Replay to reviewer, Prof. Oka

Thank you very much for your review to our manuscript. I was revised the manuscript according to your comment. The modified part are shown in this document.

1. **There are too many grammar errors and typos throughout the manuscript.**

A. The manuscript was checked by English native speakers.

2. **I do not well understand what the words "recirculation" and "timescale" in this manuscript mean. In physical oceanography, recirculation means the return flow associated with an intense western boundary current, but the word seems to be used for "transportation" in this manuscript. Also, timescale usually means a cycle of temporal variability, but this manuscript does not treat any variability. All "timescale" in this manuscript can be deleted. For example, it is more appropriate to rewrite the first sentence of the abstract to "137Cs derived from the Fukushima Nuclear Power Plant Accident rapidly transported to the Sea of Japan several years after its release to the environment in March 2011."**

A. The word "timescale" was deleted and the term "re-circulation" was modified as "transportation".

3. **In Sec. 1, the authors need to explain which part of the Japan Sea was influenced by atmospheric deposition in March 2011. They also need to explain clearly what the main purpose of this study, with necessary explanation of its background.**

A. We added ^{137}Cs activity concentrations as well as the sampling location by usingcolor in Fig. 1. The colored circle represent the sample measured in 2011. (white open circles were measurement data after 2012; triangle is the point conducted to vertical profile; The monitoring sites by Japanese and Korean governments were also plotted. As shown in Fig. 1, higher ^{137}Cs activity concentrations were observed in the north of 40^{o}N.

[Page 16, Line 21]

In the northeastern part of the SOJ, atmospherically deposited radiocaesium were caused to approximately 1-2 times higher activity concentrations of radiocaesium in May 2011 (1.5-2.8 Bqm^{-3}) in northeastern SOJ than those of before the FNPP1 accident (~1.5 Bqm^{-3}) (Fig. 1). By the end of 2011, the ^{137}Cs activity concentrations in the northeastern part of the SOJ had rapidly decreased to almost the same levels as those before the FNPP1 accident (Inoue et al., 2012). In fact, the ^{137}Cs activity concentration in surface water at an SOJ coastal monitoring site after July 2011 was almost the same as the pre-FNPP1 accident level (http://radioactivity.nsr.go.jp/ja/list/195/list-8.html).

Fig. 1.

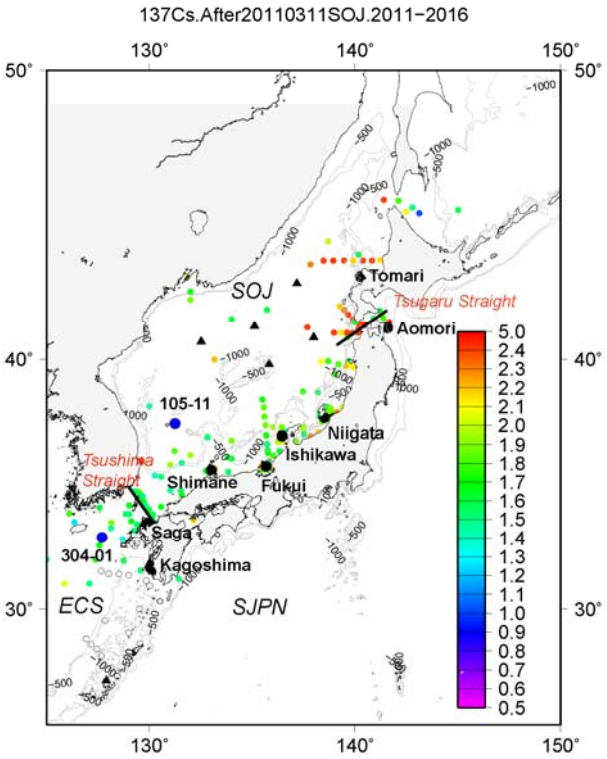

Figure 1: Location of the sampling points after the FNPP1 accident. Large red circles are sites monitored by the Japanese government. Blue circles are sites monitored by the Korean government. Black triangles are sites with measured vertical profiles. Circle colors corresponds to the ^{137}Cs activity concentrations measured in 2011. Open circles are sites measured after the FNPP1-accident. The area around Japan was divided into 3 regions: the SOJ, ECS, and SJPN (<141.5◦E).

4. Section 2 does not explain at what depths radiocaesium was sampled, especially at the coastal monitoring stations maintained by the Japanese and Korean governments (Fig. 7). In addition, readers cannot understand in which part of the East China Sea. (especially south of 30N) radiocaesium was sampled from Fig. 6, which does not show islands or bathymetry. These make it very difficult to understand the analysis in Sec. 3.2.

A. Seawater sampling methods are different with each organization. The monitoring data by the Japanese government (MARIS) was using bucket sampler. In Korea, seawater was sampled by Rosette sampler and/or intake sampling. The sampling by volunteer vessel was conducted by bucket or intake sampling. Therefore, we define the surface seawater as collecting less than 10 m. In order to show the sampling depth of seawater, the information of sampling depth was described in more detail. In order to clearly show the topographical information, the authors added the islands and bathymetry in the Map's Figure (such as Fig. 1, 8, 9, Fig.SI12)

Fig. 1 has already shown in Page 2.

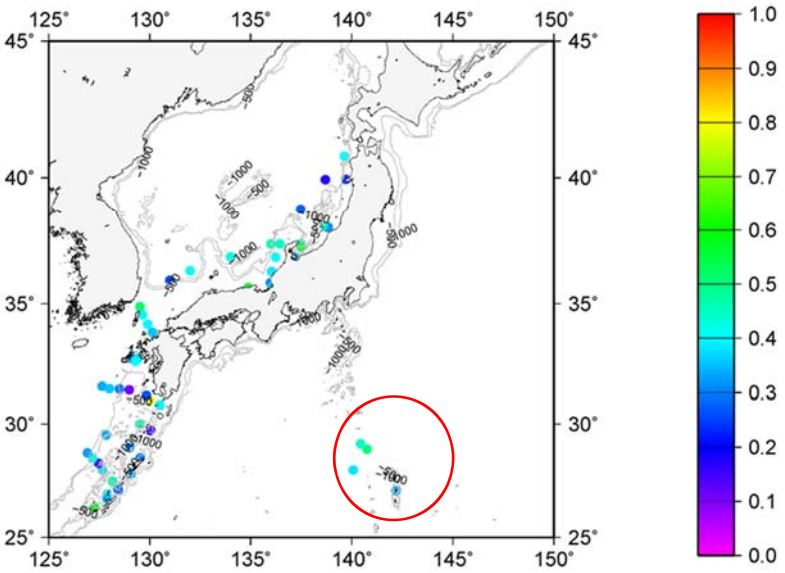

Figure 9: Latitudinal and horizontal distributions of the $^{134}Cs/^{137}Cs$ activity concentration ratios measured at the coastal sites of the SOJ and ECS in 2015-2016. The values were radioactive decay-corrected to 11th March, 2011. The data measured in the Ogasawara area (red circles in (a)) were also added. (a) Latitudinal distribution, (b) horizontal distribution.

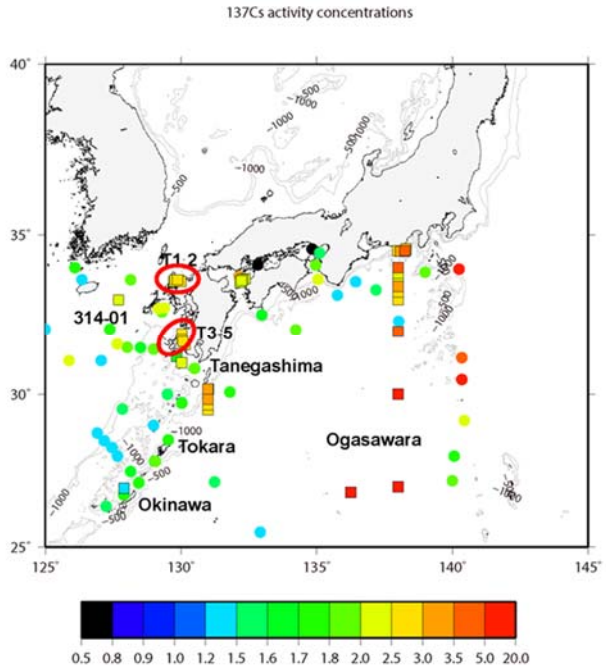

Figure SI12. Horizontal distributions of ^{137}Cs activity concentrations in SJPN and ECS from 2011 to 2016. Circles mean the surface data. Square denotes stations having vertical distribution. Unit is Bq m^{-3}. Higher activity concentrations around 25-30ºN and 135-140ºE were measured in the year of 2012.

[Page 3, Line 4-5]

The term “surface seawater” used in this study defines a sample collected at less than 10 m depth.

[Page 5, Line 1-4]

Fig. 5 show the temporal variation in the ^{137}Cs activity concentrations at different depths at station 314-01 in the ECS (Fig. 5a; 0-140 m) and station 105-11 in the SOJ (Fig. 5b; 0-2000 m). The increase in the ^{137}Cs activity concentrations at the subsurface layer (140 m at the station 314-01, 200 m at the station 105-11) occurred 1 year earlier than that in the shallower layers.

5. Although the aim of this paper is important to understand the “fate” of

STMW(e.g., Gary et al., 2014, Journal of Physical Oceanography), the authors should understand that STMW is characterized by its low stratification or low potential vorticity, and not all water with potential density of 25.0-25.6 kg m-3 is STMW. When STMW is entrained into the Kuroshio at the western boundary, it rapidly loses its low potential vorticity and is not STMW anymore.

A. Thank you very much for the adequate comments. In SJPN, the peak of ^{137}Cs activity concentrations was observed in the seawater corresponds to the potential density 25.2 kg m^{-3}. Therefore, we can consider that ^{137}Cs existed in the STMW. In ECS, ^{137}Cs was mainly observed in the layer having similar potential density. However, it was revealed that ^{137}Cs in the SOJ was observed in denser layer. As the reviewer mentioned, these distributions pattern clearly show the FATE of STMW in the SOJ. Section 4 was largely modified.

[Page 5, Line 15-29]
The vertical distributions of the ^{137}Cs activity concentration over the depth and potential density (σ_{θ}, kg m^{-3}) profiles in the southern Japan (SJPN), in the ECS, and at the station 105-11 are shown in Fig. 6. In the SJPN, the ^{137}Cs activity concentrations showed subsurface maxima at approximately 300 m depth in 2012-2013, with activities of 8.2-12.3 Bqm^{-3} as shown in Fig. 6a. These high ^{137}Cs activity concentrations were measured in the region between 136-138°E and 26-30°N. After 2014, a subsurface peak in the ^{137}Cs activity concentration was not observed. These subsurface peaks in the ^{137}Cs activity concentrations were found in the layer corresponding to a potential density of 25.2 kg m^{-3} (Fig. 6b). This is consistent with previous findings of an ^{137}Cs activity maximum in STMW with a potential density of 25.0-25.6 kg m^{-3} (Kaeriyama et al., 2014; Kumamoto et al., 2014). In the ECS, the ^{137}Cs activity concentrations gradually increased beginning in 2012 and attained the maximum activity concentrations (2.9±0.24 Bqm^{-3}) in 2015, following by a decreasing trend in the ^{137}Cs activity concentrations in 2016, as shown in Fig. 6c. The higher ^{137}Cs activity concentrations above 2 Bq m^{-3} in the ECS were found in the layer corresponding to a potential density of 23.6-25.2 kg m^{-3}, as shown in Fig. 6d. On the other hand, the ^{137}Cs activity concentrations at the station 105-11, located in the western SOJ, decreased with increasing depth until 500 m (Fig. 6e). The higher ^{137}Cs activity concentrations at the station 105-11 were measured in 2014 and 2015, and the ^{137}Cs activity concentrations decreased in 2016. The ^{137}Cs activity concentrations above 2 Bq m^{-3} at the station 105-11, except one sample measured at 2015, were located in the layer with a potential density of 25.8-27.1 kg m^{-3} (Fig. 6f).

[Page 7, Line 22-35]
As shown in Fig. 6e, the ^{137}Cs activity concentrations at station 105-11, located along the western TWC in the SOJ, were maximum at the surface and gradually decreased with increasing depth. This vertical distribution is different from those in the SJPN (Fig. 6a) and ECS (Fig. 6c). Particularly, the subsurface peak observed in the SJPN and ECS did not appear at station 105-11. At station 105-11, most of the ^{137}Cs existed in seawater with a potential density of 25.7-27.3 kg m^{-3} (Fig. 6f), which was located in a higher potential density layer than that in the SJPN and ECS. A similar vertical distribution was also observed at the western coast of the Japanese Islands along the eastern TWC (Fig. SI11). These distributions were due to cooling in the surface layer after water was transported from the Tsushima Strait. Physical processes such as the convergence and subduction of surface water inside the eddies are important mechanisms of downward transport of radiocaesium (Miyao et al., 1998; Budyansky et al., 2015). Based on the lagrangian analysis of the vertical structure of the eddies in the SOJ, the eddy in summer was characterized as unstable layer results in thinner mixed layer depth and weaker seasonal pycnocline in upper layer. During winter season, the eddy became to be very stable in the upper layers, which leads to increase mixed layer depth and become to weak seasonal pycnocline (Prants et al., 2015). There is a possibility of the seasonality of downward transport of radiocaesium. As expected, the past global fallout-^{137}Cs had already penetrated and accumulated in the deeper layers of the SOJ.