Nat. Hazards Earth Syst. Sci. Discuss.,
doi:10.5194/nhess-2016-60-RC1, 2016

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Comparison and validation of global and regional ocean forecasting systems in the South China Sea" *by* X. Zhu et al.

L. Lusito (Referee)

letizia.lusito@cmcc.it

Received and published: 31 March 2016

1. General comments

First of all, I would like to congratulate all the authors for the good scientific level of the work presented in this paper.

This paper addresses the relevant problem of comparison and validation with real observations of two ocean models (SCSOFS and MO) in the South China Sea, an area which is becoming more and more strategic. Ocean models, in general, are the key to improve our knowledge of the sea state, present and future, on which to base political, environmental, economical decisions by governments and other stakeholders. In this respect, this issues are relevant not only to the general themes addressed by this journal, but also they are especially relevant in the context of this special issue subject

Printer-friendly version

Discussion paper

'Situational sea awareness technologies for maritime safety and marine environment protection'.

The results described here can be considered innovative; in fact, even if the South Cina Sea Ocean Forecasting System for the regional modelling of the south China Sea, and the global Ocean model, developed by Mercator Ocean, have been described in previous works, their comparison and validation with real observations in the South China Sea is a new important result that will allow a substantial improvements of the ocean forecasting capability in the area. Moreover the paper shows how both models could be improved regarding the forecast skills in case of devastating events like typhoons which are unfortunately not rare in that region.

The title is clear and reflects the content of the paper. The abstract provides a good summary of the results and of the conclusions that derive from them in a language easily understandable by the average reader. Every section describes clearly a particular aspect of the data, model or method used. The overall length is adequate and a good compromise between a a too-long discussion containing a full description of many technical details and a too short description of the results without a proper introduction of the context, methods and data used.

It is strongly recommended that the English language is revised and improved by a native speaker although the actual form is sufficiently understandable. Some suggestions to improve the text will be reported separately.

Other comments (about units, figures, references, further clarifications) are reported in the next sections.

2. Specific scientific comments

Line 17: explain or define better what you are referring to with the term "mesoscale activities"

Line 74: explain better what you mean with the phrase "where they can then impact

budgets of the tracers"

Line 107: if the satellite data you use are from 2012, what is "April 2014" referring to? The starting date of the SSALTO/DUACS new data system?

Line 109: quoting from the user manual of the L4 altimeter data you are using (and that you cite http://www.aviso.altimetry.fr/fileadmin/documents/data/tools/hdbk_duacs.pdf) "Change of resolution: in DUACS 2014 version, after the feedback from users, the Mercator grid projection with 1/3 x1/3 spatial resolution (Global product) is abandoned. The DUACS 2014 Global products are directly computed on a Cartesian 1/4 x1/4 spatial resolution." Therefore, depending which data you are using, it may be incorrect saying that the products are sampled from the Mercator gridded data so please, specify better if you are using the DUACS 2014 data or a former version (and which one). From the following discussion it seems you are using the DUACS 2014 data.

Line 115: quoting the JMA database description of the MGDSST (http://near-goos1.jodc.go.jp/rdmdb/format/JMA/mgdsst.txt): "Merged satellite and in-situ data Global Daily Sea Surface Temperature (MGDSST): The MGDSSTs are analysed at the Office of Marine Prediction of the JMA with 1/4-degree grid resolution on the near-real-time basis. SSTs derived from satellite's infrared sensors (AVHRR/NOAA) and microwave sensor (AMSR-E/AQUA), and in-situ SST (buoy and ship) are used in the analysis." The list of satellite products here does not match the list of satellite products you mention in the paper

Line 122-127 please clarify in the paper that the reason for which you are using the "AVHRR-only" data is because the production of the AVHRR+AMSR data ended in 2011. Otherwise questions might arise on the impact of the usage of "AVHRR+AMSR" data in your analysis and how the results might differ from the results using "AVHRR-only" data.

Line 137-138: just for my education: why to filter out the tidal signal you use a period of 25 hours and not, for example 24 hours? Same, why did you use a 25-hour period

to calculate the daily average?

Line 140 and following: you mention that there were 5 cruises to measure the temperature/salinity data but you use data from only two of them for the TS distribution comparison? Why only two? Why do you use the data from these particular cruises? Are the data from the remaining three cruises significantly different in some ways? What changes/improvements/impacts do you expect when using all the data available?

Line 244: be more specific than "little stronger than AVISO" For example you can add a time-series-like plot showing the basin-averaged, minimum and maximum velocities (in separated components u and v) for the two models and the satellite observations in the four months. On the x-axis you have the 4 time steps (Jan, Apr, Jul, Oct.), on the y-axis 3 u-velocities (min, max, basin-averaged) for each of the two models and the observation. Same for v. Alternatively, at least quote the basin-averaged velocities in the text. From the Figure only, it is very difficult to distinguish the length of the vectors hence to have an estimation of the magnitude of the velocities. Moreover, while on lines 243 you say that AVISO shows currents that are smaller than MO or SCSOFS, at lines 249 you say that AVISO has comparable velocities to MO and SCSOFS has smaller velocities so there is an incongruence in the text.

Line 260: explain why in your opinion in spring the two models and the observation show each a different type of Kuroshio intrusion. Is this maybe due to some physics effects modelled differently in the two models or boundary conditions not implemented in the best way in the two models. Can you also explain why this effect is visible mainly in spring?

Line 271: i would prefer to use the word "temporal" instead of "phase" bias in this case. The word phase is generally more used when speaking about angles. Do you have an explanation about this temporal behaviour of SCSOFS?

At line 281 you say that the SST has been assimilated in SCSOFS but this is not mentioned when you describe which data are assimilated in the model in lines 187 and

188

At line 286 you say that the SST variation is larger in winter and smaller in summer for both MO and SCSOFS but when looking at Figure 4 this appears to not be true: the absolute magnitude of the variation is much larger for SCSOFS (where you see large blue and red areas) than for MO (where you see prevalent green everywhere) and has the same values (but with opposite signs) for summer and winter; in winter the area that show a large variation is simply larger so it is better to specify the basin-averaged variation is larger. What it seems more correct is that SCSOFS overestimates the SST in winter and underestimates the SST in summer, therefore has a more uniform trend of the SST through the year with respect to MO

Line 287 you quote 3 values for RMSE for each of the models saying that they are the maximum minimum mean monthly but it is no clear what do you mean with "monthly": are these the averaged values over the 4 months or do they correspond to a specific month? In any case please quote the values for each month for a better comparison of the performances of MO and SCSOFS

Line 303: you say that the isohaline is located at 50 km for in-situ data and SCSOFS and at 20 km for MO but this big difference is not so evident in Figure 6 , therefore from Figure 6 it cannot be concluded that SCSOFS performs better than MO when compared to in-situ data. A plot of a vertical profile of TS and the TS bias for let's say 20km, 50 km and 70 km can clarify better the performances of the models in this case.

Line 375 Define what is W

Line 387 Why do you use a period of 24 years for SCSOFS and just one year for MO?

Line 391 You say that all the three results show a small number of eddies in autumn and a larger number of eddies in spring but this is not true for MO when looking at table 1, where MO predicts 13 total eddies for both spring and autumn

Line 395 explain better the oversimplification of SLA calculation for MO and why SC-

SOFS does not suffer from this.

3. Style comments and suggestions

3.1 General

Be consistent with the space between the value and the unit of measure, for example in line 28 you write "1200m" and line 156 you write "0.16 m". As a general reference, the NIST Guide for the Use of the International System of Units (SI) states "7.2 Space between numerical value and unit symbol: In the expression for the value of a quantity, the unit symbol is placed after the numerical value and a space is left between the numerical value and the unit symbol. The only exceptions to this rule are for the unit symbols for degree, minute, and second for plane angle (...) in which case no space is left between the numerical value and the unit symbol."

Change all the "northeastly" in "northeasterly" , "southwestly" in "southwesterly" and all the similar words

Use consistently "coastal currents" or "Coastal Currents" (check for examples line 50-51)

Be consistent in using 1/4 or 0.25 for the horizontal resolutions (for example lines 116 and 119)

In the section about MO (2.4), you keep calling the model PSY4V1R3 systematically without any mention of Mercator Ocean and in the later sections this name (PSY4V1R3) disappears. Please introduce at some point in section 2.4 a clarification like : the PSY4V1R3 configuration described here is indicated for as MO model through this paper.

3.2 References

Bell, 2015 is never used Chu, 2001 is never used Daudin, 2013 never used Weiss 1991, not used Line 167: move the reference to SODA to the line where you first talk

about SODA, i.e. line 91; Line 179: The reference for Barnier 1995 is missing. In the reference there is a Barnier 2006. Please check. Line 185: the reference for Wang et al 2012 is missing. Please check Line 201: move the reference to the Arakawa C-grid to where you first introduce the Arakawa C-grid, i.e. line 152. Line 228 : the reference WOA2005 is missing

3.3 Figures

In general increase the size of the x/y labels especially in the maps and use higher resolution files so that the image does not loose sharpness when zooming in

Fig 1: change the colours for the cruises paths and the mooring station because now they cannot be easily distinguished from the background Moreover, please indicate in Fig.1 more of the channels and seas you name in lines 30-33 to facilitate the non-expert readers in understanding the unique geographical features of the SCS. Reduce the width (or the size in general to keep the aspect ratio) because the label of the scale is outside the printing area so it is missing in a printed version of the paper

Fig.2: report in a separate plot the mean maximum and minimum AGV because it is currently difficult to compare them from the maps shown in Fig.2 or report these values explicitly in the text. Increase the sizes of the labels on the legend and axes. Use higher resolution files. The unity of measure is missing from the scale

Also SSH bias maps can be added (MO minus AVISO and SCSOFS minus AVISO) to evidence better the behaviour of the two models with respect to the observations (analogous to Fig.4 maps)

Maybe you can also change the color map for Figure 4: a red/white/blue (RWB) map is usually more appropriate to represent bias. For example in the actual maps the green color can correspond to bias values of both +0.5 and -0.5; using a RWB map would make more clear the areas where the bias is positive and where it is negative.

Fig.5-6-7-8: units missing from the colorbar

Fig.9: the correlation plots for salinity show a less good linear relationship between MO and SCSOFS and data with respect to the same plots for temperature? Did you try to plot the correlations in different depth ranges to see if the plots show a better linear correlation and if there is a depth range for which the correlation is not good and this degrades the overall linear relationship?

Fig 10: change the colormap so that also the pale yellow structures can be distinguished better from the white background

Fig.11: explain what are the white areas on the map

3.4 Language and typos

Line 12-13: change "Mercator Ocean...in China" in "the global Mercator Ocean Operational System , developed and maintained by Mercator Ocean in France and the regional South China Sea Operational Forecasting System (SCSOFS) by the National Marine Environmental Forecasting Center (NMEFC) in China". I think it is better to underline that MO is a global ocean forecasting system developed by Mercator Ocean, a scientific institution in France.

Line 22: change "AVISO data" in "satellite observations": at this point it is not yet clear to a medium reader what are AVISO data; change "results compared in above" in "outcome of the results comparison"

Line 42-43: change "in the NSCS....in the SSCS" in "is present in the NSCS, while a semiannual/biennial change from a cyclonic gyre regime in winter to an anti-cyclonic gyre regime in summer can be observed in the SSCS" Please note that the word "biannual" is ambiguous; some use it with the meaning of "twice per year" in which case it is better to use the word "semiannual", others use it to say "every two years", in which case it is better to say "biennial".

Line 136 change "abnormal" in "outlier"

Line 142/263: change "See" in "see"

Line 145-147: change "All the measured...correlation analysis" in "The TS data collected from all the 5 cruises will be used to perform a correlation analysis of each of the simulated predictions of MO and SCSOFS models with the observations."

Line 149: change "Ocean" in "Oceanic" and modelling in "modeling". The first correction comes from the original name of ROMS while the second is to align the spelling of the word to the American English rule that you are using in other words (for example as in "analyzed")

Line 208: the value "-1x1010 mˆ4sˆ-1" seems odd, please check in case there is a typo.

Line 216: remove the comma before the parenthesis

Line 218 add a "-" between along and track

Line 221: since it is the first time you mention SSH add the full name: Sea Surface Height (SSH) and remove the full name from line 232 line 267 there must be a typo in "the range of large is less than". Please rewrite. Change "leading" in "anticipating"

line 317 change "ship" in "analysis"

line 320 remove "of relativity"

line 354 substitute "hot" with important

line 367 substitute "SST deceasing" with "SST decrease"

line 415 there is a typo: the first SCSOFS should be changed in MO

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2016-60, 2016.

Printer-friendly version

Discussion paper