Biogeosciences Discuss., 10, C5882–C5885, 2013
www.biogeosciences-discuss.net/10/C5882/2013/
© Author(s) 2013. This work is distributed under
the Creative Commons Attribute 3.0 License.

Biogeosciences
Discussions
Open Access

# *Interactive comment on* "Synthesis of observed air–sea $CO_2$ exchange fluxes in the river-dominated East China Sea and improved estimates of annual and seasonal net mean fluxes" *by* C.-M. Tseng et al.

**Anonymous Referee #2**

Received and published: 17 October 2013

**General comments:**

Tseng et al. conduct 12 mapping cruises in the East China Sea (ECS) shelf between June 2003 and July 2011, as well as an earlier cruise in July 1998. They propose an empirical function mainly based on their summer data, which predicts areal mean sea surface $pCO_2$ over the entire ECS from SST and Changjiang river discharges. And then they simulate time series of monthly mean $pCO_2$ and air-sea $CO_2$ fluxes in the ECS over the 14 years from 1998 to 2011. Finally they sum up the model results and deduce their synthesis flux estimation. The fundamental linear relationship between



areal mean N$pCO_2$ and Changjiang river discharge has been published elsewhere (Tseng et al., 2011). If we simply consider the ECS as a whole in a large-scale or even the global context, it is attractive. However, at first they should confirm its regional validity by both data assurance and scientific demonstration. As a regional study, they skip several significant issues, such as spatial heterogeneity in the ECS and decadal changes of nutrient discharges from the Changjiang River. Although their rich datasets are valuable, the manuscript fails to expand our understanding of the ECS $CO_2$ flux. I can't recommend it for Biogeosciences to be published as this form. They should be encouraged to re-submit a new version after substantially considering below issues.

**Specific comments:**

Before in-depth analyses and reductive calculation, the primary data set (field-measured data) should be fully presented, at least in supplementary materials. They have reported the January 2008 data in Chou et al. (2011; 2013), and the July 2011 data in Chou et al. (2013). They also present their summer data from 2003 to 2010 (7 cruises) in Tseng et al. (2011). In this manuscript, they only briefly present the cruise averaged values in Table 2 and Fig. 4, even for their new datasets obtained in July 1998, June 2005, November 2006, and May 2009. The only data map is a composite map of summer surface water $pCO_2$, which is insufficient for readers to assess the data basis of their study.

As a seasonality-based synthesis research, their seasonal surveys are quite imbalanced. If possible, more spring/fall/winter data sets should be incorporated, such as $pCO_2$ data in November 2011 (Chou et al., 2013). The effects of vertical mixing on sea surface $pCO_2$ and air-sea $CO_2$ fluxes also need to be discussed in main text, instead of being presented in supplementary materials.

The ECS is subject to great heterogeneity (e.g. Chou et al., 2009). And the Changjiang river plume mainly affects the northern ECS and the southern Yellow Sea in summer. The simplified relationship between areal mean N$pCO_2$ and Changjiang river

discharges over the entire ECS (i.e. Eq. (3)) should be better examined.

The nutrient basis of Eq. (3) has been briefly discussed by the authors (Tseng et al., 2011). However, in this study they ignore this issue. Significantly, the filling of the Three-Gorges Dam (since June 2003) have impacts not only on monthly and/or seasonal settings of the Changjiang river discharge, but also on riverine exports of nutrients (e.g. Chai et al., 2009). Since Tseng et al. have only one cruise from 1998 to 2002, the model results during this period should be removed.

The Changjiang river plume is also subject to intra-seasonal variations (e.g. Tseng et al., 2011). A time lag is needed between Changjiang river discharges at the Datong Station and their biogeochemical effects in the ECS (Kim et al., 2009).

Their model data in summer 1998 does not match their real datum in July 1998 (Fig. 4), which is interesting. It is likely that the excess nitrate load during the catastrophic 1998 flood is not effectively transferred into low $pCO_2$, due to the insufficient phosphate supply (Wang and Wang, 2006). The July 1998 data should be separately published.

**Technical corrections:**

The statistics are confusing. In their Eq. (1) and Eq. (2), n = 8. In their Eq. (3), n = 7 according to Fig. 3. In Fig. 5, n = 11. In Fig. S4, n=13. Why and how to select data?

Materials and methods, why to analyze chlorophyll a and nutrients? Delete them?

P. 13981, L. 19: what is Wanninkhof (1993)?

Table 1 should be clarified as “model results”.

Table 3, the two Wanninkhof (1992) equations should be exchanged with each other.

**References:**

Chai, C., Yu, Z.-M, Shen, Z.-L., Song, X.-X., Cao, X.-H., and Yao, Y.: Nutrient characteristics in the Yangtze River Estuary and the adjacent East China Sea before and



after impoundment of the Three Gorges Dam, Science of the Total Environment, 407, 4687–4695, 2009.

Chou, W.-C., Gong, G.-C., Cai, W.-J., and Tseng, C.-M.: Seasonality of $CO_2$ in coastal oceans altered by increasing anthropogenic nutrient delivery from large rivers: evidence from the Changjiang–East China Sea system, Biogeosciences, 10, 3889–3899, 2013.

Chou, W.-C., Gong, G.-C., Tseng, C.-M., Sheu, D.-D., Hung, C.-C., Chang, L.-P., and Wang, L.-W.: The carbonate system in the East China Sea in winter, Marine Chemistry, 123, 44–55, 2011.

Chou, W.-C., Gong, G.-C., Sheu, D.-D., Hung, C.-C., and Tseng, T.-F.: Surface distributions of carbon chemistry parameters in the East China Sea in summer 2007, Journal of Geophysical Research, 114, C07026, doi:10.1029/2008JC005128, 2009.

Kim, H.-C., et al.: Distribution of Changjiang Diluted Water detected by satellite chlorophyll-a and its interannual variation during 1998–2007, Journal of Oceanography, 65, 129–135, 2009.

Tseng, C.-M., Liu, K.-K., Gong, G.-C., Shen, P.-Y., and Cai, W.-J.: $CO_2$ uptake in the East China Sea relying on Changjiang runoff is prone to change, Geophysical Research Letters, 38, L24609, doi:10.1029/2011GL049774, 2011.

Wang, B.-D. and Wang, X.-L.: Impact of the exceptionally high flood from the Changjiang River on the aquatic chemical distributions on the Huanghai Sea and East China Sea shelves in the summer of 1998, Acta Oceanologica Sinica, 25(4), 43–52, 2006.

Wanninkhof, R.: Relationship between wind speed and gas exchange over the ocean, Journal of Geophysical Research, 97, 7373–7382, 1992.

---

Interactive comment on Biogeosciences Discuss., 10, 13977, 2013.