Ocean Science
Discussions

Open Access

OSD

Interactive
comment

Interactive comment on "Testing the validity of regional detail in global analyses of Sea surface temperature – the case of Chinese coastal waters" *by* Yan Li et al.

Yan Li et al.

ly_nmdis@163.com

Received and published: 29 March 2019

Dear Referee:

Thank you very much for the helpful comments on our manuscript "Testing the validity of regional detail in global analyses of Sea surface temperature-the case of Chinese coastal waters" (No: os-2018-137). For the revision, we fully considered all suggestions and give the item-by-item reply. Also, we tried our best to improve the English writing in our manuscript. And revised portion are highlighted in yellow in the manuscript. We appreciate for the Reviewer's work and hope that the correction will meet with approval. Once again, thanks very much for your comments and suggestions.

Printer-friendly version

Discussion paper

Best regards

Yan Li, Hans von Storch, and coauthors

Major comments

1. The introduction lacks a general overview on the present state of knowledge about coastal ocean warming worldwide.

Reply: Following with the comment, we have added a general overview on the coastal ocean warming worldwide. The new added context is as follows: A study of SST changes in the world ocean with large marine ecosystems revealed that the Subarctic Gyre, European Seas, and East Asian Seas warmed at rates 2-4 times the global mean rate (Belkin 2009). Recently, Lima and Wethey 2012 using a SST dataset with higher spatial-temporal resolution detected that during the last three decades $\sim 71.6\%$ of the world coastal locations have experienced a warming trend of $0.25\pm0.13°C$ per decade and 6.8% a cooling of $-0.11\pm0.10°C$ per decade. Increase in SST is especially important in coastal areas due to its severe impact in coastal ecosystems (Honkoop et al., 1998; Burrow et al., 2011; Wernberg et al. 2016).

2. Have e.g. previous studies identified the SST difference between coast and open sea at your coast?

Reply: Following with the comment, we have added conclusions of previous studies in the revision: As part of the Northwest Pacific Ocean, the marginal China Seas are located at one of the largest continental shelves in the world, with many coastal upwelling currents (Yan, 1992; Guan 2009; Wang et al., 2012, Xie et al., 2016). Upwelling can cause the upward movement of sea water from deeper layer into the surface layer and cool the SST at the upwelling region. Pohlmann (1987) found a negative surface temperature anomaly along the western South China Sea (SCS) from Gulf of Tokin to the central Vietnam in summer. Forced by a strong westerly monsoon during the 2000 cruise, the maximum upwelling with the coldest water cooler than $23°C$ was centered

off Shantou city of China (Guan 2009). Owing to the coastal upwelling, SST in the coast of the eastern Hainan was 1~2°C lower than ambient offshore water and SST in the Yangzte River Estuary was 2-3°C lower than ambient offshore water; 10m sea temperature in the coast between eastern Guangdong and southern Fujian provinces was lower than surrounding sea water about 5°C (Zhao et al., 2001; Xu et al., 2014; Xie et al., 2016).

3. Why is the near-coastal temperature below the open-sea SST products?

Reply: Our study informs that the near-coastal SSTs are below the open-sea SST products which may due to coastal upwelling in China Seas. And we added the following sentences to further explain the point in the revision: In the China Seas, most of the coastal upwelling currents occur at the ECS and the northern SCS, other small upwelling currents at the tops of the Liaodong Peninsula and Shandong Peninsula (Figure 1). The consensus of previous studies is that coastal upwelling currents results in cooling SST at these coastal areas (Xie S P, 2003; Guan et al., 2009; Su et al., 2012). In our study, we find that the in situ shoreline SSTs at the upwelling areas (e.g. Laohutan station, Shidao station and Dongshan station) are always colder than global gridded SST data, with the value of below -1°C (Table 2, Table 3 in the revision). We hypothesize that these negative differences are connect with coastal upwelling. To test this hypothesis, we examine the output of a numerical simulation of the currents in the South China Sea with a grid resolution of. 0.04°. The model is embedded in an almost global model with 1° grid resolution (Tang et al., 2018). The model used is Hybrid Co-ordinate Ocean Model (HYCOM) that is exposed to periodic climatological atmospheric forcing, with a fixed annual cycle but no weather disturbances. The atmospheric forcing comes from the Comprehensive Ocean-Atmosphere Data set (COADS). We extract simulated SSTs at three different distances (near the station, 50km, and 100km from each coastal hydrological station in SCS). Figure 7 in the revision shows that most shoreline SSTs are lower than ambient offshore SSTs, especially SSTs at 100km from shoreline. However, the stations Beihai (No.22) and Weizhou (No.23) are not affected

by coastal upwelling, and consistently, there are no notable differences among SSTs at three different distances from the two stations. The result reflects that the homogenized SST data set for shoreline stations catch this relative cooling water effect of the regional upwelling currents. On the other hand, the global gridded SST datasets point to higher temperatures which may be caused by their coarse resolution or by the lack of near-shore observations when compiling near-shore box averages in coastal areas (Wang et al., 2018).

Figure 1. Study area and locations of 26 coastal sites (a), for which continuous monthly SST recordings are available and corrected by eliminating inhomogeneities. The identified breakpoints in individual SST stations from 1960-2015 (b).Results from Li et al. 2018. Black circle represents 26 coastal sites and blue arrow represents coastal upwelling.

Figure 2. Simulated SSTs at different distances from each coastal hydrological station in SCS.

General comments:

(1) English language in this article could be improved. Even if I am not a native speaker, I noticed several places where - "the" should have been inserted or avoided, - singular and plural are mixed up, or - inadequate prepositions were chosen. Copy-editing by a native speaker would probably help.

Reply: We made our best to improve the language in the revised manuscript. The changes made will not influence the content and framework of the paper. Here we have not listed the language changes but all of them have been marked in yellow color in the revised manuscript.

(2) Temperature differences are given in °C or in °, this should be changed to K.

Reply: the temperature differences are changed into K in the revised paper.

(3) In those sub-figures where your x axis lists the station acronyms, these are too

small to read. You could plot them alternatingly in two rows, like in the attached figure, and/or rotate the labels by 90 to increase the font size.

Reply: We have redrawn all of the figures in our paper to improve the quality. Combing with the second referee's comment, we modify figures which x axis lists the station No., so as to increase the font size. The modified figures (e.g. Figure 3 and Figure 7) can be found in the revised manuscript.

Figure 3. Comparison of the EOF1 and EOF2 derived from the LH data set of local SST at 26 sites (blue bars; red lines), and derived from the localized analysis data LA-HadISST (yellow bars; black lines). Top: EOF spatial patterns, bottom: principal components (time coefficients).

Figure 7. The mean SST differences at the 26 locations between LH and LA-OISST (1982-2015; red line), LH and LA-ERSST (1960-2015; blue line), LH and LA-COBE SST (1960-2015; green line) and LH and LA-HadISST (1960-2015; black line)

Specific comments:

L29-33: The grammar in this sentence is not precise. Please correct.

Reply: L29-33 "A number of extended historical observed SST products have been used in global climatological community (Boehme et al. 2014; Hirahara et al. 2014), as well as in the regional climate change, for example the China Seas, the Baltic Sea and North Sea (Belkin, 2009; Wu et al., 2012; Stramska and Bialogrodzka, 2015)." is modified as "Long-term historical SST data sets have been extensively used as a source of information on global and regional SST trends and variability (Belkin, 2009; Wuet al., 2012; Boehme et al.2014; Hirahara et al.2014; Stramska and Bialogrodzka, 2015)." in the revised paper.

L35: "the different dataset" -> "the choice of dataset"?

Reply: We replaced the term "the different dataset" to "the choice of dataset" in the revised paper.

L42: larger than what?

Reply: We replaced "larger" by "large" in the revised.

L111-112: What is the difference between "no change of the mean" and "zero change"?

Reply: we replaced L111-112 "At most of the 26 stations, a downward correction has been found necessary – only at two stations (Yunwo and Pingtan) an upward change was stipulated, in one case no change of the mean and in the remaining 23 a downward or zero change." by "At 22 of the 26 stations, a downward correction of the mean has been found necessary – only at two stations (Weizhou and Pingtan) an upward change was stipulated, and in two case nearly no change of the mean (Naozhou and Shidao)" in the revised paper.

L175: which may reflect local effects

Reply: L175 is modified "The local data indicate markedly lower temperatures, which may reflect by local effects" to "The local data indicate markedly lower temperatures, which may mainly be because of coastal upwelling, but also other local effects, including local tidal mixing, sea front, sea water vertical mixing, and fresh water discharge, etc." in the revised paper.

L280: The time series of PC2 is not stationary, it rather fluctuates around zero with no prominent long-term trend.

Reply: No, "stationarity" does not imply constancy but that there is no change of the statistical properties in time. But for avoiding misunderstanding, we replaced "PC2 is mostly stationary" by "The time series of PC2 fluctuates around zero without prominent long-term trend".

L294-297: You mean it confirms the quality of the LH dataset, not the LA dataset, right? The term "alluding to the quality" is a bit unscientific I from my point of view since its interpretation is not clear. Do you consider the fact that the LH is within the range of the LAs' variability as a support for the credibility of the LH dataset?

Reply: Yes, it is support for the LH data set; "Alluding" is a proper English term, but for avoiding irritations, we replaced it by "points to".

References:

Belkin, I.M. Rapid warming of large marine ecosystem, Prog. Oceanogr., 81, 207-213, 2009.

Burrow, M. T., et al. The pace of shifting climate in marine and terrestrial ecosystems, Science, 334, 652-655, 2011.

Honkoop R.J.C., der Meer, J.Van, Beukema, J. J. and Kwast D. Does temperature-influenced egg production predict the recruitment in the bivalve Macoma Balthica? Mar. Ecol. Prog. Ser., 64, 229-235,1998.

Guan, J., Cheung, A., Guo, X. and Li, L. Intensified upwelling over a widened shelf in the northeastern South China Sea, J. Geophys. Res., 114, C09019, doi:10.1029/2007JC004660, 2009.

Su, J., Xu, M., Pohlmann, T., Xu D., Wang D. A western boundary upwelling system response to recent climate variation (1960–2006), Cont. Shelf Res., 57(2013)3-9, 2012.

Lima, F.P. and Wethey, D.S. Three decades of high-resolution coastal sea surface temperatures reveal more than warming, Nat. Commun., 3,704, 2012.

Tang, S., von Storch, H. Chen, X., and Zhang, M. "Noise" in climatologically driven ocean models with different grid resolution, Oceanologia, 10.1016/j.oceano.2019.01.001, 2019.

Wang, Q.Y., Li, Y., Li, Q.Q., et al. A comparison and evaluation of two centennial-scale sea surface temperature datasets in the China Seas and their adjacent sea areas, J. Trop. Meteor., 24(4), 452-460, 2018.

Wernberg, T., Bennett, S., Babcock, R.C., et al. Climate-driven regime shift of a temperature marine ecosystem, Science, 353, 169−172, 2016.

Xie, S.P., Xie, Q., Wang, D., and Liu, W.T. Summer upwelling in the South China Sea and its role in regional climate variations, J. Geophys. Res., 108(C8), 3261, doi:10.1029/2003JC001867, 2003.

Zhao, B.R., Ren, G.F., Cao, D.M., Yang, Y.L. Characteristics of the ecological environment in upwelling area adjacent to the Changjing River Estuary, Oceanol. Limnol. Sin., 32(3), 327-333, 2001. (in Chinese with English abstract)

Yan, T.Z. A preliminary classification of coastal upwellings in the China Seas. Mar. Sci. Bull., 10(6), 1-6, 1991. (in Chinese with English abstract)

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2018-137/os-2018-137-AC1-supplement.pdf

---

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2018-137, 2018.