

Geosci. Model Dev. Discuss., author comment AC3  
<https://doi.org/10.5194/gmd-2020-378-AC3>, 2021  
© Author(s) 2021. This work is distributed under  
the Creative Commons Attribution 4.0 License.

## Reply on RC2

Chongyang Wang et al.

---

Author comment on "Turbidity maximum zone index: a novel model for remote extraction of the turbidity maximum zone in different estuaries" by Chongyang Wang et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-378-AC3>, 2021

---

### *General comments*

*This paper describes a new approach to identify .....*

### **Response:**

Dear reviewer, thanks a lot for reviewing our manuscript and giving the valuable comments. These thoughtful suggestions are all critical for the improvement of the study.

We agree with you on the points, especially the validation and evaluation issues of the model, and language problems.

The main aims of the study is to develop a new approach, which could distinguish turbidity maximum zone (TMZ) in different estuaries and different seasons, and **provide a new reference** and **fresh perspective** for the study of TMZ.

Following your suggestion, we have revised the manuscript very carefully. The lists below are the responses to each comment and all the revising have been marked in RED in the marked-up mode (lines 17-20, 27-30, 34-38, 42-46, 53-57, 64-69, 75-92, 94, 113-115, 123-124, 126-128, 135-136, 139-141, 146-156, 169-175, 187-196, 200-201, 206-208, 215-217, 220-222, 228-232, 236-239, 246, 248-249, 255-256, 260-263, 268, 271-275, 277-279, 285-286, 295-297, 301-303, 306-311, 319-321, 337-338, 343, 356-358, 382-384, 387-389, 395-401, 416-417, 422-428, 436-438, 442-448). It is expected that the quality of the revised manuscript has been improved significantly and meet the demand of journal.

### *Major comments*

*As the authors alluded to.....*

### **Response:**

The studies of estuarine TMZ has a long history of over 80 years since it was proposed in the last century (Glangeaud 1938). The current definition of TMZ has been widely

accepted and recognized across the world (Page 3, lines 53-57). As far as we are concerned, it is a **much very** challenging task for us to give a **more** rigorous and quantified definition for TMZ.

As you point out, measuring the accuracy of corresponding results **is absolutely critical issues** for the assessment of any methods. Following your thoughtful suggestion, the common accuracy measures of object extraction from remote sensing imageries, **area-based accuracy measures** (Cai et al. 2018), has been added to evaluate and compare the performance of the different methods (*Section 2.4*; Page 11, lines 187-196; Page 16, lines 271-275; Page 19, lines 306-307; Page 24, lines 398-400; Page 26, lines 425-428).

Suppose that  $A_E$  is the area of the extracted TMZ,  $A_C$  is the correct part of  $A_E$ , and  $A_R$  is the reference TMZ (ground truth). Then the quality ( $Q$ ) of the TMZ extraction results in the study could be defined as follow.

The range of  $Q$  is 0 to 1. The bigger  $Q$  the value, the higher the accuracy of TMZ extraction results and the better performance of the method.

It should be noted that **the visual interpretation TMZ results** of the Pearl River estuary (PRE) (Pages 17-18; lines 277-278, 301; Figs. 7a and 8c), derived from two scientific and peer-reviewed journals, *Journal of Coastal Research* (<https://meridian.allenpress.com/jcr>) and *Chinese Science Bulletin* (<https://www.sciengine.com/publisher/scp/journal/CSB?slug=abstracts>), **had been defined as 'ground truth' in the study.**

In the PRE, all the TMZ extraction results based on TMZI and previous approaches has been assessed by the visual interpretation TMZ results ('ground truth') and the new added accuracy assessment measures. In order to illustrate the evaluation and comparison process better, some figures (Figs. 7, 8c, 8d and 11) in the manuscript are restructured to a sketch map here.

In the third row of the sketch map, **regions indicated by yellow dashed frames** are the visual interpretation TMZ results and defined as 'ground truth'.

In the fourth row, **regions indicated by mango colors** are the TMZ extraction results based on TMZI method. Fifth row shows the **same** results, but with the true color imagery as base map.

In the sixth and seventh rows, **regions indicated by cyan colors** and **yellow colors** are the TMZ extraction results based on Shi et al. (2017) and Wai et al. (2004), respectively.

On the one hand, the TMZ extraction results by TMZI and previous approaches have big difference, which could provide an intuitive and rough comparison. On the other hand, the **quantitative accuracy assessment** also showed TMZI model has a better performance. The quality of the TMZ extraction results by the methods of TMZI, Shi et al. (2017) and Wai et al. (2004) are 0.8429, 0.4238 and 0.1046 in low-flow season, and 0.8171, 0.4770 and 0.1661 in high-flow season, respectively (Page 16, lines 271-275; Page 19, lines 306-307; Page 24, lines 398-400; Page 26, lines 425-428).

The main aims of the studies in the Hangjiang River estuary (HRE) and Moyangjiang River estuary (MRE) are to further assess the applicability of TMZI. The observation is also one of the most basic methods in geography and remote sensing research fields. Given few specialized studies in the two estuaries, the TMZ extraction results in the HRE and MRE were assessed mainly based on remote sensing imageries and the corresponding retrieved

results.

We have revised the figures, results validation part, relevant contents and statements in the manuscript carefully (Page 11, lines 187-196; Pages 16-19, lines 271-279, lines 285-286, lines 301-303, lines 306-311; Pages 20-22, lines 326-329, lines 356-358; Pages 24-26, lines 398-400, lines 404-409, lines 422-428).

References:

Cai, L., Shi, W., Miao, Z., & Hao, M. (2018). Accuracy Assessment Measures for Object Extraction from Remote Sensing Images. *Remote Sensing*, 10, 303.

Glangeaud, L. (1938). Transport of Sedimentation Chlans l estuare et l embouchure de La Gironde. *Bulletin of Geological Society of France*, 8, 599-630.

*It's also not sufficient to .....*

**Response:**

It is right that the more validation and assessment, the better a new method. In this study, although the PRE, HRE and MRE are all in Guangdong Province, the three rivers and estuaries have significantly difference and its own characteristics (Pages 6-8, lines 123-124, lines 135-141).

**The PRE is a horn-shaped estuary.** The source of Pearl River is in Yunnan-Kweichow Plateau, southwest China. Pearl River is the fourth longest (2320 km) in China with a drainage area of  $4.53 \cdot 10^5 \text{ km}^2$ , and its annual runoff ( $3.26 \cdot 10^{11} \text{ m}^3$ ) is only smaller than Yangtze River. The sediment load of Pearl River is  $7.53 \cdot 10^7 \text{ ton/year}$ .

**The HRE is a forking-shaped estuary.** The source of Hanjiang River is in Zijin County, east of Guangdong. Hanjiang River has a length of 470 km and has the second largest drainage area ( $3.01 \cdot 10^4 \text{ km}^2$ ) in Guangdong Province. The annual mean surface runoff of Hanjiang River is  $2.45 \cdot 10^{10} \text{ m}^3$  with sediment load is  $6.93 \cdot 10^6 \text{ ton/year}$ .

**The MRE is a calabash-shaped estuary.** The source of Moyangjiang River is in Cloud Mountains, west of Guangdong. Moyangjiang River has a length of 199 km and a drainage area of more than  $6 \cdot 10^3 \text{ km}^2$ . The annual mean surface runoff of Moyangjiang River is  $8.21 \cdot 10^9 \text{ m}^3$  and sediment load is  $3.27 \cdot 10^5 \text{ ton/year}$ .

Based on the characteristics of the three rivers and estuaries, it could be found that the source, length, drainage area, shape, runoff and sediment discharge of them are different from each other, Which has a certain representativeness in the study of estuary.

On the other hand, considering that the study of TMZ has long been **a hot topic in many fields**, such as estuary and coast, hydrology, ocean, ecology, environment, geography and remote sensing, it would be better and more persuasiveness if the model could be further validated and assessed by other researchers worldwide.

*Minor comments*

*TSS usually includes CDOM and Chla.....*

**Response:**

It is no doubt that there exists a **connection** between total suspended solids (TSS) and chlorophyll a (Chla), even other water parameters or color components (CDOM). We have modified the relevant expressions to make it more precise (Page 2, lines 27-30; Page 5, lines 94-102; Pages 13-14, lines 220-222; lines 236-239).

In fact, the **defined relationship** among the water parameters is still in the study and discussion, particularly in estuarine regions of dynamic changes (Zhang and Blomquist., 2018; Hu et al., 2013; Chen et al., 2011; Zhao et al., 2009). It is expected that more detail results and conclusion could be found in the future study and research.

References:

Chen, S., Fang, L., Li, H., Chen, W., & Huang, W. (2011). Evaluation of a three-band model for estimating chlorophyll-a concentration in tidal reaches of the Pearl River Estuary, China. *ISPRS Journal of Photogrammetry and Remote Sensing*, 68, 356-364.

Zhang, Q., & Blomquist, J.D. (2018). Watershed export of fine sediment, organic carbon, and chlorophyll-a to Chesapeake Bay: Spatial and temporal patterns in 1984–2016. *Science of the Total Environment*, 619-620, 1066-1078.

Zhao, J., Cao, W., Wang, G., Yang, D., Yang, Y., Sun, Z., Zhou, W., & Liang, S. (2009). The variations in optical properties of CDOM throughout an algal bloom event. *Estuarine, Coastal and Shelf Science*, 82, 225-232.

Hu, S., Cao, W., Li, J., Yang, Y., Wang, G., & Zhou, W. (2013). Spectral absorption properties of colored dissolved organic matter along 6°N transect of tropical eastern Indian Ocean. *Journal of Tropical Oceanography*, 32, 13-21.

*Can't Eq (1) be simplified, as exp and log cancel out?*

**Response:**

In equation 1, the bases of the exponent and logarithm are 'e' and '10', respectively. We are sorry for the unclear statement in the previous version. Following your suggestion, the equation have been revised (Page 11, line 182).

*There are also very extensive syntax errors .....*

**Response:**

Dear reviewer, Following you and another reviewer's suggestions, we have asked for native English writers (a professor of Florida State University and an associated professor of National University of Singapore) helping us to pick up grammatical errors and revise the text very carefully. Besides, we also asked the professional English language services, **Editage** ([www.editage.cn](http://www.editage.cn)), to further polish the English writing and grammar.

All the revising have been marked in red in the current version (lines 17-20, 27-30, 34-38, 42-46, 53-57, 64-69, 75-92, 94, 113-115, 123-124, 126-128, 135-136, 139-141, 146-156, 169-175, 187-196, 200-201, 206-208, 215-217, 220-222, 228-232, 236-239, 246, 248-249, 255-256, 260-263, 268, 271-275, 277-279, 285-286, 295-297, 301-303, 306-311, 319-321, 337-338, 343, 356-358, 382-384, 387-389, 395-401, 416-417, 422-428, 436-438, 442-448).

**Once again**, thank you very much for your valuable comments and suggestions for the

improvement of the manuscript.

Stay healthy and best wishes,

Chongyang Wang

Please also note the supplement to this comment:

<https://gmd.copernicus.org/preprints/gmd-2020-378/gmd-2020-378-AC3-supplement.pdf>