



Interactive comment on “A reactive nitrogen budget of the Bohai Sea based on an isotope mass balance model” by Shichao Tian et al.

Fajin Chen

fjchen04@163.com

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Review comments This manuscript aims to clarify the N sources and N cycling on the Bohai Sea, by investigating the NO₃ concentration and its dual isotope variations and other chemical parameters to distinguish reactive of fixed nitrogen sources and provide an insight into the N biogeochemical transformations in the Bohai Sea, using a combined mass and isotope balance model. This topic is important in Bohai Sea (BHS) region for understanding the N biogeochemical process for marine environment management and recovering. It is an interesting manuscript with heated topics. I think the discussion is sufficient and the results is quite interesting. The Manuscript contains several typos and grammatical errors and the author is suggested to carefully check the

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manuscript such as reference, hard to read sentences. This manuscript needs some improvements. My decision is accepting with minor revision regarding the following review comments. More specific and general comments are given below.

Review 1. In line 13, 'The Bohai Sea' seems to be appeared first time, It is suggested to use 'The Bohai Sea(BHS)' instead here.

2. The author is suggested to check several sentences which is difficult to read such as In line 15, 'It is therefore crucial to quantify the reactive nitrogen input to the BHS and to understand the processes and determine the quantities of nitrogen eliminated in and exported from the BHS' is suggested to revise as 'Therefore, it is crucial to quantify the reactive nitrogen input to the BHS and understand the processes and determine the quantities of nitrogen eliminated in and exported from the BHS.'

3. The author is suggested to check the whole manuscript about some small mistakes, such as in line 44-45 Chen, 2009 should be Chen et al., 2009, Su, 2001 could not find in the reference list.

4. In line 24-25, In here, Ground water should be groundwater, it is suggested that "submarine discharge of nitrate with fresh ground water" changed to 'submarine fresh groundwater discharge of nitrate'.

5. In line 23-26, 'The main nitrogen sources are rivers contributing 17.5%-20.6% and the combined terrestrial runoff (including submarine discharge of nitrate with fresh ground water) accounting for 22.6%-26.5% of the nitrate input to the BHS while atmospheric input contributes only 6.3%-7.4% to total nitrate.' In here, firstly you discussed about nitrogen sources, then mentioned about nitrate percentage. It seems a little confuse, please use nitrate or nitrogen (DTN?) instead.

6. In line 29-30, the sentence ' A further eutrophication of the BHS could, however, induce water column hypoxia and denitrification as already observed – often seasonally off river mouths - in other marginal seas.' is hard to read, please revise it as more simple

way.

7. In line 43 (Smith et al., 2003;Liu et al., 2009). Please make sure if a space is needed between two citations.

8. In line 70, a comma is needed after study. For this study, we analyzed.

9. In line 73, Aim of the study - The aim of the study.

10. In line 75, . . .et al., 2011), Please remove the comma here.

11. In line 92, The author described as ‘Samples were taken monthly in May, July to November from Yellow River, and in November from Daliao River, Hai River, Luan River and Xiaoqing River (Fig. 1).’, Why the water sample is only taken monthly from summer to winter in Yellow river(Also why it is not taken in June?), the other river is only a winter sample, Because it contains dry and wet season in the research region, is it enough to calibrate/validate the mass balance model using one month data?

12. In line 135-140, the author described the model by using HAMSOM, and calculate the model in year 2018. How about the warm up periods of the model? And how about the calibration/validation process, the author is suggest to describe the model more detailly.

13. In line 165-176, Please uniform the nutrient name in this part, Such as there are NH₄⁺ in the text but NH₄⁺ -N in the figure.

14. In line 247, ‘nitrate- rich’ please remove the space before rich.

15. In line 250, ‘(= halo- and nutricline)’ I did not understand the expression here, Could the author explain it more clearly?

16. In line 245, the author described as ‘the YR is one of the major sources of these nutrients in the BHS’ but not discussed the nutrient contents from other rivers, The author is suggested to described more detailly here.

17. In line 249, '(see the discussion of chapter 4.2.5).' I am not sure if it is ok to refer as this way. Because it makes the reader more confused about the discussion part.
18. In line 314, 'sea water.' In manuscript, there are two descriptions as 'sea water' and 'seawater', please uniform the callings.
19. In line 317, 'north China Plain' should be 'North China Plain'.
20. In line 327, 'The difference of the' of – between.
21. In line 340, 'from sediment' to "from the sediment.
22. In line 345, 'Sinking particles in the BHS have a $\delta^{15}\text{N}$ of 5.2‰ ($\delta^{15}\text{N}_{\text{sink}}$),' I am confused about this part, Is this data measured from this curies? This suspended particulate matter value is not shown in the manuscript(in Line 200-206, it shows The average $\delta^{15}\text{N}$ of SPM in spring was $4.8 \pm 0.9\%$, The author is suggested to add reference or method of this data.
23. In line 363-365, 'ground water' should be 'groundwater' 'Most important sinks' should be 'The most important sinks' 'steady state' should be 'steady-state'.
24. In line 371, 'deposited nitrate,,' please remove a comma.
25. In line 440, 'in the eastern Hainan Island' remove 'the'.

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