Dear Reviewer (Citation: https://doi.org/10.5194/essd-2022-374-RC1)

Thank you very much for your valuable comments. Taking into account your comments, I modified the manuscript as follows.

- Please, correct the UNSCEAR quote which is incorrect in almost all of the text.

A. I modified the term of “UNSCEAR”.

- line 1850 Papucci, C., Salvi, S., Lorenzelli R.

A. Delfanti, R.,Papucci, C., Salvi, S., Lorenzelli R.: IAEA CRP "Worldwide Marine Radioactivity". Research Contract - Agreement No. ITA-26803, ENEA, Italy, 2000.

- line 1857 Papucci

  A. Delfanti, R., Özsoy, E., Kaberi, H., Schirone, A., Salvi, S., Conte, F., Tsabaris, C., and Papucci C : Evolution and fluxes of ^{137}Cs in the Black Sea/Turkish Straits System/North Aegean Sea. J. Mar. Systems. 135, 117–123, 2014.

- please, define tap in a more explicit way: apparent half-life

The regression line of the 0.5-yr median value of ^{137}Cs for each box was determined and apparent half residence time (Tap) due to the radioactive decay and ocean physical processes were estimated. The Tap of ^{137}Cs was calculated using the following equations:

$$^{137}Cs = {}^{137}Cs_0 \exp(-\lambda_{cs,\ apparent}) \quad (1)$$

$$\lambda_{Cs,apparent} = \lambda_{Cs,ocean} + \lambda_{Cs,decay} \quad (2)$$

$$Tap = 0.693/(\lambda_{Cs,apparent}) \quad (3)$$

$$Tpo = 0.693/(\lambda_{Cs,ocean}) \quad (4)$$

where $\lambda_{Cs,apparent}$, $\lambda_{Cs,ocean}$, and $\lambda_{Cs,decay}$ are the decay constants for apparent decay, physical oceanographic decay, and radioactive decay, respectively. $\lambda_{Cs,apparent}$ is estimated by using the regression line of the 0.5-yr median value of ^{137}Cs as shown in (1). Tpo is the apparent half residence time by causing the oceanic physical processes and $\lambda_{Cs,ocean}$ was estimated $\lambda_{Cs,apparent}$ and $\lambda_{Cs,decay}$ in equation (2). Considering that the half-life of ^{137}Cs ($T_{1/2}$) is 30.17 years, the Tap should be shorter than the half-life if no source of ^{137}Cs exists in the region of interest. A shorter Tap means that ^{137}Cs is removed quickly in the area and/or the ^{137}Cs inflow amount is small in the area compared with the ^{137}Cs outflow amount. In other words, a Tap shorter than the radioactive decay time indicates that the

variations in the ^{137}Cs activity concentrations are strongly controlled by physical ocean processes. In contrast, a longer Tap as well as a negative Tpo value means that ^{137}Cs is preserved in the region for a longer time and/or there is an influx of water mass with higher ^{137}Cs in the region compared to the ^{137}Cs outflow from the region.

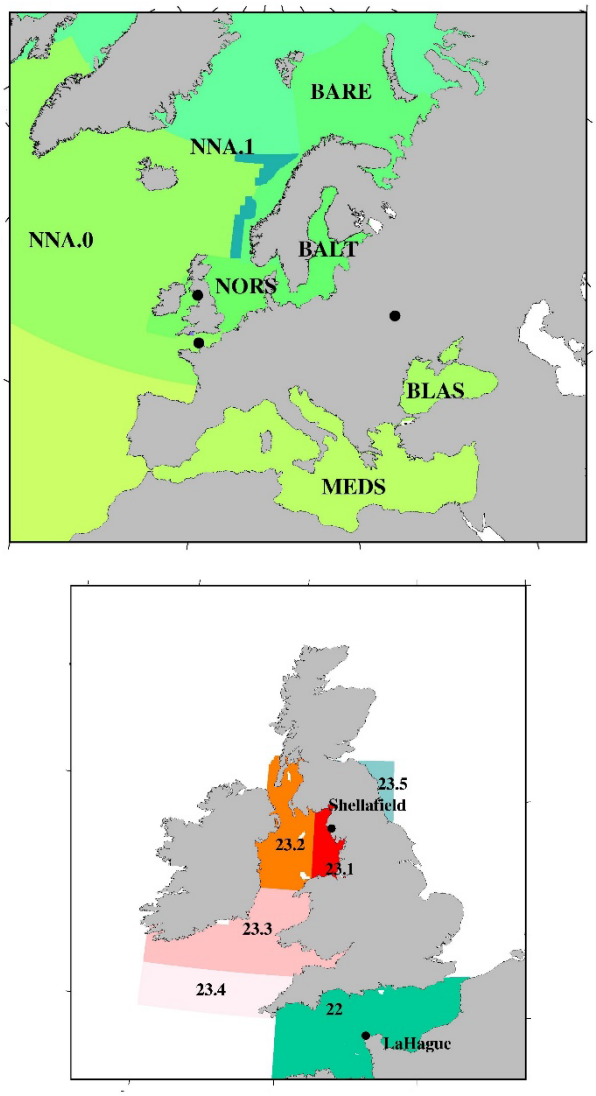
- please, define the start of half year because layering could affect the mixed layer

In Table 3, the start and end year for estimate Tap were described.

		Start	End	Tap	Tpo
Tap	western North Pacific Ocean	1970	2010	15.0	29.9
	Eastern China Sea	1970	2010	17.7	42.8
	Japan Sea	1970	2010	16.4	35.9
Tap1	subarctic North Pacific Ocean	1957.5	1969.5	8.6	12.1
	western subtropical North Pacific Ocean	1957	1970	4.3	5.0
	western equatorial Pacific Ocean	1960.5	1966.5	52.0	-71.8
	eastern equatorial Pacific Ocean	1963.5	1969.5	5.8	7.2
	eastern subtropical South Pacific Ocean	1966	1970	6.0	7.5
Tap2	subarctic North Pacific Ocean	1970.5	1984.5	9.6	14.0
	eastern North Pacific Ocean	1970.5	1985	8.8	12.4
	western subtropical North Pacific Ocean	1970	1989	34.1	-260.7
	Indonesian Archipelago	1973	1997	36.7	-169.2
Tap3	subarctic North Pacific Ocean	1990.5	2009.5	18.2	45.8
	Sea of Okhotsk	1992	2010	24.0	117.0
	western subtropical North Pacific Ocean	1990	2011	25.2	153.0
	western equatorial Pacific Ocean	1992	2003	15.6	32.5
	Indonesian Archipelago	1973	1997	36.7	-169.2
	Baltic Sea	1990	2017	11.5	18.6
	North Atlantic Ocean	1992	2017	21.3	72.3
	Central Atlantic Ocean	1992	2016	38.0	-146.5
	South Atlantic Ocean	1994	2013.5	15.4	31.4

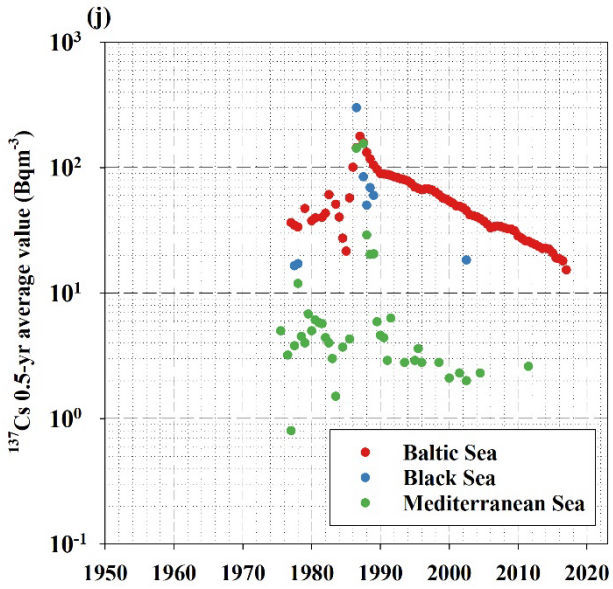
- Correct the follow figure:

- fig 1 (a-b) unreadable labels and coordinates



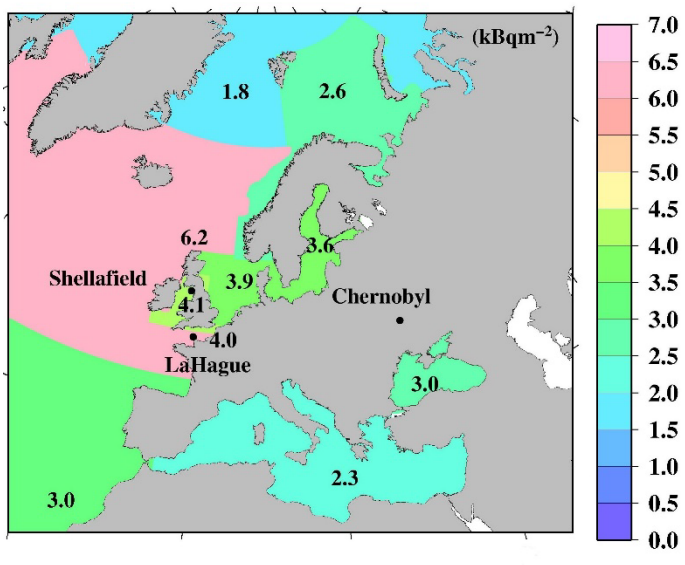
- fig 2 label, Mediterranean

A. The spell of Mediterranean Sea is modified as follows.

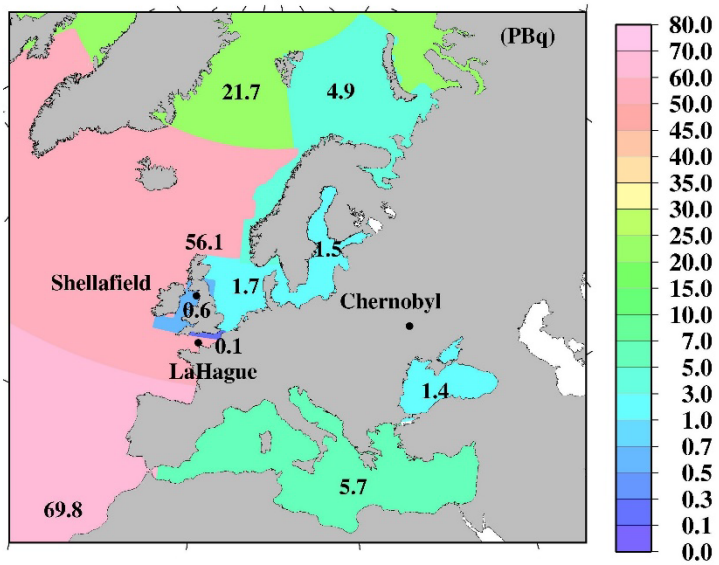


- fig 5 b unreadable coordinates

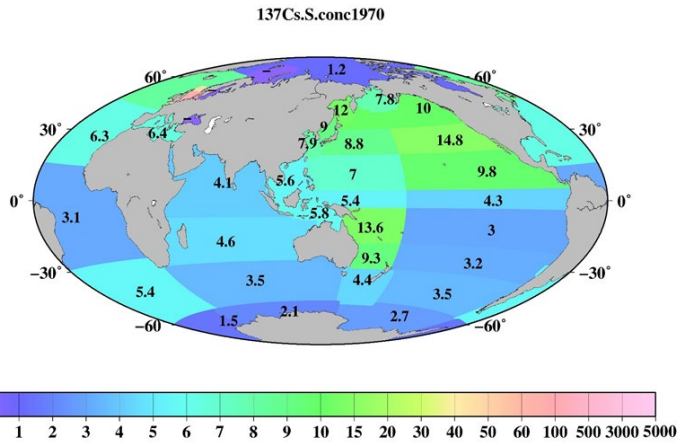
Fig 5b was modified as follows.



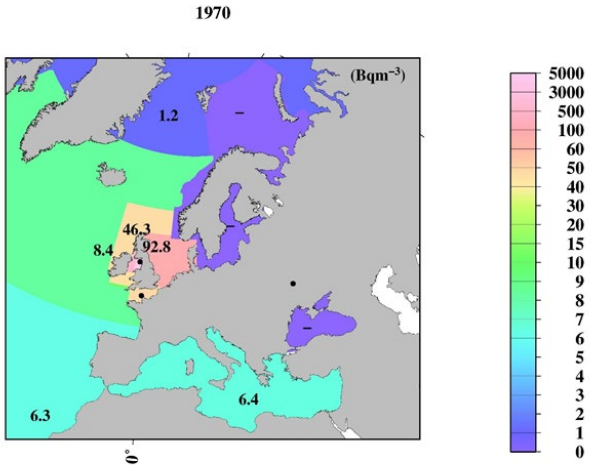
- fig 6 b unreadable coordinates



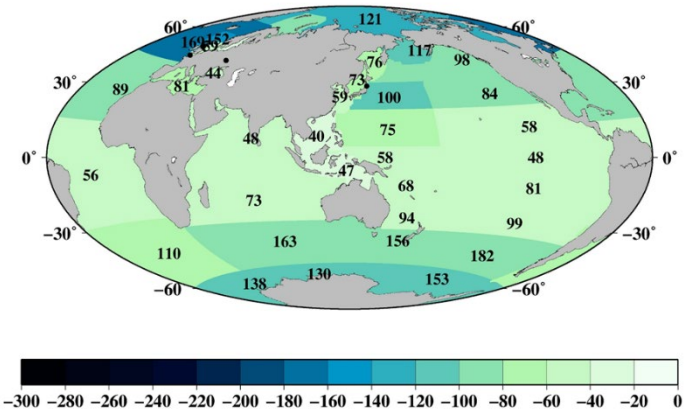
- fig 7 (a-j) unreadable label

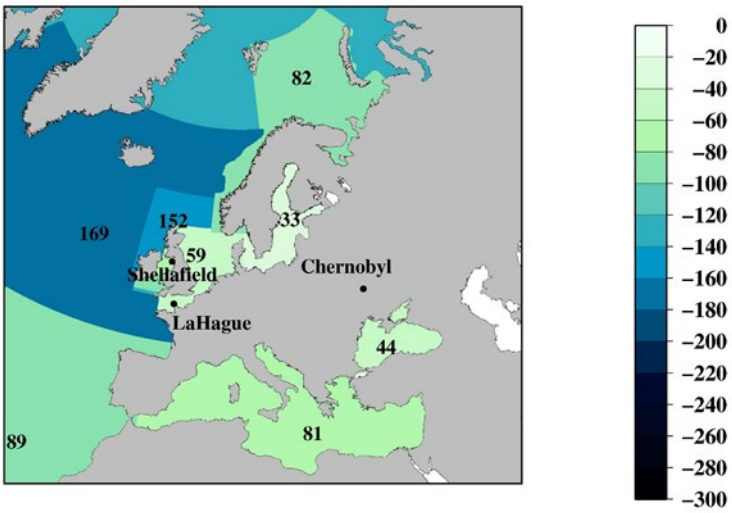


- fig 8 (a-j) unreadable coordinates

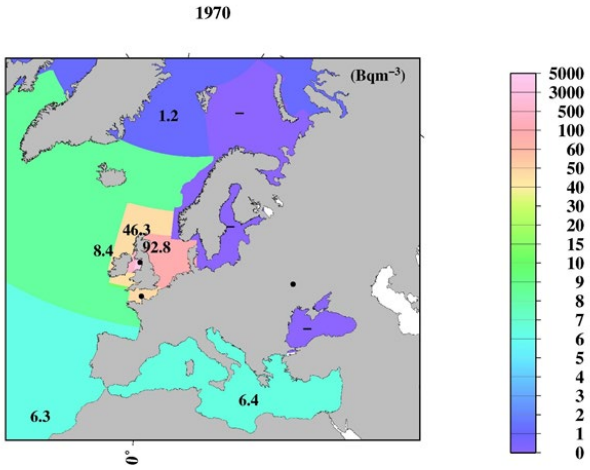


- fig 10 (a b) unreadable coordinates

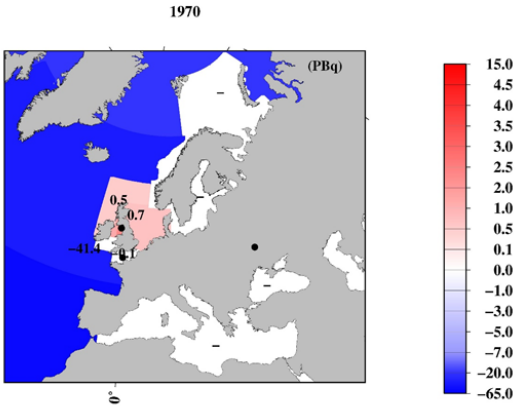




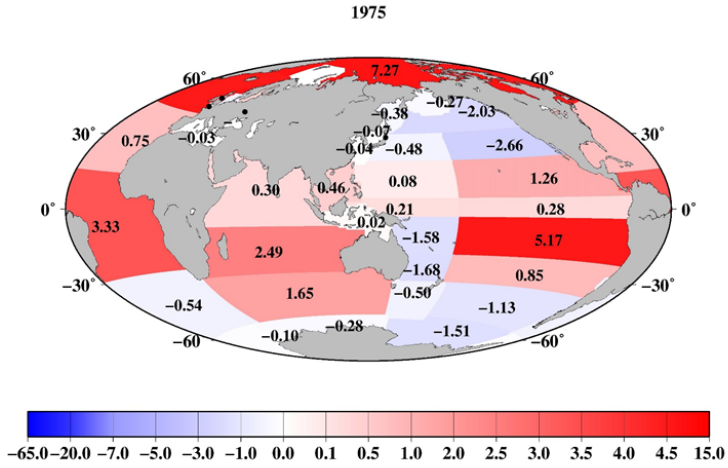
- fig 12 (a-j) unreadable labels and coordinates



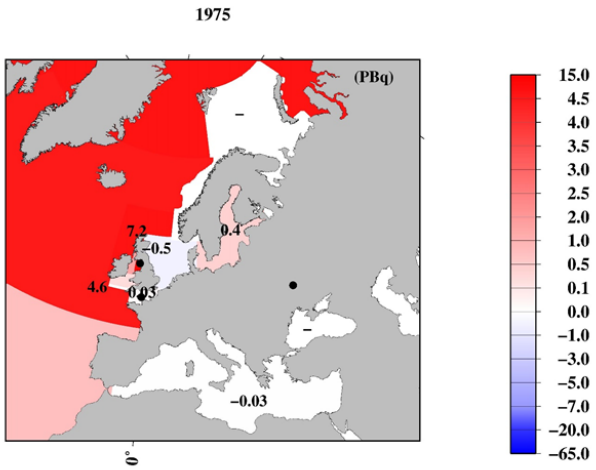
- fig 18 (b) unreadable coordinates



- fig 19 (a-i) unreadable label



- fig 20 (a-i) unreadable coordinates



- line 480
  the value that is almost equal to the value before Chernobyl accident demonstrates the importance of increased release from the rivers flowing through the area affected by the accident: in fact, in Mediterranean Sea, where this input is negligible, the value in 2002 were less than half pre-Chernobyl accident.

  Thank you very much for your comments. The importance of ^{137}Cs inflow into the Black Sea from the rivers were added in the manuscript.

The 0.5-yr median value of ^{137}Cs in the Black Sea (Box 26) in 1977 and 1978.5 was approximately 17 Bq m^{-3}, and in 1986, it increased to 299 Bq m^{-3}, which was at least 18 times higher than that before the Chernobyl accident (Fig. 2j). The 0.5-yr median value of ^{137}Cs decreased rapidly to 60 Bq m^{-3} in 1989. The 0.5-yr median ^{137}Cs value in 2002 was almost equal (18.3 Bq m^{-3}) to that before the Chernobyl accident. The rapid decrease in surface ^{137}Cs could be due to the strong intrusion of surface waters to the deep layers, ^{137}Cs inflow into the Mediterranean Sea after passing through the Bosporus Strait, and radioactive decay (Egorov, 1999; Delfanti et al., 2014). However, Black Sea continues to receive ^{137}Cs derived from Chernobyl by the runoff from rivers (Gulin et al., 2013).