**Biogeosciences
Discussions**

Interactive comment on "The stoichiometric ratio during biological removal of inorganic carbon and nutrient in the Mississippi River plume and adjacent continental shelf" *by* W.-J. Huang et al.

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Thanks for your comments. We appreciate the chance to clear ourselves. In the following paragraphs, we will reply to each comment point by point.

1. A big assumption in the MS is that S, TA and TA+NO3 act as conservative tracers in the studied area. One should justify. Are the effects of evaporation/precipitation of water and precipitation/dissolution of carbonate minerals minor or negligible?

Reply: We have had similar concerns and have given this issue much consideration. One possibility that can change TA values in the river plume is the formation of coccolithphores, precipitating CaCO3. Although we observed coccoliths in filtered par-

ticle samples at some stations collecting during June 2006 in the Mississippi River plume, the analyzing of Ca2+: Na+ ratios of the particles on the filters from several stations across the salinity gradient suggested that calcification was not sufficient in magnitude to alter the TA –salinity relationship (W.-J. Cai unpublished). In addition, CaCO3 saturation statuses calculated by seawater pH and TA were higher than 1 in this plume, showing that it was unnecessary to consider dissolution of carbonate minerals. Another concern is that the effect of precipitation on the mixing between river-sea mixing process. A maximum precipitation of 36 mm and 2.54 mm per day were observed in New Orleans, LA during 24-29 June 2003 and 9-12 August 2004, respectively. Assuming the area of Louisiana Bight is 4000km2 and 50% of the Mississippi River discharge flows through this bight, such precipitation on the Louisiana Bight were only ∼2% of the discharge from the Mississippi River (173000 cms and 9000 cms for June 2003 and August 2004, respectively). Besides, the annual evaporation rate at the New Orleans is 60 to 70 inch (http://www.grow.arizona.edu/Grow–GrowResources.php?ResourceId=208); showing an average 45mm/day. This evaporation rate of seawater is usually lower than this value on the land. In addition, since both cruises were under precipitation, the evaporation would be less important. Evan if we consider that, the maximum effect of precipitation is < 2%. Therefore, as the error of the stoichiometry of DIC uptake and nutrient removal in Table 2 were larger than 5%, precipitation or evaporation is insignificant compared to the freshwater input in this model. Finally, these results will be modified as a paragraph and be added in Section 3.1.

2. It will be helpful to have a plot of S versus TA+NO3 to demonstrate the three-end-member mixing.

Reply: We had a choice between putting a plot of "S versus TA+NO3" or a plot of "S versus TA" as there is no space or need to present both. Actually both of them showed a similar pattern. Therefore, we decided to use Salinity – TA plot as they are the original data and we will add a statement that "S versus TA+NO3" showed a similar pattern.

Note that in an open-ocean water mass, mixing with other water masses is only a minor process contributing to changes in TA and most of the [NO3] change will contribute to the TA change. However, in a larger river plume, most of the [NO3] change is due to the "mixing/dilution" effect, and only the biological component (a smaller part) will contribute to the TA. Thus, this is a small correction term and does not affect the main story. We include it in the equation mainly to illustrate the principle.

3. Giving two CM values in Table 1 and Figure2f for the year 2004 data is confusing. From Figure 2f, one may simply say that the CM with high TA is an effective end member value, and redraw the M-S mixing line upward (similarly in Figure 3c). There is no reason to restrict the model to only the data with S >24 per mil. The footnotes 4 and 5 in Table 1 do not make sense (a mixed-up?).

Reply: To avoid confusion, we will remove this CM of footnote 5 from Table 1 since we did not use it in the mixing model. In addition, we didn't restrict the model to only data of salinity larger than 24. The only reason we didn't apply this model for the region of salinity less than 24 is because we didn't collect nutrient data for this region (due to rapid mixing conditions, DIC and TA samples were collected from the underway pumping system in this section while nutrient samples were not collected). We show these DIC and TA data from salinity less 24 waters in 2004 on Fig. 2f only to emphasize the changes of river endmember with time. The rapid river endmember change is also shown directly with the USGS river data. These data justify our approach to choose an appropriate river endmember by considering the corresponding fresh water transit time for the water mass being considered. For the middle and high salinity (S>24) waters in August 2004, the appropriate river endmember corresponding to conditions is the one two weeks before our survey (as given by USGS in footnote 4 in Table 1).

4. In the caption of Figure 4, spell out what LSiLN and HSiLN stand for. Also what is the difference between S<24 and S<24 HSiLN?

Reply: We now add: LSiLN stands for "Low Silicate and Low Nitrogen" and HSiLN

stands for "High Silicate and Low Nitrogen". We also add that "S< 24" includes both "non-HSiLN data" and "HSiLN data". We want to draw reader's attention on "S<24 HSiLN" data, so we highlight it with a different symbol. We did not separate "S<24 non-HSiLN" because there is no need to discuss it in this study.

5. In Table 2, the C/Si/N/P ratios were obtained by assuming N=16 with no error. My calculations give (91ï′C ′s5)/(8.0ï′C ′s1.6)/16/(0.32ï′C′s0.06) for 2003 data and (80ï′C ′s18)/(19ï′C ′s6)/16/(0.62ï′C ′s0.17) for 2004 data. It will be helpful to provide the uncertainties in Table 1.

Reply: Thank you. We will add these error estimations in Table 2. We calculated the error and they were (91±5)/(8.0±1.6)/16/(0.3±0.2) for 2003 data and (80±18)/(19±6)/16/(0.6±0.3) for 2004 data. As table 1 is already busy, we will add "Uncertainties: 0.1% for TA and DIC, and the detection limits for nutrients are: NO3-: 0.07 μM, PO4: 0.07 μM, and Si(OH)4 is 0.1 μM."

6. The paper by Li and Peng (2002) used three end member mixing model, not two end member mixing as authors suggested.

Reply: Thank you. We will change that sentence to "three-end-member" mixing model.

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