General Comments

This study focuses on Matsukawa-ura, a brackish lagoon, where the authors conducted observations of dissolved and particulate ^137Cs concentrations in lagoon and inflowing river waters during 2021–2023, approximately ten years after the Fukushima Daiichi Nuclear Power Plant accident. The study demonstrates the seasonal dependence of dissolved ^137Cs concentrations in the lagoon and estimates particulate and dissolved fluxes from rivers. The results suggest that riverine fluxes alone cannot explain the elevated dissolved ^137Cs concentrations in the lagoon, and the authors cite previous studies to point out the possible contribution from bottom sediments. The observational dataset itself is valuable and provides important insights for understanding the long-term dynamics of radiocesium in Matsukawa-ura.

However, the section on mass flux analysis contains fundamental problems, and in its current form, the conclusions cannot be supported. The flux estimation includes many questionable assumptions and methodological flaws. I believe that this part requires major revision or should be removed entirely.

While the observational data are highly valuable, the mass balance analysis is methodologically and conceptually inappropriate and does not support the conclusions. I strongly recommend removing or substantially revising this section. If the manuscript focuses instead on the observational results and their comparison with previous studies, it would represent a useful and significant contribution.

We thank the reviewer for your time and constructive feedback. The comparison with previous studies are going to be added for our study being a useful and contribution for the recovery of the coastal areas in this estuarine area. Please see our responses below.

Specific Comments

Mass balance section

L244: The authors estimated the supply flux from sediments by using the tidal prism to calculate "the volume of seawater inflow per 12 hours," and assuming that this inflowing water uniformly reaches the lagoon's mean concentration within 12 hours. The difference was then attributed to sedimentary fluxes. However, this estimation has several critical flaws:

(1) The tidal prism does not represent a "pure inflow" of new seawater. In reality, inflow and outflow occur simultaneously, and the exchange efficiency is less than 100%.

As suggested by the reviewer, the seawater that flows into Matsukawa-ura lagoon is not 100% replaced, but I wanted to suggest a qualitative trend that there is a seasonality. We have addressed the lack of this as follows:

" Although the tidal prism does not fully represent the entire exchange of estuarine water with oceanic seawater entering from outside the lagoon, it is used here—based on the simplified assumption that pure seawater flows in from the open ocean—to help understand the monthly variation in the influx of dissolved ^{137}Cs and the key factors maintaining relatively high ^{137}Cs concentrations in the lagoon" in the main text.

(2) The assumption that inflowing water reaches the lagoon-wide average concentration uniformly within 12 hours is unrealistic. Observations clearly show higher concentrations in the inner lagoon, demonstrating strong spatial heterogeneity.

The water depth of Matsukawa-ura lagoon is very shallow, averaging about 1m, and it has been indicated that about half of the water is exchanged during one tidal cycle (Kohata et al., 2003). For the simplicity in clarifying the seasonality of dissolved ^{137}Cs in the lagoon, we used the average concentration of dissolved ^{137}Cs among several sampling stations which could might represent the dissolved ^{137}Cs levels in the area of the lagoon. Actually, in February 2022 and 2023, dissolved ^{137}Cs concentrations ranged 2.5-9.0 and 3.5-8.3 Bq m^{-3} with small variation, respectively, with weighted mean dissolved ^{137}Cs concentrations of 5.3 and 5.5 Bq m^{-3}, but, weighted mean dissolved ^{137}Cs in June 2022 were 17.0 and 15.0 Bq m^{-3}, respectively, about three times higher than winter season. These results suggest that seasonal variations are more influential than variations in concentrations between areas within the lagoon.

(3) The authors assume a constant tidal prism exchange volume throughout the year, yet still discuss seasonal (summer vs. winter) differences. This is logically inconsistent.

For these reasons, the flux estimation is not valid and should be considered inappropriate.

This study focused on the seasonality of dissolved ^{137}Cs in Matsukawa-ura lagoon, and the calculations showed that dissolved ^{137}Cs in Matsukawa-ura lagoon is seasonal and would like to suggest the influence of water temperature. In this study, we measured the water depth at the station WKO, where connects with Pacific Ocean, from December 29, 2021. The average water depth during the study period was 1.9 m, with a maximum of 2.2 m and a minimum of 1.7 m, and the difference between the maximum and minimum values was about 50 cm (Figure a). Therefore, the exchange volume in Matsukawa-ura lagoon was assumed to be constant throughout the year, making it possible to compare between seasons.

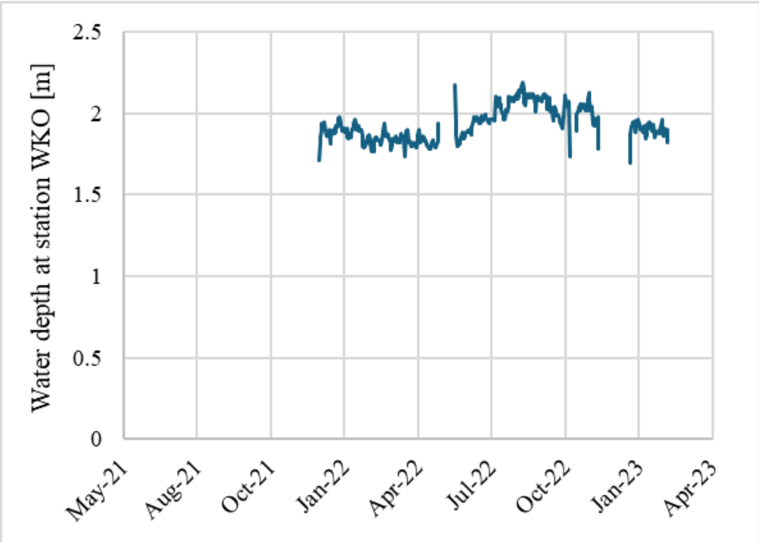

Figure a. Time series changes in water depth at Station WKO from December 29, 2021.

L260: The method used to estimate the decrease of ^137Cs in bottom sediments is unclear. Given that the mass flux calculation itself is subject to large uncertainties, presenting the results as quantified values—and further highlighting them in the abstract—risks giving readers an impression of unwarranted accuracy. Considering the likelihood of these numbers being cited in future work, the current presentation lacks scientific integrity. This section should be deleted or, at the very least, thoroughly rewritten.

We will remove the section on estimating the decrease of ^{137}Cs in sediments, suggest only seasonality. The abstract will be revised accordingly to exclude quantitative values and instead emphasize the seasonality.

L31：Sanial et al. (2017) is not a study of sedimentary fluxes and its citation here is inappropriate. The positioning of this reference should be reconsidered.

Introduction：Kambayashi et al. (2021) is a highly relevant prior study and should be cited in the Introduction.

We remove Sanial et al. (2017) as a citation in the introduction and add Kambayashi et al. (2021) as a new citation in the introduction and discussion for the comparison with our study. Kambayashi et al. (2021), studied in Matsukawa-ura lagoon in 2014-2016, calculated the mass balance of dissolved ^{137}Cs in Matsukawa-ura lagoon, and suggested that supply from porewater in bottom sediments increased in the summer, and the fluxes of dissolved ^{137}Cs from bottom sediments were 287-293 MB day^{-1} in summer. The estimated fluxes of dissolved ^{137}Cs from bottom sediments during the summer were consistent with our results. These results suggest that the amount of ^{137}Cs deposited in marine sediments in the early stages of the accident and dissolved and dispersed into the seawater may not change significantly, whether three or ten years have passed since the accident. Thus, as more time passes since the accident and the supply of ^{137}Cs to coastal waters from rivers decreases due to the decommissioning of contaminated soils in their catchment areas, the contribution of the dissolution of this nuclide from bottom sediments may have continued.

Fig. 4：The spatial arrangement of sampling sites is difficult to understand. I recommend improving the map by adding scale bars, landmarks, or other visual cues to make the locations more intuitive.

We have done.

Reference

Kohata, K.; Hiwatari, T.; Hagiwara, T. Natural water-purification system observed in a shallow coastal lagoon: Matsukawa-ura, Japan. Marine Pollution Bulletin. 2003, 47, 148-154. https://doi.org/10.1016/S0025-326X(03)00055-9

Kambayashi, S.; Zhang, J.; Narita, H. Significance of Fukushima-derived radiocaesium flux via river-estuary-ocean system. Sci. Total Environ. 2021, 793, 148456. https://doi.org/10.1016/j.scitotenv.2021.148456