

Review of the manuscript OS-2017-90 entitled “Rapid recirculation of FNPP1 derived radiocaesium suggesting new pathway of subtropical mode water in the western North Pacific to the Sea of Japan” by Inomata et al.

The authors of the above manuscript examine the concentrations of radiocaesium as revealed by extensive sampling campaigns and monitoring programs around Japan (e.g. Pacific Ocean, East China Sea and Sea of Japan) to document transport pathways of mode waters and to estimate flow rates of radiocaesium through the neighboring straits (Tshushima and Tsugaru). Based on their impressive compiled dataset of decay-corrected radioactivity concentrations, and considering their summarized view of the most probable sources (e.g. the Fukushima Nuclear Power Plant accident in 2011), they conclude by presenting a simplified schematic of the circulation in the region and by proposing a new transport pathway for subtropical mode waters.

While the general topic of analyzing transport and mixing processes in the ocean based on almost-conservative tracers is very relevant, the manuscript is quite descriptive and I found that the results are not necessarily well supported by the analyses. In addition, many references are missing, thus the results are poorly-discussed results. The paper is not well written and contains too many grammar and typing mistakes as well as confusing sentences. Although the scientific question and the dataset are promising, this paper suffers from unsatisfactory writing, from superficial analyses and incomplete discussion. Both “result” and “discussion” sections should be developed by introducing new materials and extensive referencing. Overall, I think the manuscript is not publishable in OS in the present form. Before being acceptable, a major revision should carefully address the below points.

Major points:

- Although English is not my mother tongue, I found that grammar and typing mistakes are everywhere in the manuscript; furthermore, it contains many awkward sentences that confuse the reader and make the scientific message difficult to understand. I suggest the authors to consider English professional editing for the revised version.
- Analyses: to properly analyze the circulation and to estimate transport (by the way, how this is done in this manuscript?), especially through the straits or across frontal structure, I suggest the authors to present cross-sections (longitude or latitude versus depth) of radiocaesium. Looking at fig. 1, it seems that the authors have access to at least a few almost-synoptic measurements along “sections” (including at the straits), so this seems feasible. There are also many other ways to gain insights into transport processes in the ocean. For surface pathways, one could be looking at satellite data (SST patterns and SSH data to derive geostrophic currents). For subsurface pathways, one could examine the subsurface dispersal of ARGO floats in the region and exploit numerical models. The latter includes (1) exploring the outputs of Eulerian mesoscale models (looking at the list of references, some outputs may be sourced by the authors themselves; the Japanese modelling group at the Earth-Simulator possibly run routinely models in the region; there are also some outputs publicly available, for instance on <http://marine.copernicus.eu/services-portfolio/access-to-products/>) as well as (2) performing ad-hoc Lagrangian experiments to unveil pathways (see also some references provided below). Altogether, these additional analyses could really help to grasp the three-dimensional structure of the flow and could provide further evidences to support their conclusions.
- Discussion: I found that the results could be discussed further. For instance, the authors assumed

that atmospheric deposition occurred only over the Pacific but what if airborne radiocaesium also fell down over the Sea of Japan? They conclude with a transport pathway crossing a well-established oceanic front : what kind of physical processes (front destabilization? Mesoscale processes? Etc...) could explain this route? What about discussing the effect of diffusive mixing?... A recent publication (Sania et al. PNAS 2017) suggests that continuous submarine groundwater discharge could also contribute to the radioactive elements measured in Japanese coastal waters; this process could also occur on the western shores...etc...

- Bibliography: this contribution contains a large number of auto-citations and crucially suffers from a lack of key references. A large body of bibliography is not cited nor discussed properly. Bibliographic items which have been totally omitted in the present manuscript, but which MUST be cited and properly discussed in a revised, include:

Behrens, E.; Schwarzkopf, F. U.; Lubbecke, J. F.; Boning, C. W. Model simulations on the long-term dispersal of ^{137}Cs released into the Pacific Ocean off Fukushima. Environ. Res. Lett. 2012, 7, 034004.

Budyansky, M.V., V.A. Goryachev, D.D. Kaplunenko, V.B. Lobanov, S.V. Prants, A.F. Sergeev, N.V. Shlyk, M.Yu. Uleysky, Role of mesoscale eddies in transport of Fukushima-derived cesium isotopes in the ocean, Deep Sea Research Part I: Oceanographic Research Papers, Volume 96, 2015, Pages 15-27, <https://doi.org/10.1016/j.dsr.2014.09.007>.

Oka, E., Qiu, B., 2012. Progress of North Pacific mode water research in the past decade. J. Oceanogr. 68, 5–20, <http://dx.doi.org/10.1007/s10872-011-0032-5>.

Oka, E., Qiu, B., Kouketsu, S., Uehara, K., Suga, T., 2012. Decadal seesaw of the Central and Subtropical Mode Water formation associated with the Kuroshio Extension variability. J. Oceanogr. 68, 355–360.

Prants, S.V., M.V. Budyansky, V.I. Ponomarev, M.Yu. Uleysky, P.A. Fayman. Lagrangian analysis of the vertical structure of eddies simulated in the Japan Basin of the Japan/East Sea. Ocean Modelling. V.86 pp.128-140 (2015). <http://dx.doi.org/10.1016/j.ocemod.2014.12.010>.

Prants, S.V., M.V. Budyansky, M.Yu. Uleysky. Statistical analysis of Lagrangian transport of subtropical waters in the Japan Sea based on AVISO altimetry data. Nonlin. Processes Geophys. V.24, p. 89-99, 2017 doi:10.5194/npg-24-1-2017.

Rossi, V.; Van Sebille, E.; Sen Gupta, A.; Garçon, V.; England, M. H. Multi-decadal projections of surface and interior pathways of the Fukushima Cesium-137 radioactive plume. Deep Sea Res., Part I 2013, 80, 37–46.

- Some figures are not necessarily well chosen and some are not very informative due to their poor content and/or low quality and low visual rendering. This is especially true for fig. 2 (e.g. grey and red data points and error bars are not readable); fig. 3 (panels d, e and f: cut the x-axis in mid-2016 since there is no data afterwards); fig. 5 (subplots are not numbered; what does black color means in panel 5c and 6c?); the scatters in fig. 9 are not clear to me, please clarify.