

## Response to reviewer's comments

Title: Factors controlling dissolved  $^{137}\text{Cs}$  activities in Matsukawa-ura lagoon, a semi-closed estuary, after the Fukushima accident

We sincerely thank the reviewer for this important and constructive comment.

The comments from reviewers are in black, and our responses to the comments are in blue. Additions and changes to the main text in response to reviewer comments are marked in blue.

Reviewer comment:

The discussion of the mass balance still involves substantial uncertainties, and it is difficult to understand how the authors have adequately addressed the reviewer's concerns. In particular, regarding the response to the following question:

“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.”

Although the authors state that their focus is on seasonal variability, the flux discussion presented after L283 appears largely unchanged. While the authors mention that tidal exchange does not fully replace lagoon water and that only concentrations within the affected area were considered, this point is not clearly defined or quantitatively justified.

As currently presented, the analysis does not convincingly constitute a mass balance assessment. Instead of pursuing a mass balance framework with these simplifying assumptions, it would be more appropriate to clearly frame and focus the discussion on the seasonal variability of dissolved  $^{137}\text{Cs}$ , which is the main strength of the dataset.

Response:

We fully agree that, due to the strong spatial heterogeneity of dissolved  $^{137}\text{Cs}$  concentrations in the lagoon, a strict mass balance for the entire lagoon cannot be established with the present dataset. In the revised manuscript, we have therefore explicitly stated that our calculation is not intended to represent a strict mass balance, but rather a simplified, first-order estimate to evaluate the relative magnitude of the major source of dissolved  $^{137}\text{Cs}$  (Section 3.2.3, L298 and thereafter).

We have also revised the structure and wording of the flux discussion to clearly frame it as a supporting analysis for the interpretation of seasonal variability, rather than as a mass balance assessment. In particular, we now emphasize that the exchange volume is assumed to be constant only to enable comparison of seasonal variations, and that the resulting fluxes should be interpreted as approximate, upper-bound estimates, not as exact values. In addition, based on the assumption that up to half of the lagoon water volume can be exchanged during a single tidal cycle under spring tide conditions (Kohata et al., 2003), we recalculated the fluxes (Section 2.3, L138 thereafter). Although our flux estimates are based on a simplified, first-order model, we believe that they are sufficient to imply the dominant factor controlling the seasonal variability of dissolved  $^{137}\text{Cs}$  in the lagoon.

Accordingly, we believe that the revised manuscript no longer pursues a strict mass balance framework but instead uses a simplified flux comparison to support our main conclusion: namely, that the seasonal variability of dissolved  $^{137}\text{Cs}$  in the lagoon is primarily controlled by temperature-dependent release from bottom sediments, while the contribution from riverine inputs is relatively minor.

We hope that these revisions adequately address the reviewer's concerns and clarify both the limitations and the intended scope of our analysis.