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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.

Anonymous Referee #2

Received and published: 9 November 2011

The manuscript provides almost complete set of simultaneous observation on ^{234}Th , ^{210}Po , and ^{210}Pb activity concentrations in the upper 200 m water column from the oligotrophic South China Sea along with sediment trap and other primary productivity related ocean variables. This observation complements the earlier observations in the Arabian Sea, the Black Sea, and marginal ice zone in the Antarctica, the Sargasso Sea, and the Equatorial Pacific. The very well measured data reported in this manuscript will facilitate to analyze the forming and decomposition/dissolution of particles in the sea and their association of particle reactive radionuclides, and articulate the relevant working hypotheses and testing these hypotheses in the coming years, because the interaction of individual radionuclide and particle in the sea is not well understood. It

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would be very useful for readers if the authors compare their measurements with other regions in the world ocean, and if they are comparable or different in terms of the characteristics of the sea.

Minor points the authors may consider prior to finalizing the manuscript are give as table below.

page	line	current suggestion
9672	22	sequestration ..sequestration from the atmosphere in the ocean
25		cycling ..cycling in the ocean.
9673	5	..mixed .. surface mixed..
9674	20	parameters .. oceanographic variables or marine environmental variables
9675	7	formaldehyde % concentration may be given here or mixture. . . (v/v)
10		minimum It is not clear whether authors tried to say their mixture will prevent re-
		leased of particle associated radionuclides into the overlying water in the trap.
22		..for FPC.. .. please delete after 'for.'
24		.. for FPOC.. .. please delete after 'for.'
9676	4	related .. please delete 'related.'
11		related .. please delete 'related.'
19		related .. please delete 'related.'
9677	20	..daughter Except 238U/234Th pair, 226Ra/210Pb and 210Pb/210Po pairs are not mother/daughters.
9780	23	.. acceptable The authors elaborated why trapping efficiencies obtained using 210P0-210Pb pair subsequently. Therefore, it may be more correct to say that trapping efficiencies derived from three pairs are not comparable.. due to chemistry of radionuclides (210Po was explained in detail, but other radionuclides can be also expanded).
9681	2	..30 m, .. 30 m depth, within the surface mixed layer,
9683	21	Values.. PIC, POC, and PN are not individual particles that carry 234Th separately, but they are the components of sinking particulate matter. $PIC/234Th = (PIC \text{ of sinking particulate matter})/234Th$ of sinking particulate matter. The authors did not measure PIC particles nor 234Th of PIC particles. Therefore specific ratio of 234Th and the PIC, POC and PN cannot address the issue related to different biological particles. Fig. 5 suggests that carbonate and organic particles would account roughly less than 30% of the bulk sinking particles, and compositional change in PIC, POC, PN are not pronounced, although figures do not allow calculating them exactly.
9686	5	..intrinsic.. Those intrinsic differences may be a little bit elaborated, if possible. The assumptions used for the respective scavenging models, Eqs. (1) to (3) need to be explained in order to constrain the limits

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of those models. Apart from sources, its half life and chemistry of the respective pair radionuclides in relation to time scale of movement of water, formation and destruction of particles in the sea. For example, $^{210}\text{Pb}/^{226}\text{Ra}$ pair has a number of intermediate radionuclides - ^{222}Rn – ^{218}Po – ^{214}Pb – ^{214}Bi - ^{214}Po . They were not considered in the model. Their involvement in particle sinking process and their implications may need to be addressed. Especially the authors looked at the time frame of about 2 days, then, ^{222}Rn should be certainly considered among other radionuclides. As this point may merits its own discussion apart from this manuscript, nonetheless it is advisable for the authors to provide overall inherent constraints in their model in this manuscript. 9688 13 ..estimated flux It would be very valuable for readers if the authors provide their view on the meaning of export fluxes obtained from short-termed moorings (~ 2 days) and 3 pairs of radionuclides, and which method would be more economical or more accurate based on this and other earlier works.

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

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