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Interactive comment on "Impact of the Kuroshio intrusion on the nutrient inventory in the upper northern South China Sea: insights from an isopycnal mixing model" *by* C. Du et al.

Anonymous Referee #1

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This manuscript reported observation of nutrients in the NSCS and analyzed seasonal variation of nutrient inventory and the influence of Kuroshio intrusion on it. In general, this manuscript is well organized and written. The analysis is well designed and the results are interested. I hope following comments will be helpful for their revision.

1. Please give a full description on the concept of "nutrient inventory" and on why it (or its seasonal variation) is important to us.

2. As described in section 3.3, the development of surface mixed layer is apparent in the NSCS. Since diapycnal processes are important to the development of surface mixed layer, it is therefore necessary to address why the development of mixed layer

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has no relation to the discussion in section 4.1 where only diapycnal mixing at 100m depth is given.

3. As causes of seasonal variation in nutrient inventory in the surface 100m water column, Kuroshio intrusion and biochemical processes are addressed in the manuscript. I am wondering how the circulation inside the SCS, which can change its direction (P6942, L13-14), affects the seasonal variation of nutrient inventory in the NSCS. It is better to add some sentences on this point. The second concern is on the seasonal variation in the depth of isopycnal layer. The authors chose 100 m depth as lower limit for integration of nutrient inventory and used isopycnal mixing model to understand the seasonal variation of calculated nutrient inventory. If the isopycnal layer at 100 m depth changes with season, this effect must be included as a cause of seasonal variation in nutrient inventory.

4. Is it possible for the authors to change "Kuroshio intrusion" to "Kuroshio surface intrusion" in their title? Their analysis is actually limited to surface layer (0-100m). It is also necessary to realize the intrusion depth of Kuroshio water when using the term "Kuroshio intrusion" inside the manuscript.

5. P6943, L7: please mention depths of water sampling.

6. P6944, L7-8: I guess this comparison is at the same density. If so, please clarify this point.

7. Fig.3: the texts inside the black background for land are hard to recognize. The same thing is also true for other similar figures.

8. P6945, L5: why wind-driven upwelling produced such local high nutrient concentration?

9. Section 3.3: following Fig. 3, it is natural to expect vertical profile of N+N in Fig.4. Please mention why the authors use SRP, not N+N, in Fig. 4b. 1 0. Fig. 4: it is not easy to understand why vertical profile of nutrient does not follow that of temperature.

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The water temperature is homogenous inside the surface mixed layer, but the nutrient concentration is not. For example, the surface mixed layer reaches ∼70 m but the concentration of SRP is much higher at 50 m than at 25 m. Why?

11. Fig.4: why the mixed layer vanishes in spring but develops in summer? This is opposite to general case. Usually, heat flux increases from spring to summer.

12. P6948, L11: what is evidence for the "lower limit"? This value is possible, but is not so small.

13. P6949, L2-3: the authors may check whether they can obtain the same mixing ratio from water temperature and salinity. Maybe they can add one figure to show Rk from water temperature versus that from salinity.

14. P6949, L2-3: since the surface mixed layer is at order of 50 m, it is not reasonable to apply isopycnal mixing model to the upper 60 m. Please add some sentences to address this point.

15. Fig.6: As I compare Fig. 6 with Fig. 2, it is likely that some data in Fig. 2 (e.g., data with salinity > 34.8) are beyond the range between the Kuroshio and SCS water. It is therefore better to add the lines for two end members of Kuroshio water and SCS water in Fig.2 and to state the relation of two end members with the deleted data.

16. Fig. 6b: it is better to reduce range of color bar. The data between two end member lines is smaller than 20.

17. P6952, L19: If it is really an "exchange", why the fraction of Kuroshio water decreases? "exchange" occurs in two ways in which the Kuroshio water must enter the SCS.

18. P6952, L21: please mention how this estimation (4.1 years) was done. "24%" is not throughout one year.

19. P6952, L1-10: it is better for the authors to add some sentences to address the

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causes why the fraction of Kuroshio water is low in winter than in spring and why the nutrient fraction of Kuroshio is generally lower than the water fraction in Fig. 8. I also do not understand the spatial pattern of water fraction of Kuroshio water in spring. It is natural to expect a reduction in the fraction of Kuroshio water with a distance from the Luzon Strait. However, this is not the case in spring when a high fraction was identified in the area close to the northern shelf of SCS. Why?

20. P6954, L27: please define the difference. I guess it is "predicted concentration – measured one". If the authors can change it to "measured concentration – predicted one", then a negative difference means biological consumption. This way is similar to the figure of nutrient concentration versus salinity in the estuary.

21. P6957, L10-15: I like this note. But, why the authors observed higher nutrients concentration in the SCS water than in the Kuroshio water. Please add one or more sentences to clarify causes.

Interactive comment on Biogeosciences Discuss., 10, 6939, 2013.