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Interactive comment on "Subsurface low pH and carbonate saturation state of aragonite on China side of the North Yellow Sea: combined effects of global atmospheric CO_2 increase, regional environmental changes, and local biogeochemical processes" *by* W.-D. Zhai et al.

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We thank the two anonymous reviewers for their comments and constructive suggestion. Most of them are incorporated in the modified MS.

[1] We re-calculate bottom water pH and Ω_{arag} using DIC and TAlk. To further assess the quality of this dataset, we compare the calculated DIC (from measured pH_T at 25 °C and TAlk) versus measured DIC, and the calculated pH (from DIC and TAlk)

versus field-measured pH, and Ω_{arag} values from DIC and TAlk versus those from field-measured pH and TAlk. Most of them are consistent with each other at deviation levels of $\pm$15 μmol kg $^{-1}$ (DIC), $\pm$0.05 (pH_T at 25 °C) and $\pm$0.1 (Ω_{arag}). New Ω_{arag} data give similar patterns to the original MS, although some Ω_{arag} values from DIC and TAlk are slightly higher than those from field-measured pH and TAlk by 0.1 to 0.2.

[2] According to the reviewers' suggestion, the focus has been changed into seasonal variations of subsurface pH and carbonate saturation state of aragonite on China side of the North Yellow Sea. The impacts of mixing process are substantially discussed. And the future prediction is touched under a scenario of global atmospheric CO_2 increase. So, we have tried to appropriately utilize the high quality dataset and to adequately reveal its merits.

[3] We have heavily strengthened the demonstration on the mixing process. Basically, we plot TAlk against salinity, including those TAlk data obtained in the Bohai Sea. We find that the relatively low-alkalinity Yalujiang River has effects on the NYS carbonate system, probably due to the winter cooling induced freshwater subduction and mixing with salty waters. Therefore, we obtain a three end-member mixing pattern, including a NYS water mass (salinity ~32), and a Bohai Sea water mass (at salinity ~31), and the low-alkalinity river plume end-member. However, we find that the summer-time Bohai Sea outflow current was mainly localized in the upper 25 m layer in warm/flooding seasons. On those deep stations (water depth > 25 m), the effects of summer-time Bohai Sea water mass outflow are limited, due to the strong stratification in summer in the study area. In the modified MS, we have changed the relevant statements and discussion.

[4] We change most pH_T (25 °C) into in situ. We also put all the bottom water data of temperature, salinity, TAlk, DIC, DO, field-measured pH_T (25 °C), and calculated pH_T (in situ) and Ω_{arag} in the new Table 1.

[5] We agree that most of the controlling processes have been docu-

mented in literatures. However, in order to better understand their regional effects, more researches are still needed, especially for those coastal zones of economic importance. In the NYS, the similar spatial distribution pattern and low values of Ω_{arag} have been observed again in the 2012 autumn (See "Bulletin of Marine Environmental Status of China: 2012" http://www.soa.gov.cn/zwgk/hygb/zghyhjzlgb/hyhjzlgbml/2012nzghyhjzkgb/201303/W020130 That is, this phenomenon may occur every year in the NYS. Our paper is the first try to report the significant phenomenon in this region in details.

[6] So far most researchers resolve seasonal variations of pH and Ω_{arag} only based on several snap-shot like surveys. We contend that this is insufficient since carbonate system in any marginal sea shall be subject to tremendous heterogeneities in both space and time. In this study, we try to resolve the seasonal variations and spatial distributions of subsurface pH and Ω_{arag} in the NYS, based on nearly monthly surveys conducted from May 2011 to January 2012 (plus another May 2012 dataset in the modified MS). This detailed baseline dataset shall benefit the scientific community for long.

[7] Point-by-point responses have been made in the supplement.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/10/C1861/2013/bgd-10-C1861-2013-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 10, 3079, 2013.