainly did play a part in enhancing the transport. Moreover, there was a La Niña in place in 2007-08, which would also be of the correct sign to explain the discrepancy. So the INDO12 – INSTANT difference could be attributed to a combination of the positive IOD in 2006 and the La Niña in 2007-08.

p. 6623, lines 22-23 – In the case of 2008, there was a weak positive IOD and (at least) a weak La Niña, and these together might have enhanced transport. It might be better to rephrase this sentence as "In 2008 and 2013, ENSO and IOD signals were generally weak but the simulated ITF transports were among the largest in the period, particularly in Ombai and Timor straits."

p. 6624, lines 6-10 – Based on Fig. 8, I would characterize the relative transports of Timor Passage and Ombai Strait differently. Namely, it seems that the Timor Passage transport compares favorably to INSTANT measurements, but the Ombai Strait transports are substantially weaker than INSTANT measurements.

p. 6627, lines 11-12 – Are the model "measurements" (i.e., blue dots in Fig. 13) coincident in time with the INDOMIX measurements? Are the model means (both for INDO12 and the parent model) daily or monthly averages at the given locations, or are they averages over another time period?

p. 6628, lines 14-16 – In addition to the parent model having insufficient vertical mixing (most evident at S4 and S5b), there seems to be a persistent salty bias within and at the entrance to the Halmahera Sea (S0-S3). What might account for this, and for the fact that it does not seem to be present in the INDO12 simulation?

Figures 2 and 3: What exactly is being plotted in the colorbar? It seems like the current speed at 16 meters (in units of m/s) but the quantity and units need to be specified.

Figure 5: If amplitude differences are given by the colors of the squares and circles (as indicated by the colorbar), how are the phase differences indicated? It would also be helpful, though perhaps not necessary, to include text labels at the top of the figure that indicate FES2012 – obs (for left column) and INDO12 – obs (for right column).

Figure 9: For what depth is the salinity plotted? The text in the upper-left corner says "depth = -92m", but if this is the depth it would be good to also say in the caption "Color shading indicates salinity at 92 m depth".

Figure 13/Table 3: It would be helpful to include a map showing the locations of the INDOMIX moorings, rather than having to consult Table 3 and then cross-reference with another map. This might be added as a panel in Fig. 13; if this is done Table 3 probably is not necessary. Alternatively, the authors could include the locations of each mooring below the panel, e.g. "Halmahera Strait (S1)".

Figure 13: The distinction between the INDO12 points (blue dots) and the INDO12 means (light blue line) needs to be made clearer here. Are the model means a daily average, or an average for the month of July 2010? This should be explained either in Section 3.5.2 of the text, or in the caption. In either case, the caption needs to be clear that the blue dots are model values that are co-located with the INDOMIX profiles (if that is the case), and the light blue line is a temporal (and spatial?) average.

Figures 14a and 15a: The key in the lower-right corner is confusing; the circles are barely visible and do not help the reader identify what the circles on the map represent. As it seems like the circles are color-coded (blue for temp/psal measurements, green for temp only measurements, yellow for sal only measurements), the key should show this instead. It might also be mentioned in the caption that the brightness of the blue circles indicates the density of observations in the area.

Figure 14: It is not clear from the figure where the 8 observation points are distributed in the region. If the observations were more evenly distributed this would not matter. However, since there are only 8 observation points clustered in different corners of the region, it would be helpful to know where each profile shown is in relation to the strait. Perhaps the best way to do this would be to show separate T-S diagrams for the measurements near the Philippine coast west of the strait, and for the measurements east of the strait.

Figure 16 and 19 captions: It needs to be specified that the panels on the right show the bias of the INDO12 dataset relative to the Aquarius/AMSR-E and ARGO datasets. The text "ARGO (JAMSTEC)" should probably have the order switched, as the JAMSTEC dataset itself does not consist solely of ARGO data. So this could be replaced by "JAMSTEC (ARGO + TRITON + CTD)".

Technical Comments:

p. 6613, line 14 – Replace "get" with "are".

p. 6613, line 22 – Replace "physic" with "physics".

p. 6614, line 8 – Replace "to progress" with "from progressing".

p. 6614, line 12 – Replace "exits" with "exit".

p. 6615, lines 14-15 – Possibly replace "vertical eddy diffusivity values into numerical models" with "vertical eddy diffusivity values for use in numerical models".

p. 6622, line 11 – Replace "Talley et Sprintall (2005)" with "Talley and Sprintall (2005)".

p. 6624, lines 7-8 – Replace the word "unbalance" with "imbalance".

p. 6625, line 19 – Replace "boundaries" with "boundary".

p. 6626, line 22 – Replace "suffer" with "suffers".

p. 6626, lines 24-26 – Rephrase this sentence, perhaps something like: "Fortunately,

the INDOMIX cruise occurred during the period of our simulation, providing a unique dataset to validate our model."

p. 6631, line 12 – Replace "excepted" with "except".

p. 6631, line 15 – Replace "(non-symetric)" with "(non-symmetric)".

p. 6631, line 24 – Replace "West-Sumatra" with "west Sumatra".

p. 6632, line 8 – Replace "excepted" with "except".

p. 6632, line 9 – Replace "where bias tends to be negative" with "when bias tends to be negative".

p. 6632, line 12 – Replace "are quite similar than" with "are quite similar to".

p. 6632, line 13 – Replace "pacific" with "Pacific".

p. 6632, line 15 – Replace "Java sea" with "Java Sea". More generally, where there are the names of specific seas (e.g., Timor Sea, Andaman Sea), the first letter of "Sea" should be capitalized.

p. 6632, line 18 – Replace "both dataset" with "both datasets".

p. 6633, line 15 – Add an apostrophe to the end of "clouds", i.e., replace "the clouds influence" with "the clouds' influence".

p. 6634, line 18 – Replace "excepted" with "except".

p. 6637, line 11 – Replace "SST dataset" with "SST datasets".

Table 2: Commas in the INSTANT % column (specifically 17,3 and 32,7) should be replaced with periods (17.3 and 32.7).

Figure 4: What are the units of the EKE shown? This should be in the caption or next to the colorbar.

Figure 7: Specify the units of velocity (presumably m/s).

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Figure 8: In the caption, the color for the Ombai Strait transports should be spelled "brown".

Figure 9 caption: Replace "water masses" with "water mass".

Figure 10-15 captions: Replace "Salinity (PSU) and Temperature (°C) respectively along x and y axes" with "Salinity (PSU) and temperature (°C) are plotted along the x- and y- axes respectively."

Figure 11: In the caption, the PSY3V3R3 climatology is labeled with a yellow line, not a green line.

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