

## ***Interactive comment on “Coupling the chemical dynamics of carbonate and dissolved inorganic nitrogen systems in the eutrophic and turbid inner Changjiang (Yangtze River) Estuary” by W.-D. Zhai and X.-L. Yan***

**Anonymous Referee #3**

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This manuscript is generally written clearly and provides a fairly detailed analysis of linked carbonate and DIN systems over a brief time-period. One strength of this manuscript is that it outlines a method that could potentially be used to quantify DIN interactions with the carbonate system using a data set gathered during an intensive 6 day sampling. Studies of eutrophic estuaries are valuable in understanding carbonate system dynamics where respiration rates and rates of nitrogen cycling are extremely high. It is a disadvantage that the manuscript is based on such a limited time-period, as a seasonal study would be much more compelling. If the focus of the paper is indeed

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to highlight a method, as opposed to doing a comprehensive study, this point needs to be highlighted. The main conclusion the authors seem to draw is that the spillover effect on the South Branch is small - this is not very interesting or unexpected, so a compelling reason for this paper that describes such a limited time-window is needed. The manuscript could also benefit from an improvement in the language, where the abstract and multiple sections of the paper are sometimes difficult to understand.

Specific Comments: (1) Abstract, Line 17: the wording “CO<sub>2</sub> productions were quantified by. . .” is difficult to understand. What is meant by this? (2) Page 6408, Line 16: “Quantificationally” is not a word in the English language.

(3) Page 6409, Line 1: I think the word “solid” used here should be the more conventional “suspended solids”

(4) Page 6415, Line 6: Here and in other parts of the manuscript, the language “presumably influenced by sewage” or something like it is used. Is there a major sewage treatment plant discharging into this region? If so, this should be stated clearly. Is there any information about what this plant discharges to the river (e.g., water, nutrients, carbon)?

(5) Page 6416, Line 1: In this sentence, the system is referred to as the “Changjiang estuary” when specifically talking about the data, and it is confusing because up until this point, only the three study zones are referenced. Why the change? It would be clearer if you specifically stated the study regions that contribute to the conservative mixing lines.

(6) In Figure 4 (and elsewhere), it appears that data from the south branch are used in the mixing diagrams. This seems odd, as apparently the south branch only exchanges with the other study regions in a limited way under spring tides and the overall exchange is small.

(7) Page 6418, Line 17: Equation 14 has two unknown values (Q<sub>s</sub> and Q<sub>n</sub>), but the

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text does not describe how both values are computed using the equation – please add this.

(8) In addition to the comment above, QN, the spillover flux was quite small relative to the other water inputs and elevated the South branch salinity to 0.2 to 0.67, but from what base value? Zero? This suggests a relatively small impact of the spillover fluxes.

(9) In the absence of a map, I am having difficulty envisioning the dynamics of this system, especially the location and size of the exchange area between the North and South branch – a better, more resolved map would help.

(10) The limitation of this study, as it only involves data over relatively brief period, is highlighted by the fact that the study period occurred during a relatively dry period (Figure 2). Would this method work under much higher flow conditions, where residence time is much shorter? Some discussion would be helpful here.

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