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Interactive comment on "The impact of oceanic circulation and phase transfer on the dispersion of radionuclides released from the Fukushima Dai-ichi Nuclear Power Plant" *by* Y. Choi et al.

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We greatly appreciate the comments and suggestions from the reviewer. Responses to the comments are described below:

1. The paper has improved very much since the first version. Nevertheless, the English should still be improved.

[Response] We have significantly improved the English throughout the manuscript.

2. I add a few specific comments: Equations 1-3: it should be commented that advection/mixing operators should be added, since in their present form they are only

describing the transfers between phases. Also, the physical meaning of phi should be explained.

[Response] The impact of advection and mixing are included in the total derivative term through the motion of the particle, u. Since the original manuscript was unclear about this point, we now include such description (Line 123-125). phi is a correction parameter that represents the fact that not all the sediment particles are in contact with seawater. This description is now also added to the manuscript (Line 182-183).

3. Section 2.2 and Section 5: The reference to the stochastic method (Perianez, 2000) is not correct. It should be Perianez and Elliott (2002), which is also in the reference list.

[Response] Corrected

4. page 3682, line 19. As I understand, it should be said that 15 μm is the mean radius of LPM particles (i.e., add "mean").

[Response] Modified

5. page 3683. Atmospheric fallout of radionuclides on the sea surface has not been considered, but only direct release from Fukushima. Please comment why this source has been neglected, in comparison with other previous works which have not.

[Response] Atmospheric fallout was not included in this study because our main focus was on understanding the role of phase transfer for the radionuclides that were directly released to the ocean. We have now clarified this aspect (Line 154-156). Addition of atmospheric fallout would provide a new source of radionuclides in dissolved phase at the sea surface but on a much larger spatial scale than the direct oceanic release from the FNPP and thus consider not to significantly affect our findings.

6. page 3684. It seems that LPM concentration is constant in time and uniform in space. The second assumption seems very strong, since along the coast particle concentrations will be higher than in the open sea because of runoff from land and

river inputs. Some comments on this should be added. Also, the used value (0.1 mg/L) seems very low to me. Actually I have checked the van Raaphorst reference I could not see where this value has been taken from. Suspended matter concentrations in the North Sea coast may reach values more than 100 times larger than 0.1 mg/L. Then they decrease offshore.

[Response] Van Rapphorst et al. (1998) shows that the SPM concentration in the open oceanic region of the North Sea is about one order smaller than that in the English Channel. SPM concentration observed in the English Channel or along the continental coast of the North Sea, where there are large estuaries of several great rivers, are on the order of O(1-10) mg/L. This matches well with other studies (1-6 mg/L (Lafite et al. 2000) and 3.4 mg/L by Van Alphen 1990). The spatial scale of the high SPM concentration region is also only about 10-20 km from the coast where the depth is no deeper than 20 m. Since the characteristics of the oceanic regions around the FDNP has less river runoff, deeper topography, and more connected to the deep open ocean than the North Sea, we decided to take the LPM concentration as 0.1 mg/L, a value that is about one order less than that observed near the English Channel. While this value is indeed small, we consider it feasible for the model domain focused in this study. We have now added these descriptions in Line 168-178.

The LPM concentration is indeed assumed constant in this study and we agree with the reviewer that temporally-spatially varying LPM concentration exist. We have chosen a constant value for its simplicity because our goal was to understand the role of phase transfer to its first order. The impact of spatial variability may further enhance the accumulation of sediment phase radionuclides near the coast but consider detail examination of their impact beyond the scope of this study. We have added these descriptions in Line 160-163 and Line 439.

Lafite, R., S. Shimwell, N. Grochowski, J.-P. Dupont, L. Nash, J.-C. Salomon, L. Cabioch, M. Collins, S. Gao: Suspended particulate matter fluxes through the Strait of Dover, English Channel: observations and modeling. Oceanologica Acta, 23, 687-

700, 2000.

Van Alphen, J.S.L.J.: A mud balance for Belgian–Dutch coastal waters between 1969 and 1986. Neth. J. Sea Res. 25, 19–30, 1990.

7. page 3684. The symbol "phi" is not the same as in equations 1-3. Also add a reference for its value.

[Response] Thank you for noticing this typo. The symbol "phi" in page 3684 should have been the same one with the "phi" in equations 1-3. The reference is now clarified in Line 157-160.

Interactive comment on Biogeosciences Discuss., 10, 3677, 2013.