

Interactive comment on ‘Tracing water masses with ^{129}I and ^{236}U in the subpolar North Atlantic along the GEOTRACES GA01 section’ by Castrillejo et al.

Maxi Castrillejo et al., on behalf of all co-authors.

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Dear Reviewer 2,

We are grateful for your time and for the positive comments on the manuscript. We will gladly address the major and minor points and make the convenient changes.

On behalf of all co-authors,

Maxi Castrillejo

Point by point answer to reviewer 2.

In general, this article presents new information about two circulation loops of Atlantic Waters which are tagged with nuclear reprocessing plant effluents from their source region based on the observations at stations from Lisbon (Portugal) to the southern tip of Greenland (Cape Farewell), and from Cape Farewell to St. John’s (Newfoundland, Canada). The reviewer thinks that this article should be published in Biogeoscience, but there are several points should be revised before publication.

Major points:

Page 8 line 25 The authors used a binary mixing model of which three end members are LB, GF and NRP. But, as the authors recognized and stated in the text, most of the samples can be explained by simple two end members model except 6 samples collected in the deeper layers (page 9, line 2) which towards the lithogenic background, LB. This means that in the surface to mid depths in this region, to discuss sources of ^{129}I and ^{236}U in the SPNA, the reviewer thinks that it is enough to use simple two end members mixing model and the authors can revise the discuss here.

The reason why the lithogenic background is included is that despite its small contribution (by mass of radionuclide), it has a very distinct $^{129}\text{I}/^{236}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$ atom ratios that makes this source clearly distinguishable from the two artificial radionuclide sources (NRP and the GF). Therefore, the third ‘natural’ source (i.e. Lithogenic background) allows identifying waters that have a very small anthropogenic impact. This is the case of NEADWL, a water mass that has a large presence in the eastern part of the section. Therefore and since it does not harm, we would prefer to keep the lithogenic background in the binary mixing model.

Page12 Line 1 -27 The discussion about transit times and dilution factors in the paragraph is poor and difficult to understand how the authors calculate time scales of 8-10 years for shorter loop and 8-18 years for longer loop.

We will provide more detailed information regarding water mass transport pathways and time scales in the introduction section and in section 3.4.4. Particular emphasis will be put also on the circulation within the Arctic Ocean (the longer loop) that was not explained in sufficient detail in the original manuscript and which might help on the discussion about the estimated transit times. We shall summarize earlier findings on this matter, making clear what are confirmations of previous findings and what is novel information obtained from this study. For instance, the existence of the two loops has been previously pointed by Smith et al., (2005, 2011 and 2016) and our results confirm such hypothesis. This will be stated clearly.

This 8-18 years statement is also inconsistent the numbers stated “between the maximum 16-8 years (page 13 line 19)” in the conclusion.

We acknowledge the reviewer for noting such inconsistency. The correct time scales are 8-10 years for the short loop and 16-18 years for the long loop. This will be corrected in the conclusion.

The authors used ^{129}I input function at 60 N deg. By Christle 2015 and compared observational peak. But the input function already includes several assumptions and based on the figure caption, no explanation in the main text, the authors expanded the function to fit the measurement. But as shown in Figures 4A and 4B, the reviewer observes inconsistency between input functions and observations for both ^{129}I and ^{236}U .

We shall provide the assumptions made by Christl et al., (2015) for uranium-236 and for Iodine-129. The inconsistencies between the observed radionuclide values and the input functions will be further discussed briefly in terms of uncertainties related to the source input function and the circulation of water masses.

Therefore, the reviewer suggests that the authors can and should collaborate with numerical modeling guys to get modeling results and compared with authors observation.

The reviewer is certainly right that model simulations are desirable to better understand the observed tracer levels and their distribution. Indeed, we are exploring/looking for potential collaborations with ocean circulation modellers to simulate the release and transport of ^{129}I and ^{236}U in the subpolar North Atlantic. Yet, such comparison between experimental and modelling data would be out of the scope of this manuscript. The two main reasons are that the experimental data already provide a very rich information for one manuscript, and that finding a suitable model which can fit the tracer input in a well resolved ocean circulation for the subpolar North Atlantic is apparently not trivial.

Minor points:

page 2 line 25-29 The authors should add about ^{238}U data in their study.

The study focuses on the ^{129}I and ^{236}U which are largely of artificial origin and thus provide transient information about the ocean circulation. Nevertheless, we shall provide data on concentrations of ^{238}U (mostly natural) in the supplemental information in case this is of interest for the oceanographic community.

Page 5 line 25 and 24 12L Niskin bottles.! and 24 of 12L Niskin bottles.?

24 Niskin bottles of 12 L each. The sentence will be clarified accordingly.

*Page 7 line 8 The authors used data marked *, but the uncertainties are so large for $^{236}\text{U}/^{238}\text{U}$ ratio $^{129}\text{I}/^{236}\text{U}$ ratio as 2350+- 370 and 200+-60, respectively. These numbers should be in the blanket (), and 2090+-140 and 140+-30 should be used. Due to larger uncertainty, 2350+-370 and 2090+-140 mean within the same and 200+-60 and 140+-30 locate are also within the same.*

Thank you for noting the need for ‘()’ in some of the data. Change will be done as requested. A small part of the dataset has larger uncertainties for uranium-236. This is because additional corrections had to be made to address limited contamination issues in those samples. We are confident that those data are valid and well represented as long as they are reported with the associated uncertainty.

Page 8 line 3 and c1600 x . The reviewer can not understand the meaning of this part. Please clarify the meaning of this part.

We apologize for this error. ‘andc’ will be replaced by ‘and’.

Page 27 Figure4 Caption of Figure 4 is not enough and color coordinations for previous and current date are not good, eg. think open green circle in Fig.4B was hard to find in Fig.4D.

The colour and shape of the symbols, as well as figure captions will be revised in order to improve the overall comprehension of the data.

Time series data in Fig.4A is also not good to undestand temporal changed of ^{129}I concentration.

Please see the comment above.

In general, all figure captions did not contain enough information about meaning of each color and each mark. Please state more precisely.

Please see the comment above.

End of comments.