

We would like to thank the reviewer for providing constructive comments and suggestions. Please find our responses below.

GENERAL COMMENT

This is an interesting research. The aim of this work is to develop a warning system for fishery to predict exceptionally cold water days in the southern Taiwan Strait. The authors used ONI and wind speed as indicators to predict the days and found that both proxies can be at lead times of 60 - 210 days and 0 - 30 days, respectively. This analysis results are useful for the regional warming system and worth publishing. Thus, this reviewer recommends the manuscript to be accepted for publishing after doing the following minor revisions.

1. The aim of this study is to assess the predictability of exceptionally cold water in the Taiwan Strait and to develop a warning system. Therefore, the tests conducted using relative operating characteristics curves (ROC) need to be careful because ROC plots could be misleading when applied in imbalanced classification scenarios. However, Precision/Recall (PRC) plots can provide an accurate prediction of future classification performance (Saito and Rehmsmeier, 2015, The Precision-Recall Plot Is More Informative than the ROC Plot When Evaluating Binary Classifiers on Imbalanced Datasets, PLOS one). This reviewer suggests the authors apply PRC plots to confirm the predictability.

Reply:

Thanks the reviewer for pointing this potential problem out. In a similar research work, McKinnon et al. (2016, Nature Geoscience) have used ROC curves to analyze SST and successfully predicted 321 hot days from the 2040 summer days in imbalanced classification scenarios. Both of ROC and PRC are statistical methods to find out a threshold depending on the tolerance for the TPR, FPR, and PPV. As suggested by the reviewer, we have incorporated PRC method in our revised manuscript. By using PRC method, the lead time are 60-120 days and 0-25 days for the ONI-based prediction and the wind-based predictions, respectively. We will add the consequent discussion in the revised manuscript.

2. *Page 2, lines 2-3. It is better to have some references to support the statement.*

Reply:

Yes, two relevant papers, Wang et al. (2000) and Lau et al. (2006), were added in the revised manuscript.

3. *Page 2, lines 20-21. The critical temperatures for different fished are different. What is the critical temperature defined in this study for exceptionally cold water?*

Reply:

Yes, we understand the critical temperatures inducing the death of different fishes are not consistent. We will incorporate the known critical temperature for the fish kind associated with the cold disaster event in the revision. However, for cold disaster prediction based on the relationship between fish death and critical temperature is questionable because (1) no fish death occurring west of Penghu Island (onshore of mainland China), where the water temperature is much lower than near Penghu Island, and (2) the fish could escape from the cold water zone, where the water temperature reach critical value. There must be some unknown physical and biological processes and their interaction. As a result, we won't focus on exploring the value of critical temperature. Instead, this manuscript studies exceptionally cold water, as indicated in the title of this manuscript, which might potentially trigger "cold damage" (we will name it as cold disaster, referring to the events of large amount of fish death, in the revised ms) in the TS and assess the predictability of exceptionally cold water. In this study, exceptionally cold water (cold water day) is defined by SSTAs $< -2^{\circ}\text{C}$, translating into temperature about 17°C . We will add a figure in the supplement. Please note that the threshold to define the cold water days SSTAs $< -2^{\circ}\text{C}$ has been modified as SSTAs $< -2.5^{\circ}\text{C}$ due to the change of targeting area by the review #2's commend.

4. *Page 2, line 18. Does the winter of 2008 mean from December 2007 to January 2008 or from December 2008 to January 2009? Please make it clear.*

Reply:

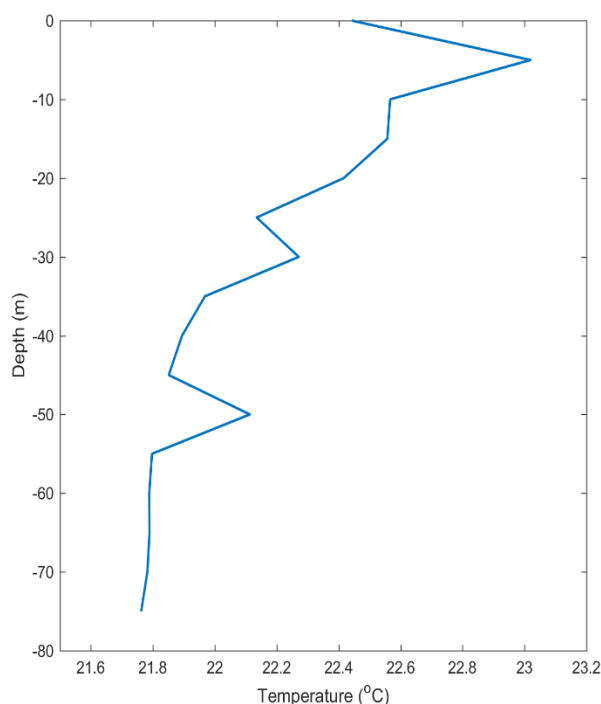
The winter season in this area is from December to the following February. We have clarified it in the revised manuscript.

5. *Page 3, line 4. This study used sea surface temperature (SST) as the indicator of temperature. However, the influence of temperature on fish is not only SST but also the temperature at subsurface layer. Is the temperature at sea surface and subsurface the same in the study area?*

Reply:

Thanks. Because the Taiwan Strait is shallow and the wind is very strong in winter, it is excepted water column is well mixed in the vertical. The climatological temperature profile during winter (averaged in December to February, 1985~2017)

near the Penghu (23.75°N, 119.75°E) is displayed in AC1-Figure 1. Indeed, the figure showed insignificant temperature difference between surface and subsurface in this region ($< 1.2^{\circ}\text{C}$). As a result, we believe SST is a suitable indicator depicting the water temperature of whole layers. We will add the above results in the revised manuscript.



AC1-Figure 1. A SST profile provided by the Ocean Data Bank of Taiwan

6. *Page 3, line 25. Is it 1320 winter days or 1380? Please check and confirm it. If the span of data is from January 1995 to May 2007, the reviewer's calculation is 1380?*

Reply:

Thanks. It is 1380. We have corrected it in the revised manuscript.

7. *The authors gave the ONI time series in Figure 2. Are these ONI values calculated by the authors self or an official data from NOAA CPC? If it was calculated by authors, it's better to indicate the relative time period for calculating the SSTA?*

Reply:

ONI used in this manuscript are downloaded from NOAA CPC (<https://goo.gl/V6CtMD>). We have added essential illustration in the revised version.

8. *Page 4, line 17. It better to show and discuss the results of air-sea heat fluxes in El*

Niño and La Niña events instead of just giving the temperature difference in Figure 3.

Reply:

Thanks for the reviewer's suggestions. We will add figures of heat flux and associated discussion in the revised manuscript.

9. Is it possible to list all during dates of "cold events" in a new table? Figure 2 (a) does not show clearly, for example, events 2 and 3, and events 7 and 8.

Reply:

Thanks for reviser's suggestion. We have clarified it in Table 1 in the revised manuscript.

Table 1: A list of cold events during 1995-2017

Number	Date (yyyy/mm/dd)
Event 1	1996/02/23—1996/02/29
Event 2	2000/02/02—2000/02/15
Event 3	2000/02/23—2000/02/29
Event 4	2006/01/09—2006/01/14
Event 5	2008/02/16—2008/02/25
Event 6	2011/01/30—2011/02/02
Event 7	2012/01/16—2012/02/12
Event 8	2012/02/18—2012/02/20
Event 9	2013/01/16—2013/01/19

10. The English of the manuscript is understandable, but still needs to be carefully polished.

Reply:

Thanks for the suggestion. The manuscript has been through English editing before submission. We will revise it more carefully in the revision.