

Interactive comment on “Particle-reactive radionuclides (^{234}Th , ^{210}Pb , ^{210}Po) as tracers for the estimation of export production in the South China Sea” by C.-L. Wei et al.

P. Cai (Referee)

caiph@xmu.edu.cn

Received and published: 20 October 2011

This field study gives an insight into the temporal variability of POC (Particulate Organic Carbon) fluxes at SEATS in the South China Sea. In doing so, the authors have used a multi-tracer approach ($^{234}\text{Th}/^{238}\text{U}$, $^{210}\text{Pb}/^{226}\text{Ra}$ and $^{210}\text{Po}/^{210}\text{Pb}$ disequilibria) and sediment trap technique to determine the magnitude of POC export from the euphotic layer in the South China Sea. There have been only a limited number of previous studies which applied a multi-tracer approach to the investigation of POC flux in the upper ocean. The authors found consistent estimates of POC flux from the various methods and concluded that POC export can be reliably estimated using the

C3686

radioactive disequilibrium approach. Overall, I find this manuscript of much interest and completely suitable for this journal. It is well written and clear, and in general terms the data and interpretation is correct and merits publication.

My only concern with this manuscript is its treatment of errors. The manuscript did not present the errors associated with the measurements of radionuclides. This is rather unusual. Therefore, I strongly suggest that the authors add in the Method section a paragraph briefly describing how ^{234}Th , ^{210}Pb and ^{210}Po were determined (even that the procedure has been described in previous study) and how the errors were assessed. The authors should also present the errors associated with the calculations of inventory, deficiency and flux. The error bars should also be added in the related figures.

Detailed comments: Page.9676 Line 4: ...in the upper 200 m... Page 9678 the 2nd paragraph, when assuming negligible physical transport, it is important to refer to Cai et al. (2008, Journal of Geophysical Research-Oceans, 113, C04019, doi:10.1029/2007JC004268) who have constructed a three-dimension model in the same study area and demonstrated that physical transport terms are really negligible. Page 9678 Line 9, ... (=0.0288 d⁻¹). Page 9679 Line 6, the flux of ^{210}Po . . . Page 9679 Line 15-16, also refer to Cai et al., 2002 (Deep-Sea Research I, 49, 53-66) and Cai et al. 2002 (Science in China (series D) 45(2), 103-109) who reported a range of 2.0-8.6 m²d⁻¹ (i.e., 0.23-1.0 cm²s⁻¹) based on three ^{228}Ra profiles collected in the same region. These estimates will help set the bounds of ^{210}Po contribution from upper diffusion. Page 9681 the 1st paragraph, the authors need to explain why fast regeneration of ^{210}Po could lead to trapping efficiency >1. Page 9685 line 21: ...by $^{234}\text{Th}/^{238}\text{U}$ and $^{210}\text{Po}/^{210}\text{Pb}$. . . Page 9686 Line 5-9: I am more conservative about this statement. As shown in this paper, the ratio of Export production/Primary production is much higher than a typical food web (normally 10% in an oligotrophic ocean). This is quite not understandable. Table 4 also shows that the POC fluxes obtained from this study are much higher than ^{15}N -based New production and POC flux based on the

C3687

biological modeling. As different methods have their own problems, I don't think that POC fluxes obtained from this study can be accepted as representative in the study area. I suggest that the authors change the tone of this statement. Page 9686 the 2nd paragraph and Table 4, the authors should extend this comparison to the whole South China Sea, not just limit it to the northern South China Sea. This will increase the impact of the paper, which also will be of interests to a broader readership. There are a number of studies that the authors may consider to add to Table 4: Cai et al. 2002 (Deep-Sea Research I, 49, 53-66); Cai et al. 2002 (Science in China (series D) 45(2), 103-109); Cai et al. 2008 (Journal of Geophysical Research-Oceans, 113, C04019, doi:10.1029/2007JC004268); Chen et al., 2008 (Journal of Oceanography 64, 417-428); Yang et al. 2009 (Chinese Science Bulletin, 54(12) 2118-2123). Table 1-3, The ± 1 sigma uncertainty associated with each parameter should be reported. Table 4. also report the average of the estimates and the associated standard deviation. Figure 2, 3, 4, 6, 8: The error bar which represents ± 1 sigma uncertainty should be added to these figures.

Interactive comment on Biogeosciences Discuss., 8, 9671, 2011.

C3688