ANSWERS TO EXECUTIVE EDITOR

In particular it would be helpful to the reader to add the oceans model name and version to the title and maybe also the setup name. I noticed that you submitted to the NEMO
special issue, but this is not instantaneously clear to a reader looking at the general list of GMD articles. Therefore I suggest to change the title to
"Evaluation of an operational ocean model (NEMO2.3) configuration at 1/12° spatial resolution for the Indonesian seas (INDO12). Part I: ocean physics" in accordance to our Editorial upon revision for the final publication in GMD

As suggested, we changed the title, now, it is:
Evaluation of an operational ocean model (NEMO2.3) configuration at 1/12° spatial resolution for the Indonesian seas (INDO12). Part I: ocean physics

Additionally I would like to encourage you to add a Code and Data Availability section at the end of the article stating how NEMO and your specific setup can be accessed by other scientists.

We added a new section '**Code and Data Availability**' at the end of the manuscript.

The INDO12 configuration is based on the NEMO2.3 version developed at Mercator Ocean. All specificities included in the NEMO code version 2.3 are now freely available in the recent version NEMO 3.6, see the NEMO web site http://www.nemo-ocean.eu. World Ocean Database and World ocean Atlas are available at https://www.nodc.noaa.gov. Aquarius data L3 (V3.0) data are available at http://podaac.jpl.nasa.gov/dataaccess.
AMSR data are produced by Remote Sensing Systems and sponsored by the NASA Earth Science MEaSUREs DISCOVER Project and the NASA AMSR-E Science Team. Data are available at http://www.remss.com.

ANSWER TO REFEREE # 1

General Concerns:

1) INDO12 differs from ORCA12 because it does not include tides that induces important physical processes in the Indonesian region. In addition, the INDESO project includes biogeochemistry and fish population dynamic model. Moreover, the INDO12 model is 'online' coupled to the biogeochemisty model PISCES. As said in the introduction, this NEMO2.3 version has already been successfully applied to the IBI (Iberian-Biscay-Ireland) area (Maraldi et al., 2013).
It has to be outlined that, it is easier to modify (bathymetry) and/or tune parameters and for a regional model than a global one at same horizontal and vertical resolution.
Finally, this kind of regional model is an easy tool to modify and enrich a global version which has been the case for volume transport by modifying bathymetry locally.
A sentence has been added in the introduction in order to show the benefit of having such regional configuration to feed the global model. We also precise the main differences between the 1/12° operational model (PSY4) and INDO12.

As pointed out in the introduction, since mid-September 2014, the entire system (Ocean, Biogeochemistry and Fish population dynamics) is fully operational in Perancak (see http://www.indeso.web.id}) and deliver 10 day forecast/two weeks hindcast on a weekly basis. It is an important issue because the Indonesian infrastructure within the INDESO project were designed and dimensioned for that. It has not been designed for a huge global 1/12° ocean model.

2) We agree that it is a short run, but because we needed a simulation forced by an operational global model, the only longest available period with PSY3 was 2007-2013. Note also that operational PSY4 system has a shorter hindcast period (only from 2013) that is also a reason why PSY3 has been chosen to force the regional model. Comparisons with parent model (section 3.7) give a first indication on the biases origin. Nevertheless, it is always difficult to sum up by choosing initial and/or boundaries conditions rather than model itself. There are certainly many interrelated reasons for these biases.
As mentioned in the conclusion, new boundary conditions from the new 1/12° global ocean forecasting model are also planned and should be more consistent (same horizontal resolution and same bathymetry).
We agree that for deeper T/S analysis, it is highly dependent on the initialization. Moreover, all new Mercator ocean systems will start from the WOA 2013 instead to start from WOA2005 (PSY3) and WOA2009 (PSY4), see Lellouche et al., 2013. It is an important issue in this region where few data exist to constraint the model with the data assimilation system.

3) We put the SSS and SST results after the SSH/EKE section. As suggested by the referee.

4) We changed Figures and captions in many cases. See new manuscript.

5) We tried to homogenize the manuscript in order to produce a coherent style. We proofread text for clarity, readability, spelling and grammar.

More specifically.

-**page 6613, line8:** The companion paper (Gutknecht et~al., 2015) has been mentioned in the abstract.

-page 6613, line15: The suggested complicating factor has been added. “An additional complicating factor comes from the internal variability associated with ENSO.”

-page 6616, line20: The following reference has been added. Umlauf and Burchard, 2003.

-page 6618, line16: The Global Ocean Forecasting System comes from Mercator Ocean and it has been added into the text.

-page 6619: We are not sure that a comparison of INDO12 surface current with OSCAR products is adequate. Indeed, OSCAR products have a lower resolution (1/3°) and have a larger error at the equator for zonal current if you refer to the following paper. As an example,
Eric S. Johnson, Fabrice Bonjean, Gary S. E. Lagerloef, John T. Gunn, and Gary T. Mitchum: Validation and Error Analysis of OSCAR Sea Surface Currents. J. Atmos. Oceanic Technol., 24, 688–701.doi: http://dx.doi.org/10.1175/JTECH1971.1, 2007.

Nevertheless, we plotted equivalent OSCAR currents to Figure 2(left) and (right), see attached files. You will see that in the Pacific and Indian oceans (open ocean), we have the same patterns but close to the coast it is difficult to compare. For example, the NGCC does not appear in the OSCAR product and magnitude of currents in the ITF (Lombok, Ombai and Timor) is generally weaker from the OSCAR product.

-page 6619, line 23: This sentence was just to mentioned that several studies made the link between the SJUC and Kelvin waves in this particular area.

-page 6620, line 5: Actually, there is a mistake, it is “high frequency oceanographic signals” without comma. It refers to the Dynamic Atmospheric Correction (D.A.C.) that needs to be applied to altimeter data. It allows removing high frequencies signals forced by atmosphere (pressure and wind) and aliased in altimeter data because of bad temporal sampling of altimeters.

-page 6620, line 10: We agree with the referee. On both sides of Luzon Strait, a discrepancy exists between AVISO and INDO12. EKE from INDO12 is certainly too weak which corroborates the weak inflow as mentioned in the section 3.6. We add the following sentences into the text.
“On both sides of Luzon strait, EKE from INDO12 exhibits weaker values than EKE derived from altimetry data (AVISO). These weak EKE values corroborates the weak inflow as mentioned in the section 3.6.”

We also modify the sentence p6620, line10 : “Excepted in coastal regions, EKE from INDO12 and EKE derived from altimeter data have the same strongest values at the same locations.”
by
“Excepted in coastal regions, EKE from INDO12 and EKE derived from altimeter data have the same patterns for strongest values.”

-page 6621, line 13: Low frequencies are associated with large scale patterns correlated over hundreds to thousands of kilometers. In our spectral analysis, they corresponds to frequencies smaller than 10^{-1} which corresponds to period larger than 1 week. This precision has been added into the text.

-page 6623, line 2: We only made a focus on ITF transport by considering the three major outflow passages and then compared to INSTANT estimates. It is why we do not discuss the Torres strait. Moreover in our 1/12° ocean model (13 levels in the top 20 m) , it is not significant, we found a yearly eastward flow of approximately 0.1 Sv which is very low and the same order of magnitude than Wolanski et al., 1988 who found 0.01 Sv for 5 month of measurements. Moreover, from 5

months of current observations, Wolanski et al. (1988) found a strong tidal flow, but no evidence of a mean flow through Torres Strait.
In 2005, Gordon 2005 said that the ~10 m deep Torres Strait between Australia and New Guinea does not permit significant throughflow in Oceanography of the Indonesian Seas and their Throughflow.
In addition, Schiller et al, 2008 with an Eddy-resolving ocean model wrote that Torres Strait is a very shallow (20 m) strait. They found that even in a 1/10° model with 10 m vertical resolution near the surface the shallow circulation of Torres Strait is not well simulated. They therefore refrain from an investigation of its transport.
Van Sebille et al., (2014) found (with the same horizontal resolution) that the Torres strait is 1 Sv. Given that few measurements exist and that a lot of articles show the difficulty to well represent the Torres strait, the results of Van Sebille et al., (2014) is quite surprising. This discrepancy could be due to the fact that in van Sebille et al., it is a free model run forced by an ocean model without any data assimilation.

Wolanski, E., Rido, E., Inoue, M., Currents through Torres, Journal of Physical Oceanography, 1988, 18: 1535-1545.
Schiller et al, 2008, Eddy-resolving ocean circulation in the Asian–Australian region inferred from an ocean reanalysis effort, Progress in Oceanography 76 (2008) 334–365.
Gordon, A. L.: Oceanography of the Indonesian Seas and their throughflow, Oceanography, 18, 14–27, doi:10.5670/oceanog.2005.01, 2005.

page 6623, line 16: We add the van Sebille et al. (2014) reference into the text.

page 6624, line 2: In order to be more precise these following sentences has been added into the text.
“Indeed, the ITF transport variability would be linked both to spatial patterns of SLA and to zonal wind stress anomalies. During concurrent La Niña and negative IOD events (e.g. 2010), a stronger SSH signature exists in both Pacific and Indian Oceans with higher SLA throughout the Indonesian Archipelago. In the same time, a westerly winds anomaly (September-December) in the tropical Indian Ocean would lead to reverse the upper layer ITF transport (Lombok, Ombaï and Timor) via downwelling Kelvin waves.
Whereas during a solo La Niña event (no occurences during 2008-2013), only a slight SLA imbalance exists in the Pacific latitude bands around 5-10°. This leads to off-equatorial Rossby waves which results in an increase in Timor volume transport as suggested by Clean et al., 2005.”

page 6630, line 20: We agree with the Referee remark. We remove this footnote. All relevant informations concerning Aquarius V3.0 level 3 can be found on the Aquarius web pages.

page 6631, line 16: We agree with the Referee above 10°N in the Pacific Ocean but not around 2°N. Around 2°N, biases are quite similar but stronger for Aquarius as written in the next sentence. We modify the sentence:
“Biases relative to each dataset are consistent for the same coverage except in the northern Pacific (above 10°N) where SSS data are probably polluted by strong RFI (Radio Frequency Intereference), see Kim et al., (2014) and Le Vine et al., (2014).

page 6631, line 25: RMSD means Root Mean Square Deviation. It has been added into the text.

Page 6632: We suppose that the referee write about SSS not SST. Actually, the first sentence (line 1) was just to point out the fact the negative bias is enhanced during the monsoon. In this section, the seasonal aspect is not the main point and it is not discussed.

Page 6632, line 4 and Page 6635 line 12: Globally replaced by Overall

Page 6632, line 26: We modify the sentence. “There is only one important region where the INDO12 SST is significantly too cold, it is in the southern part of the INDO12 domain, i.e. in the southern tropical Indian Ocean. “

Page 6636, line 26: “wiggles” has already been employed in different papers to describe a zigzag pattern.

See papers:

Small scale turbulence and mixing in the ocean, proceeding of the 19th international Liege Colloquium on ocean hydrodynamics edited by J.C.J. Nihoul and B.M Jamart.

Or in

Ffield,A. and Robertson,R.: Temperature finestructure in the Indonesian Seas,J. Geophys. Res., 113, C09009,doi:10.1029/2006JC003864, 2008.

ANSWER TO REFEREE # 2

General Suggestions:

(1) As suggested by the referee, bias and RMSD of temperature and salinity between observations and models have been added, see Figures 21 and 23. It is also true that biases found in the MLD could have an effect on SSS and SST, mainly in region where vertical mixing is crucial.

(2) T/S profiles and statistics (bias and RMSD) have been plotted on each side of LUZON strait as suggested by the referee.

Specific comments:
p.6616, lines 21-23 - We included two following sentences:
In semi-enclosed seas, an approximate value of 1.5 cm2 .s−1 for
eddy diffusivity has been estimated by Koch-Larrouy et al. (2007). Note that this background diffusivity is the same order of magnitude as that used by Jochum and Potemra (2008).

p.6623, lines 18-20 - The suggested paragraph has been included.

p.6623, lines 22-23 - The suggested paragraph has been included.

p.6624, lines 6-10 - We agree with the referee and we included the suggested sentence.

p.6627, lines 11-12 - For clarity, Figure 13 has been modified. The new Figure is Figure 20. Now, are only compared collocated T-S diagram models (INDO12 and PSY3) at in-situ locations. PSY3 data come from daily averages and INDO12 data come from hourly instantaneous mooring at the same time than INDOMIX moorings. It is also point out on the figure caption.

p.6628, lines 14-16 – In the parent model, a systematic salty bias (compared to WOA2013) exists in this area. That is the reason why compared to INDOMIX data, this bias still appears. It is certainly due to a wrong initialisation of the parent model that is unfortunately not constrained by data assimilation in this area because of a lack of available data.

Figures 2 and 3 – Units have been added.

Figures 5 – Caption has been changed. In fact, it is the module of the complex difference of surface tidal elevation which necessarily includes amplitude and phase. Text labels at the top of the figure have been added.

Figures 9 – Caption has been modified

Figure 13 – Table 3 has been removed and a map of profile locations has been added (see Figure 19). Figure 13 has changed, now it is Figure 20. As asked by the referee, bias and RMSD have been added, see Figure 21a,b,c,d,e,f. T/S diagrams have also changed. Now, collocated model variables (INDO12 and Parent model) to in-situ data are shown.

Figures 14a and 15a have changed for clarity.

Figure 14 has been modified. Now it is Figure 22 and 23. Two areas are shown, one is on the eastern side of Luzon strait and the other on the western side of Luzon strait, as suggested by the referee.

Figure 16 and 19 captions: Suggested modifications have been taken into account. Now, it is Figure 7 and 10.

Technical Comments: All suggested modifications have been taken into account.