Biogeosciences Discuss., 10, C1330–C1334, 2013
www.biogeosciences-discuss.net/10/C1330/2013/

Biogeosciences
Discussions

Interactive comment on "Fukushima-derived radiocesium in western North Pacific sediment traps" *by* M. C. Honda et al.

M. C. Honda et al.

hondam@jamstec.go.jp

Received and published: 30 April 2013

Specific comments P2459, L25: The terminology used for the unit of radioactivity in the manuscript is not appropriate. Strictly "Specific activity" should not be used for the concentration of radioisotopes in environmental samples. For example, "concentration of 137Cs in particulate matter" is just OK. (Answer: A) Based on previous "Sediment trap-Cs" papers, "Specific activity" was used for the concentration of radioisotopes in sediment trap sample (environmental samples) (Buesseler et al. 1987, Kemp and Nies, 1987, Kusakabe et al., 1988). On the other hand, Fowler et al. (1987) used "radionuclide activity" or "radionuclide concentration". However, in accordance with Reviewer #2's suggestion, We decided to use "concentration" instead of "specific activity".

P2460, L13: Show the month, not season. (A) I changed description of "In autumn and

winter" to "Between November and February".

P2461, L18: activity ratio (A) I add "activity" before "ratio".

P2462, L14: It seems that two kinds of averages were calculated in this manuscript: one is an average of 137Cs concentration and the other is calculated considering both the concentration and flux. See also P2464, L20. Differentiate them clearly. (A) I estimated average Cs concentration (activity) with respective concentrations in Table 1. Thus description " (total 137Cs flux/TMF during the observation period)" is wrong. I eliminated this from the text.

P2462, L20: increase with depth or time? (A) I add "with time".

P2462, L24: "April or" should be "April and". (A) I changed.

P2463, L7: See the comment for P2462, L14. (A) I estimated "average Cs concentration" with respective concentrations in Table 1. Thus description " (total 137Cs flux/TMF during the observation period)" in P2464 L19-20 is wrong. I eliminated this from the text. On the other hand, "average daily 137Cs flux" was estimated by (137Cs inventory/ the observation period) (P2467 L4 in section 4.4). I insert description "137Cs inventory/ the observation period".

P2463, L16: "radiologically" This is an inappropriate term. Consider using other term. (A) The "radiologically-contaminated" and "radioactively-contaminated" are listed in Japanese-English dictionary. However same thing was also pointed out previously during another reviewing. Therefore I eliminated "radiologically".

P2464, L1: 26 March ->25 March (?). (A) "25 March" is correct.

P2464, L9: Can you give any thought to slower sinking velocity in the shallower depth? (A) I added the following description in order to explain its reason. "This increase might be partly attributed to the increase in density of settling particle because "light" and fragile organic material decreases with depth compared to "heavy" and relatively refractory opal, CaCO3 and lithogenic material."

P2464 – 2465: Discussion in these pages needs to be more quantitative. The CNPP accident is different from the FDNPP accident in some aspects. Factors such as proximity from the sites of the accident, amount of 137Cs emitted to the atmosphere, elapse of the time after the accident should be taken into account when comparison is made between two accidents. (A) Taking into account for distance between NPP and sediment trap stations, I revised sentence as follows: “Despite distances from the CNPP to respective sediment trap stations (about 580 km for the Black Sea, 1950 km for the Mediterranean Sea and 1880 km for the North Sea) are comparable to distances from the FNPP1 to S1 (950 km) and K2 (1870 km), concentrations observed after the CNPP accident were much higher than that after the FNPP1 accident this study. This might be mainly attributable to the fact that the amount of 137Cs emitted during the CNPP accident was about six times the amount emitted during the FNPP1 accident. In addition, as results of wind direction and dry/wet deposition, the higher concentrations observed after the CNPP accident might be attributed to higher fallout of radionuclides to observation areas and subsequent elevated concentration in the water.”

P2464, L25: The higher activity observed in the particles after the CNPP should not be ascribed to greater amount of Cs emitted from the CNPP, but to the higher flux to the areas of observations and subsequent elevated concentration in the water. (A) Same as above, I changed this description as folloes: “Despite distances from the CNPP to respective sediment trap stations (about 580 km for the Black Sea, 1950 km for the Mediterranean Sea and 1880 km for the North Sea) are comparable to distances from the FNPP1 to S1 (950 km) and K2 (1870 km), concentrations observed after the CNPP accident were much higher than that after the FNPP1 accident this study. This might be mainly attributable to the fact that the amount of 137Cs emitted during the CNPP accident was about six times the amount emitted during the FNPP1 accident. In addition, as results of wind direction and dry/wet deposition, the higher concentrations observed after the CNPP accident might be attributed to higher fallout of radionuclides to observation areas and subsequent elevated concentration in the water.”

P2465, L23-25: Can you elaborate on this part? How can you relate the “not steady state value ” to “more refractory than in . . .”? It was very difficult for me to follow the argument concluding that radiocesium was more refractory. (A) We changed description as follows: “In steady state, distribution coefficient (Kds) of Cs of sediment or lithogenic materials is much higher than concentration factor (CF) of creature (IAEA, 2004). Although the observation period were not steady-state and only transient 137Cs concentration of the various materials were measured, it is suspected that radiocesium in sinking particle was mainly associated with lithogenic materials.” * IAEA (International Atomic Energy Agency) (2004) Technical reports series 422, 95pp.

P2466, L12: Please show the results of computation of correlations. (A) I showed the results of computation of correlations. “** not always significant: correlation coefficients (r2) between fluxes of Cs and LM (potassium) for respective depths of stations were 0.42 (0.37) on average.”

P2466, L15-17: This part is inconsistent with P2465 L24-25. (A) As pointed out, this part is inconsistent. Thus I added description before sentence of “another possibility ***** assimilated by living organism” as follows: “although it is suspected that radiocesium in sinking particle was mainly associated with lithogenic materials as described before.”

P2466, L18: What is the relationship between sulfate aerosol and settling particles? (A) I changed description as follows: “Moreover, Kaneyasu et al. (2012) reported that sulfate aerosol is a potential transport medium of radiocesium rather than lithogenic materials. In this case, sulfate Cs is easily dissolved in surface and then might be absorbed by creature.”

P2467,L2: “input” must be deleted. (A) I deleted this.

P2467, L5: It is totally impossible to assume that the 137Cs fluxes remained constant for a year. Any supporting evidence? (A) As Reviewer #2 pointed out, this assumption might be unlikely. However concentration of 137Cs at K2-4810 m, S1-500 m and S1-

4810 m did not begin to decrease. In addition, it is suspected that total mass flux at K2 might increase in summer. Thus we added this description. before sentence of "if 137Cs flux was constant a year***". "After this study, 137Cs flux might decrease with time. However concentration of 137Cs at K2-4810 m, S1-500 m and S1-4810 m did not begin to decrease. In addition, it is suspected that total mass flux at K2 might increase in summer." In addition, the following sentence was added after the last sentence of this paragraph. "Residence time estimated this study (68 – 312 years) might be underestimate."

Table and Figure captions: Difference between BDL and (BDL) is not clear. What are criteria used to distinguish one from the other? Is it necessary to show both BDL and (BDL)? (A) Co-exist of BDL and (BDL) might be confusing. There is no criteria. The (BDL) is based on our "assessment of the situation." However there should be two BDL. One is BDL which means no Fukushima-derived Cs in sample (the early two and three samples from 500 m and 4810 m, respectively). The (BDL) means that, despite a little Fukushima-derived Cs exists, Cs activity was not detected because of insufficient sample. Four samples of (BDL) are shown in Fig.2 (samples with asterisks). It is clear that sample volumes are smaller than anteroposterior samples. It is hard to think that only these samples were not contaminated. However there is no quantitative criteria as Reviewer #2 concerns. Thus we changed present description to that with presumption as follows: "(B.D.L.) is supposed to be below detection limit because of insufficient sample mass and activity by gamma procedures."

Interactive comment on Biogeosciences Discuss., 10, 2455, 2013.