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Ocean Science Discussions

Interactive comment on "Tracer distribution in the Pacific Ocean following a release off Japan – what does an oceanic general circulation model tell us?" *by* H. Dietze and I. Kriest

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We thank the referee for his encouraging and constructive comments. The referee agreed with referee 1 in that the nature of our results is rather preliminary. Among his reasons to support our manuscript nevertheless was its timeliness, a quality which we feel got lost meanwhile. This forced us to refocus the paper in the cause of which we discarded the review on what is known about 137Cs in marine environment.

Reviewer: Tracer distribution depended on the distribution of eddy in this model. More discussion of Figure 5 is needed even if the input conditions of the model have large uncertainties. In addition, they did not discuss about the observed dataset in this study.

At least, they should discuss what kind of dataset they need to benchmark the OGCMs. In addition, they also should discuss what kind of information the OGCMs can tell observational researchers.

Authors: Triggered by more reliable information concerning the release of 137Cs to the sea we set up a new set of simulations and discarded all of those shown in the original manuscript. We have now a proper discussion of the differences in the respective simulations and do, by comparison with measurements now available, make a statement on the realism.

Reviewer: Specific comments 1) They discussed the particle reactivity of 137Cs in a brief literature review. In this discussion, they should summarize the differences of the cases. They referred the papers of three different input conditions to the ocean (1) Global fall- out to the North Pacific, (2) Close-in fallout to Baltic Sea, (3) Direct discharge to English Channel and Irish Sea. And Fukushima case is direct release and close-in fallout off Fukushima and to the North Pacific. Productivity (the concentration of suspended ma- terials), the form of input 137Cs and time scales are different for each case. Vertical transport of 137Cs depends on the forms of 137Cs (particle or dissolved forms). Scavenging effect of 137Cs depends on the concentration of suspended materials. Time scale is also important for vertical transport and scavenging process.

Authors: We thank the reviewer for correcting us here. Following the suggestions of reviewer 1 we omitted the review and refocussed the manuscript.

Reviewer: 2) They concluded that "However, on longer timescales, or if processes like sediment burial and resuspension or uptake by the benthic biota come into play, the assumption of 137Cs as an "inertial" tracer might well be fundamentally wrong." I don't understand this conclusion. Their simulation shows that released 137Cs was transported to the open ocean by meso-scale eddy and Kuroshio. Therefore, on longer *timescales, scavenging effect of 137Cs could be smaller than their rough estimation in 5.3. So I think, on longer timescales, the assumption of 137Cs as an "inertial" tracer might be correct for Fukushima case and "global fallout in the open ocean".*

Authors: Our model results (from the initial submission as well as this one) have been achieved under the a priori assumption that 137Cs acts as an inertial tracer. Therefore, we could not rule out the potential impact of biota onto the tracer transport and whereabouts. To quantify the potential impact of biota our rough calculation in the first submission resulted in a more or less negligible influence of the pelagic biota (depending on local particle concentrations and properties). However, depending on local sediment type and reactivity, as well as on residence times of water on the shelf, we cannot rule out a potential role of the sediment in the cycling of radiocesium. We think this is also reflected in the consideration of sediment-water interactions in the works by Perianez (for the English Channel) and Kobayashi (Irish Sea), as well as from the measurements made in the (brackish) Baltic Sea. However, due to the re-organisation of the paper we do no longer state that "on longer timescales, or if processes like sediment burial and resuspension or uptake by the benthic biota come into play, the assumption of 137Cs as an "inertial" tracer might well be fundamentally wrong."

Reviewer: 3) They mentioned about the concentration factor in section 5.2 when they discuss about the tracer distribution. They should refer the distribution coefficient (Kd). The Kd of 137Cs is quite smaller than other particle reactive radionuclides such as Pu isotopes. 137Cs is as an inertial tracer in the ocean in comparison with Pu isotopes (i.e. K. Hirose, M. Aoyama and P. P. Povinec, 239,240Pu/137Cs ratios in the water column of the North Pacific: a proxy of biogeochemical processes, J. Environ. Radioact., 100 (2009) 258-262.).

Authors: The concentration factor discussion is omitted in the revised manuscript.